Review of Environmental Factors Addendum

Thompsons Creek and South Creek Catchments Wastewater Network Stage 1 – South Creek Extension and Thompsons Creek Optimisation

Determination

This Review of Environmental Factors Addendum (REFA) assesses potential environmental impacts of South Creek Extension and Thompsons Creek Optimisation (the proposal change). The REFA was prepared under Division 5.1 of the *Environmental Planning and Assessment Act 1979* (EP&A Act), with Sydney Water both the proponent and determining authority.

The Sydney Water Project Manager is accountable for ensuring the proposal is carried out as described in this REFA and the Thompsons Creek and South Creek Catchments Wastewater Network Stage 1 Review of Environmental Factors (10 January 2025) (Approved REF). Additional environmental impact assessment may be required if the scope of work or work methods described in this REFA change significantly following determination.

Certification

I certify that I have reviewed and endorsed this REFA and, to the best of my knowledge, it is in accordance with the EP&A Act and the Environmental Planning and Assessment Regulation 2021 (EP&A Regulation). The proposal has been considered against matters listed in section 171 (**Appendix A**) and the guidelines approved under section 170 of the EP&A Regulation. The information it contains is neither false nor misleading.

Prepared by:	Reviewed and endorsed by:	Endorsed by:
[redacted]	[redacted]	[redacted]
REFA authors CreekConnect Date: 8 August 2025	Senior Environmental Scientist Sydney Water Date: 21/08/2025	Project Manager Sydney Water Date: 21/08/2025

Decision Statement

The main potential construction environmental impacts of the proposal change include impacts to biodiversity and Aboriginal heritage. The proposal change will reduce potential construction impacts to soils and water by reducing the volume of excavated materials and groundwater extraction. The proposal change also incorporates landowner feedback into the design, minimising potential impacts on the community. The proposal change will not result in any changes to the operational impacts assessed in the approved REF. The proposal will not be carried out in a declared area of outstanding biodiversity value and is not likely to significantly affect threatened species, populations or ecological communities, or their habitats. Therefore, a Species Impact Statement (SIS) and/or Biodiversity Development Assessment Report (BDAR) is not required.

Given the nature, scale and extent of impacts and implementation of the mitigation measures outlined in the approved REF, the proposal is unlikely to have a significant impact on the environment. Therefore, we do not require an Environmental Impact Statement (EIS) and the proposal may proceed.

Determined by:	[redacted]	[redacted] Environment and Heritage Services Senior Manager Sydney Water Date: 04/09/2025

1. Proposal description

Table 1-1 Proposal need, objectives and consideration of alternatives

Aspect	Relevance to Proposal
Proposal approvals	• Thompsons Creek and South Creek Catchments Wastewater Network Stage 1 Review of Environmental Factors (10 January 2025) (Approved REF) • Thompsons Creek and South Creek Catchments Wastewater Network Stage 1 REF Addendum: South Creek Pressure Main Optimisation (30 January 2025)
Proposal need and objectives	The proposal is part of the Upper South Creek Network (USCN) program. It is needed to provide wastewater servicing to new growth and development areas within the Liverpool and Penrith local government areas (LGAs). The USCN program is designed to service development within the Upper South Creek (USC) precinct. It is required to meet Sydney Water's objective to provide timely delivery of reliable wastewater infrastructure to support development and growth in the South West Growth Area (SWGA) and Western Sydney Aerotropolis Growth Area (WSAGA). All flows from the proposal will ultimately connect to the USC Advanced Water Recycling Centre (AWRC) and will be operated under the future USC catchment and AWRC Environment Protection Licence (EPL). Until the future USC catchment EPL is in place, a scheduled development work licence under s47 of the *Protection of the Environment Operations Act 1997* (POEO Act) will be required for construction of the proposal. The key driver for the proposal is to ensure there is sufficient wastewater system capacity to service the government's planned development within the SWGA.

Proposal change description and methodology	The proposal change involves modifying the 6.25 km Thompsons Creek gravity carrier alignments (TCGC01 and TCGC02), relocating maintenance holes along TCGC01 and TCGC02, and extending the South Creek gravity carrier (SCGC01) to connect to SP1228 interim pumping station.
	Specifically, the proposal change will:
	• Extend the South Creek gravity carrier (SCGC01) by about 0.8 km to connect to the SP1228 interim pumping station and relocate maintenance holes along the southern section of SCGC01 from SC MH07 to SC MH12 (see **Figure 1-1**). The extension will result in three additional maintenance holes along SCGC01 (SC MH13 to SC MH15).
	• Modify sections of the TCGC01 and TCGC02 alignments and the associated maintenance holes and vent shafts, including shifting a section of the alignment:
	  ○ west at Victor Avenue / Watts Road (see **Figure 1-2**)
	  ○ west at Ramsay Road (see **Figure 1-2** and **Figure 1-3**)
	  ○ west at Kelvin Park Drive (see **Figure 1-4**)
	  ○ slightly east at Medich Place (see **Figure 1-5**).

Aspect	Relevance to Proposal
	• Upsize TCGC01 to OD1499. TCGC01, TCGC02, and the extension of SCGC01 will be constructed using trenchless construction methods (e.g., Horizontal Directional Drilling (HDD), Horizontal Auger Boring (HAB) and micro-tunnelling). An area of about 40 m wide by 60 m in length will be required around each maintenance hole to enable launch pits and laydown areas. Design optimisations of the Thompsons Creek gravity carrier alignments have resulted in a reduction of 11 maintenance holes across TCGC01 and TCGC02.
Justification for proposal change	Sydney Water has refined the USCN concept designs for individual catchments by adopting an innovative 'program-wide' network design approach. The network optimisation provides a more flexible and efficient network solution that can be scaled to meet demand. This proposal change includes several changes resulting from the network optimisation and feedback from landowners. **Network optimisation** The Thompsons Creek design optimisation includes extending SCGC01 to connect to SP1228 interim pumping station and reducing the total number of maintenance holes along TCGC01 and TCGC02. As a result of the optimisation, some works approved as part of the REF are no longer required, including construction and operation of the 3.1 km Thompsons Creek pressure main (TCPM01). This network optimisation provides significant capital expenditure (CAPEX) savings for the broader USCN program by: • reducing the quantity of pipework and associated infrastructure • eliminating the need to construct temporary infrastructure • allowing the network to be built incrementally to match demand • standardising designs across the network. These changes enhance efficiency of the wastewater management system by reducing material waste, lowering resource consumption, and minimising the network's overall environmental footprint. It also streamlines the construction process and avoids the risk of overbuilding. **Landowner Feedback** Some of the proposed changes to the TCGC01 and TCGC02 alignments and associated maintenance holes directly respond to landowner concerns. The alignments have been relocated closer to and/or within the flood zone to reduce impacts on developable land and future development, specifically for: • 63-69 Victor Avenue (35/DP28050) • 82-86 Watts Road (9/DP28050) • 105 Watts Road (37/DP28050) • 100 Watts Road (10/DP28050) • 56 Kelvin Park Drive (711/DP788485). **Constructability**

Aspect	Relevance to Proposal
	Key changes to the TCGC01 alignment and associated maintenance holes were required due to constructability constraints, specifically: • **High voltage power lines:** overhead power lines on the eastern side of Ramsay Road require a minimum safe working distance of at least 3 m. To maintain this offset, the alignment would have to be shifted an additional 10 m east into developable land at the front of adjacent properties, close to existing structures. Therefore, the alignment was relocated to follow the flood zone at the rear of properties on the western side of Ramsay Road. • **Proximity to existing structures:** Two maintenance holes were located less than 5 m from existing greenhouses at 63-69 Victor Avenue and 105 Watts Road. As a result, the maintenance holes were shifted west to avoid impact to the existing structures during construction.
Location and land ownership	The proposal change is located within the South West Growth Area (SWGA), about 40 km southwest of the Sydney CBD in the suburbs of Badgerys Creek, Bradfield, Rossmore, and Kemps Creek. It is in the local government areas (LGA) of Liverpool City Council (south of Elizabeth Drive) and Penrith City Council (north of Elizabeth Drive). The proposal change intersects private property, developer owned land, and council land. Due to the proposal change, six additional properties that were previously unaffected are now impacted: • 260 Martin Road (55/DP3050) • 260 Martin Road (56/DP3050) • 330 Ramsay Road (13/DP28050) • 320 Ramsay Road (12/DP28050) • 310 Ramsay Road (11/DP28050) • 300 Ramsay Road (1/DP1083552). The proposal change has avoided direct impact to six properties and three public roads from the approved REF alignment: • 56 Kelvin Park Drive (711/DP788485) • 305 Ramsay Road (51/DP222177) • 315 Ramsay Road (50/DP222177) • 100 Watts Road (10/DP28050) • 105 Watts Road (37/DP28050) • 185 Lawson Road (102/DP1300747) • Martin Road (Local) • Cuthel Street (Local) • Lawson Road (Local).

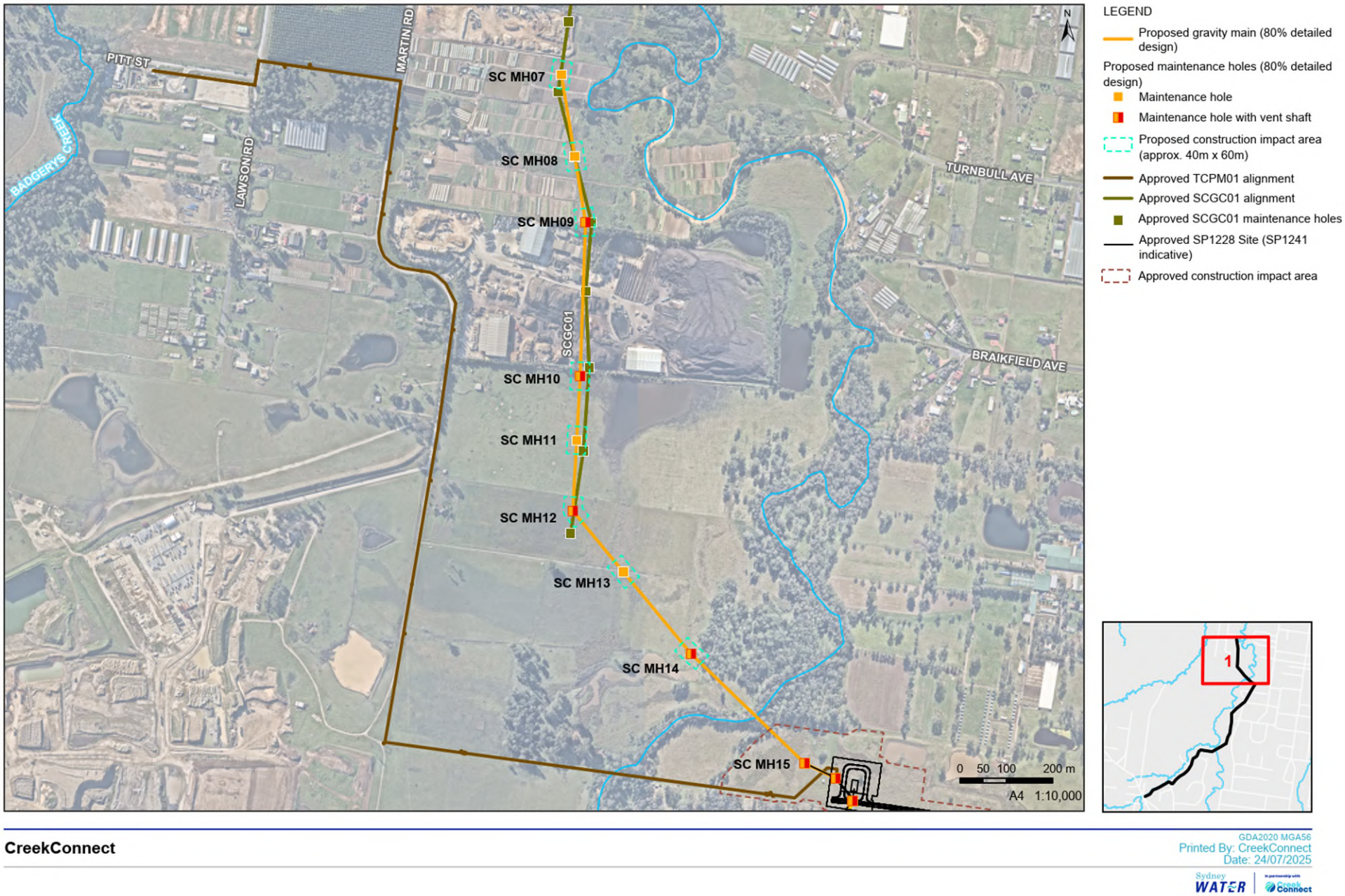


Figure 1-1: South Creek Extension (SCGC01) - Proposed alignment (1 of 5)

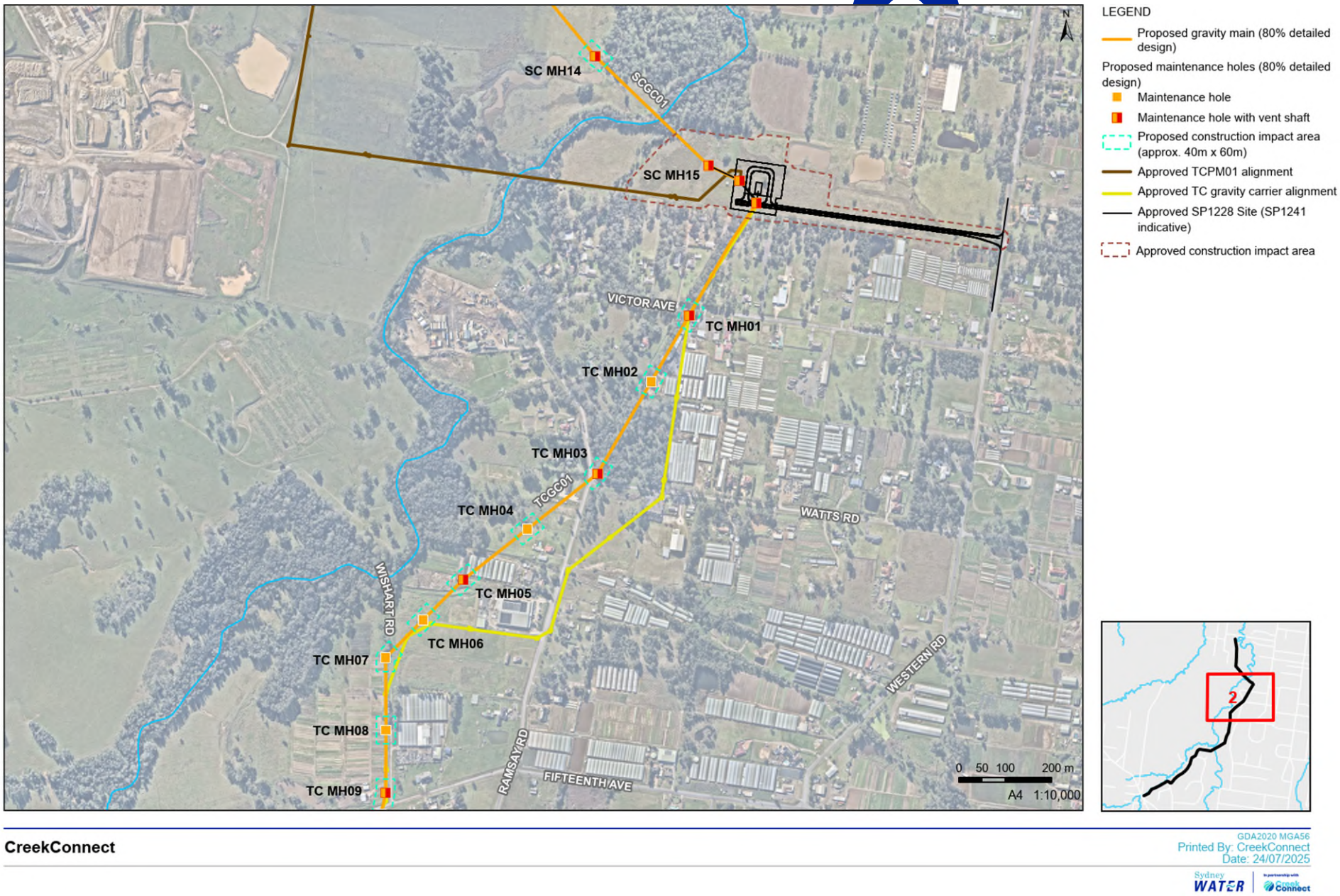


Figure 1-2: Victor Avenue/Ramsay Road – Proposed alignment (2 of 5)

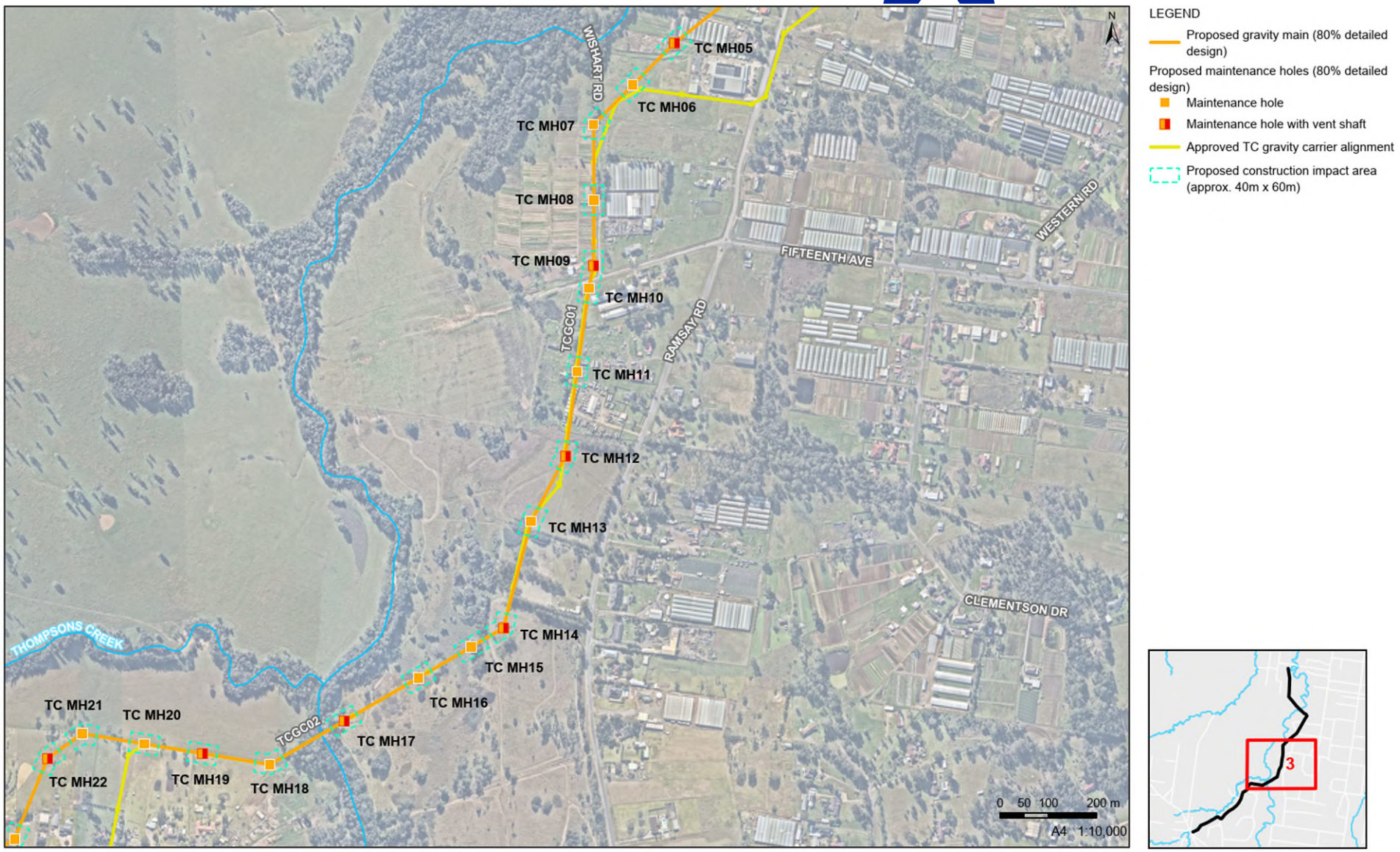


Figure 1-3: Rossmore Grange – Proposed alignment (3 of 5)

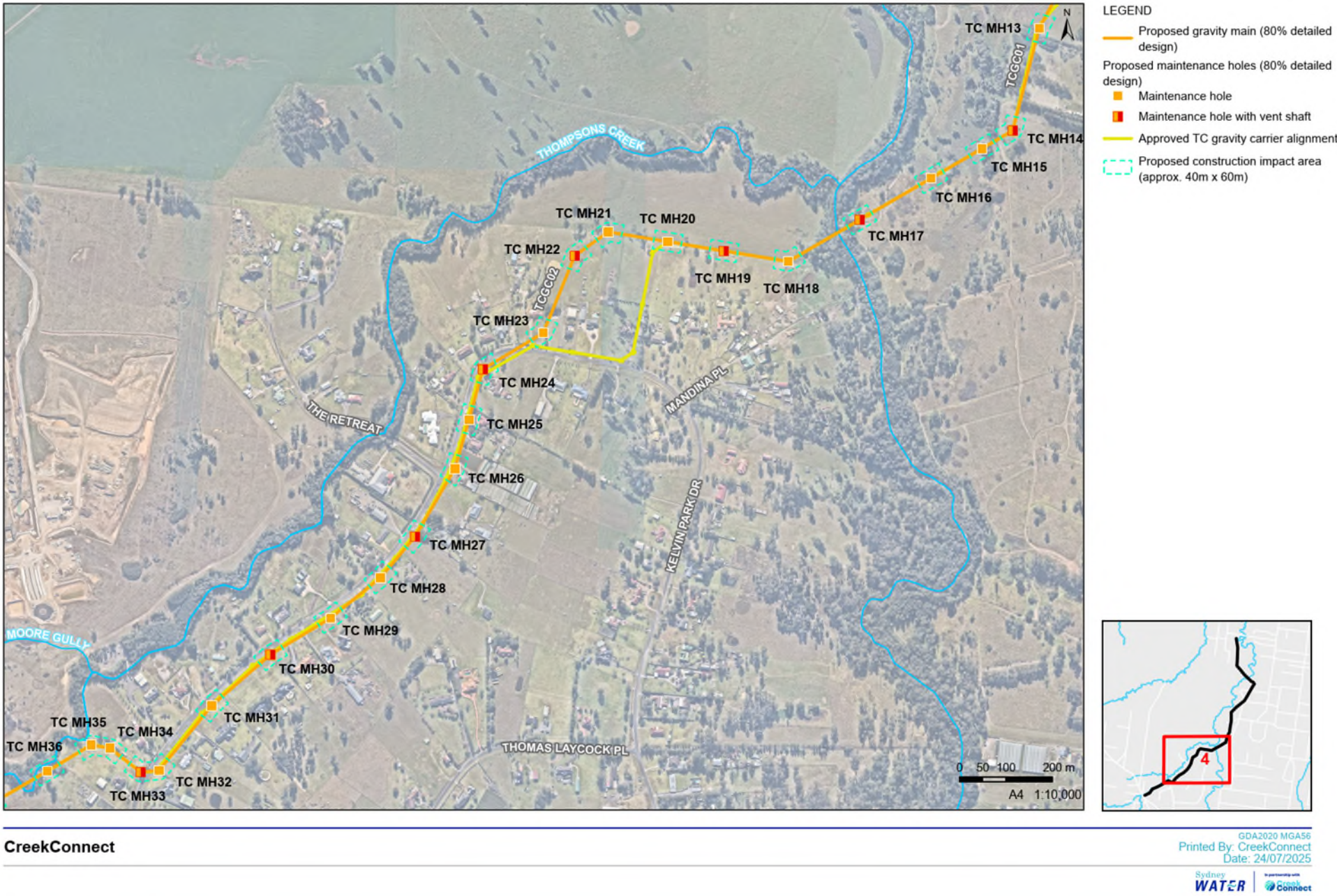


Figure 1-4: Kelvin Park Drive – Proposed alignment (4 of 5)



Figure 1-5: Medich Place - Proposed alignment (5 of 5)

2. Consultation

Consultation matters in addition to those matters considered in the approved REF are detailed below.

2.1 Community and stakeholder consultation

The proposal change will impact six private properties that were previously unaffected, avoid impacts to certain properties and changes the impact for several properties. Some of the proposed changes have been made in response to landowner feedback received during detailed design consultations. Landowner consultations will continue throughout design and delivery.

2.2 Consultation required under State Environmental Planning Policies and other legislation

Sydney Water must consult with councils and other authorities for work in sensitive locations or where the work may impact other agencies' infrastructure or land. This is specified in the State Environmental Planning Policy (Transport and Infrastructure) 2021 (TISEPP).

Notification to the Department of Planning, Housing and Infrastructure (DPHI) is required under SEPPs (Precincts – Central River City) (2021) and (Precincts – Western Parkland City) (2021) for clearing of native vegetation in non-certified land in the Sydney region growth centres. DPHI was notified as part of the approved REF about the impacts to 0.574 ha of ENV in non-certified land. Their response included the following comments:

- In accordance with relevant orders, agreements, legislation, planning instruments and policies the retention, maintenance and enhancement of native vegetation, habitat and riparian areas must be a key consideration in the refinement of the proposal's design.
- Efforts to avoid impacts to land classified as ENV should be prioritised. If avoidance is not possible, this must be clearly justified, and the design should minimise impacts to existing native vegetation under the SEPP (Precincts—Western Parkland City) 2021.
- Where impacts are unavoidable, offsetting of ENV under SEPP (Precincts—Western Parkland City) 2021 is required. The approach to offsetting must be confirmed and documented in the REF.
- In consultation with Sydney Water, the contractor must provide the DPHI with shapefiles of impacted ENV.

These comments were taken into consideration during design development and are addressed in **Table 3-1**. The proposal change will modify the impact to native vegetation in non-certified land, and therefore, additional notification to DPHI is required. The proposal change will reduce impacts to ENV in non-certified land by 0.056 ha. Additional opportunities to reduce impacts to ENV in non-certified land will continue to be explored through ongoing design development and construction planning. DPHI will be notified at least 21 days prior to commencing construction, and consideration of their comments will be incorporated into the Construction Environmental Management Plan (CEMP). This notification will confirm the final clearing areas of less than 0.518 ha of ENV in non-certified land (refer to **Table 4-4**). No other consultation under TISEPP is required (refer to **Appendix C**).

3. Legislative requirements

There are no additional legislative requirements above those already assessed in the approved REF. The proposal change is required to facilitate development for the purpose of a ‘sewerage reticulation system’. Section 2.126(6) of the State Environmental Planning Policy (Transport and Infrastructure) 2021 permits development for sewage reticulation systems without consent on any land in the prescribed circumstances. Development is carried out in the prescribed circumstances if the development is carried out by a public authority.

Accordingly, this REFA has been assessed under Division 5.1 of the EP&A Act and Sydney Water can self-determine the proposal change.

4. Environmental assessment

The environmental impacts checklist (SWEMS0019.01) was considered for the Proposal**. Table 4-1** includes only the potentially impacted/ changed aspects and **Table 4-4** lists additional mitigation measures. All other environmental impacts in the approved REF remain the same and will be incorporated into the contractor's CEMP.

Table 4-1 Review of environmental aspects

Aspect	Potential additional impacts
Topography, geology and soils	The volume of excavated materials is expected to decrease due to the reduction in the number of maintenance holes. Excavation works occur in areas with moderate to high potential for salinity. Less disturbance of saline soil reduces the potential for transfer of saline sediments offsite, especially in proximity to creek lines.
Water and drainage	The proposal change will not directly impact watercourses, alter surface water drainage patterns, or adversely affect flood behaviour. Construction of the maintenance holes within SCGC01 will require dewatering resulting in short term drawdown of the immediate groundwater table. However, the proposal change would reduce the total volume of groundwater extraction compared to the approved REF as a result of the reduction of the number of maintenance holes and the removal of TCPM01 from the scope. The number of maintenance holes which are near or within terrestrial groundwater-dependent ecosystems (GDEs) remain consistent with the approved REF. Due to the short duration of works associated with construction of the maintenance holes, the proposal change is not anticipated to have measurable impacts on these ecosystems. Impacts can be managed through implementation of the mitigation measures in the approved REF.
Flora and fauna	A desktop assessment conducted on 22 April 2025 identified plant community types (PCTs) and threatened ecological communities (TECs) within the SCGC01 extension area as well as along the revised TCGC01 alignment, near Victor Avenue / Watts Road. In response, an Addendum Biodiversity Assessment Report (BAR) was prepared by CreekConnect ecologists in July 2025 to identify the likely presence of, or suitable habitat for, any threatened species entities listed under the *Biodiversity Conservation Act 2016* (BC Act), *Fisheries Management Act 1994* (FM Act), and/or *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and evaluate the potential impacts of the proposal change on biodiversity. The full report is provided in **Appendix D**. Accounting for the proposal change, the overall Thompsons Creek alignment, including the South Creek extension, is expected to impact up to 1.103 ha of native vegetation. This is an increase of about 0.065 ha compared to the approved alignment. No new PCTs or TECs types have been identified within the proposed impact areas (see **Figure 3-1** to **3-5**). The proposal change impacts on native vegetation between SC MH07 to TC MH41 are listed in **Table 4-2** below.

Table 4-2 Comparison of direct vegetation impacts (from SC MH07 to TC MH41)

Vegetation Type*	Total Approved Alignment Impact Area (ha)	Total Proposed Alignment Impact Area (ha)	Difference between Approved Project and Proposal Change (ha)
PCT 3320 Cumberland Shale Plains Woodland	0.229	0.128	0.101 (decrease)
PCT 4023 Coastal Valleys Swamp Oak Riparian Forest	-	0.100	0.100 (increase)
PCT 4025 Cumberland Red Gum River-flat Forest	0.319	0.298	0.021 (decrease)
EPBC Act **and** BC Act: River-flat Eucalypt Forest on Coastal Floodplains	0.202	0.104	0.098 (decrease)
Only BC Act: River-flat Eucalypt Forest on Coastal Floodplains	0.123	0.369	0.246 (increase)
BC Act: Cumberland Plain Woodland in the Sydney Basin Bioregion	0.165	0.104	0.061 (decrease)
Total	**1.038**	**1.103**	**0.065 (increase)**

**Please note that some PCTs are also classified as TECs. Where this occurs, the area is included once under the relevant TEC to avoid double counting areas of native vegetation.*

Updated Tests of Significance (ToS) were completed for the proposal change. The proposal change is not expected to result in a 'significant impact' on threatened species, populations or ecological communities, or their habitats. The proposal change will not be carried out in a declared area of outstanding biodiversity value. Therefore, a Species Impact Statement (SIS) and/or Biodiversity Development Assessment Report (BDAR) is not required.

About 0.518 ha of the native vegetation impacted by the proposed alignment is Existing Native Vegetation (ENV) on non-certified land and requires statutory offsets in accordance with the *Sydney Region Growth Centres Biodiversity Certification Order.* This means that the proposal change will decrease the required statutory offsets by about 0.056 ha. **Figures 3-6** to **3-8** show the areas of ENV on non-certified land within the proposed construction impact areas.

As part of design development, efforts to optimise the alignment have reduced the total impact to ENV in non-certified land by repositioning and removing maintenance holes. As a result, the proposal change decreases the overall impact to ENV in non-certified land. However, the impacted areas have changed. The most notable change in ENV impacts results from the proposed relocation of one maintenance hole (TC MH03), near the intersection of Ramsay Road and Watts Road. For the proposal change, TC MH03 has shifted west to align with the revised pipeline route, which was redirected to the rear of properties on the western side of Ramsay Road to avoid high voltage power lines. This proposed change addresses both constructability

Aspect	Potential additional impacts

constraints and concerns raised by landowners. Alternative locations considered for TC MH03 were assessed as follows:

- Positioning TC MH03 further west onto 330 Ramsay Road, which was deemed unfeasible due to the presence of existing underground services. These constraints would have resulted in MH03 and the alignment being located too close to the existing house and driveway on the property.
- Relocating TC MH03 south onto 100 Watts Road was not viable due to its proximity to high voltage power lines, which posed safety and constructability concerns.

TC MH03 has been positioned as close to the roadway as possible to reduce native vegetation clearing. In addition, impacts to ENV on non-certified land have been minimised by implementing trenchless construction methods.

Impacts to ENV on non-certified land will be managed by the mitigation measures listed in the approved REF. Ongoing design development and construction planning will continue to identify and implement opportunities to avoid and/or minimise impacts to native vegetation on non-certified land. These measures, which will be documented in a future Consistency Assessment, are expected to reduce the final statutory offset requirements.

Non-statutory voluntary offsetting would also be undertaken in accordance with *Sydney Water's Biodiversity Offset Guide (SWEMS0019.13)*. The required offsets for the proposal change are outlined in **Table 4-3** below.

Table 4-3: Proposed alignment offset requirements

Offset requirements	Total impacted area (ha) within non-certified land	
	ENV	Non-ENV
Proposal change impact area (ha)		
PCT sub-total	0.161	0.365
TEC Sub-total	0.357	0.220
Combined (PCT and TEC) total	**0.518***	**0.585****
Required offsets (ha)		
PCT Sub-total	0.483	0.730
TEC Sub-total	1.071	0.660
Combined (PCT and TEC) total	**1.554**	**1.390**

**Statutory offsets required under the Growth Centres BCOs (3:1)*

***Voluntary offsets implemented under Sydney Water's Biodiversity Offset Guideline (3:1 for TECs and 2:1 for PCTs)*

Aspect	Potential additional impacts
	There is a relict oxbow adjacent to one of the proposed maintenance holes (SC MH14) as shown in **Figure 3-14**. The relict oxbow was identified to have suitable habitat features that could support amphibians such as the Green and Golden Bell Frog (*Litoria aurea*) which is listed under the BC Act and EPBC Act as 'Endangered' and 'Vulnerable' respectively. The Green and Golden Bell Frog is considered to have a moderate likelihood of occurrence in the proposal change area. An Assessment of Significance was completed. The proposal change is not likely to have a significant impact on the Green and Golden Bell Frog. There is potential for the proposal change to introduce, or increase the risk of, infection of frogs by amphibian chytrid fungus, which may lead to degraded health and loss of individuals within the local area. During construction, the movement of plant and equipment have the potential to move weeds and pathogens within and out of the impact areas. This can be managed by implementing the mitigation measure outlined in **Table 4-4**. This can be managed by implementing the mitigation measures in the approved REF in addition to those outlined in **Table 4-4**.
Heritage	An updated Aboriginal Cultural Heritage Assessment Report (ACHAR) was prepared by Kelleher Nightingale Consulting (KNC) in July 2025. The full report is provided in **Appendix E**. The updated ACHAR will support an application for an Aboriginal Heritage Impact Permit (AHIP) under section 90 of the *National Parks and Wildlife Act 1974*. A field survey was conducted in May 2025 to assess sections of the proposed alignment located outside of the previously surveyed corridor. One Potential Archaeological Deposit (PAD) area (Martin Road South Creek PAD 1) was identified within the proposed South Creek extension alignment (refer to **Figure 3-9**). A test excavation program was undertaken in June 2025 which confirmed subsurface archaeological deposit at Martin Road South Creek PAD 1, thereby designating the area as an archaeological site, namely Martin Road South Creek AFT 1. Salvage excavation is recommended to be undertaken at sites of moderate-high archaeological significance within the impact area. No archaeological salvage mitigation is warranted for low significance sites located within the impact area. Martin Road South Creek AFT 1 was assessed as displaying low archaeological significance, therefore, no archaeological salvage mitigation is warranted. An AHIP is being sought for Aboriginal objects within the boundaries of the construction impact corridor associated with the proposal change. This can be managed by implementing the mitigation measures in the approved REF in addition to those outlined in **Table 4-4**.
Noise and vibration	Temporary noise and vibration impacts are expected during construction. The proposal change will impact the same sensitive receivers identified in the approved REF. However, the level of impact is expected to change based on their proximity to the revised alignment and associated work areas. As trenchless construction methods will be used, noise impacts will generally be associated with the maintenance hole locations. There will be some additional receivers adjacent to the SCGC01 extension area who will be affected during construction of the maintenance holes.

Aspect	Potential additional impacts
	The proposed alignment maintains a minimum distance of approximately 10 m from existing structures. The approved REF permits mechanised bored tunnelling within a minimum distance of 5 m to 12 m from a structure. Landowner consultations are ongoing, and no additional mitigation measures are required. Impacts can be managed through implementation of the mitigation measures in the approved REF.
Air and energy	Temporary impacts to air quality are anticipated as a result of emissions from construction vehicles and equipment, as well as dust generation from vehicles travelling along unsealed access tracks, and during excavation and stockpiling activities. The proposal change is expected to decrease the generation of dust and exhaust emissions, primarily due to a reduction in excavation and stockpiling activities during construction. Specific locations for vent shafts were not defined in the approved REF. The proposed locations have been selected to minimise potential impacts on sensitive receivers where possible and no additional impacts are expected. With the implementation of mitigation measures in the approved REF, impacts to air and energy are expected to be minor and consistent with the approved REF.
Traffic and access	The South Creek gravity carrier extension has been routed through private paddocks to minimise traffic disruption and access issues for potentially affected landowners. During pipe installation, there may be temporary partial road closures and short-term impacts to driveway access. Impacts will be short-term and move along the alignment. Maintenance hole locations have been chosen to minimise disruption to driveways during these works. Ongoing consultation with affected landowners will be undertaken. Operation of the proposed change is expected to have minimal traffic and access impacts, as maintenance is minor and infrequent. All maintenance work will follow Sydney Water procedures. Impacts can be managed through implementation of the mitigation measures in the approved REF.

Table 4-4 Additional mitigation measures

Additional mitigation measures
During construction a 10 m buffer is required around the relict oxbow (farm dam) adjacent to Study Area C to avoid potential impacts to Green and Golden Bell Frog (refer to **Figure 3-14** below).
A hygiene protocol must be prepared prior to works starting, and implemented by the Delivery Contractor during works to avoid introduction of pathogens in machinery, tools, PPE or imported soils.
In consultation with Sydney Water, the contractor must notify DPHI of the final area of ENV to be cleared at least 21 days prior to the commencement of construction. The notification should confirm clearing of less than 0.518 ha of ENV and include figures to clearly demonstrate how the construction footprint has been designed to minimise impacts to ENV to the greatest extent practicable.

Additional mitigation measures

Archaeological salvage excavation of Aboriginal objects is to be completed prior to commencing construction works within the impacted portion of the following Aboriginal archaeological sites; Western Road AFT 1 and Rossmore Grange AFT 1.

These following Aboriginal heritage sites should be identified as “no-go zones” on the CEMP maps and workers inducted as to appropriate protection measures:

- non-impacted portions of Martin Road South Creek AFT 1
- non-impacted portions of Rossmore Grange
- non-impacted portions of Rossmore Grange AFT 1.

The boundary of the AHIP at these locations will be surveyed and protective hard barriers (i.e. ATF fencing, concrete barriers or water-filled barriers) and signage will be installed before construction.



Figure 4-1: Ecology constraints (1 of 5)

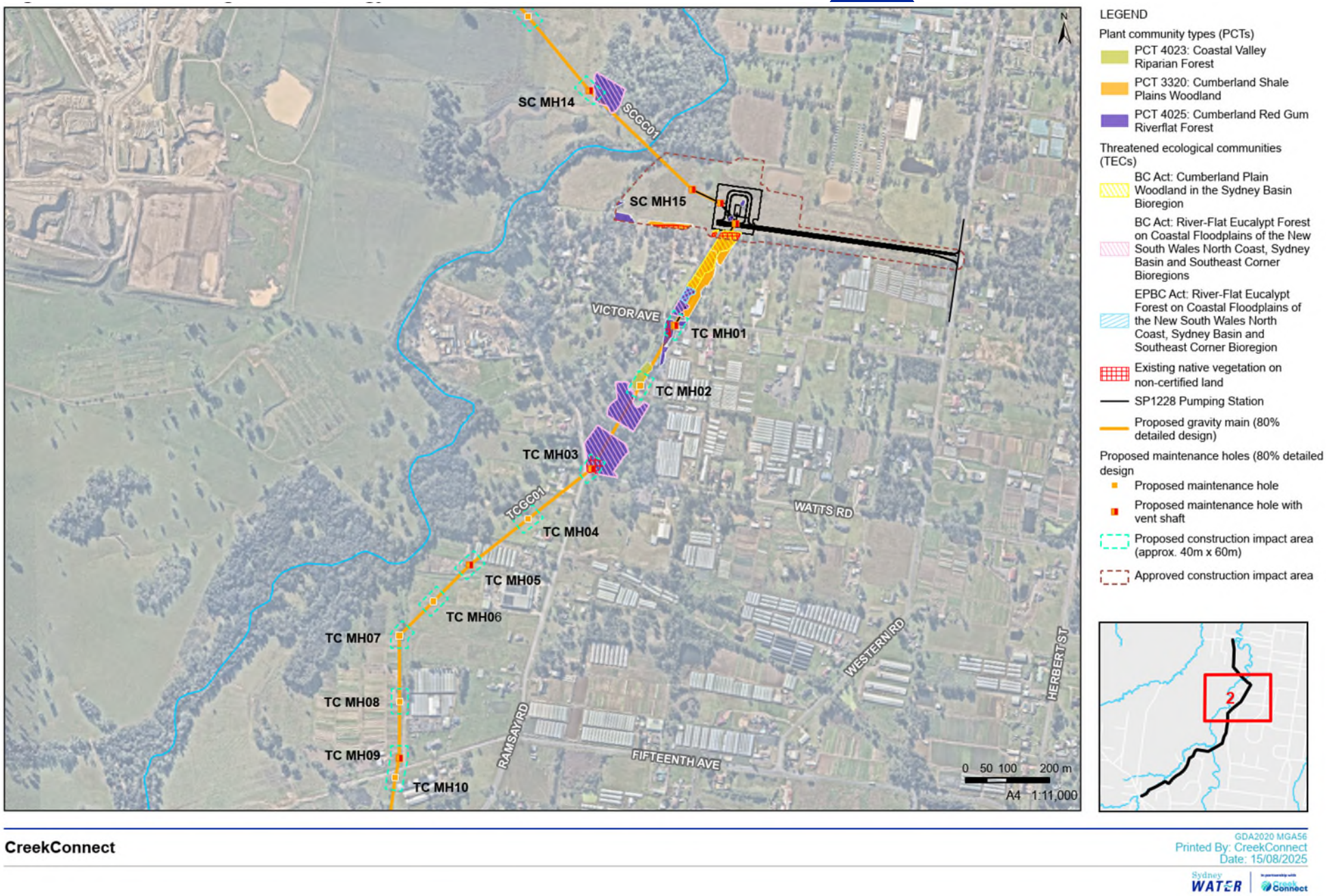


Figure 4-2: Ecology constraints (2 of 5)

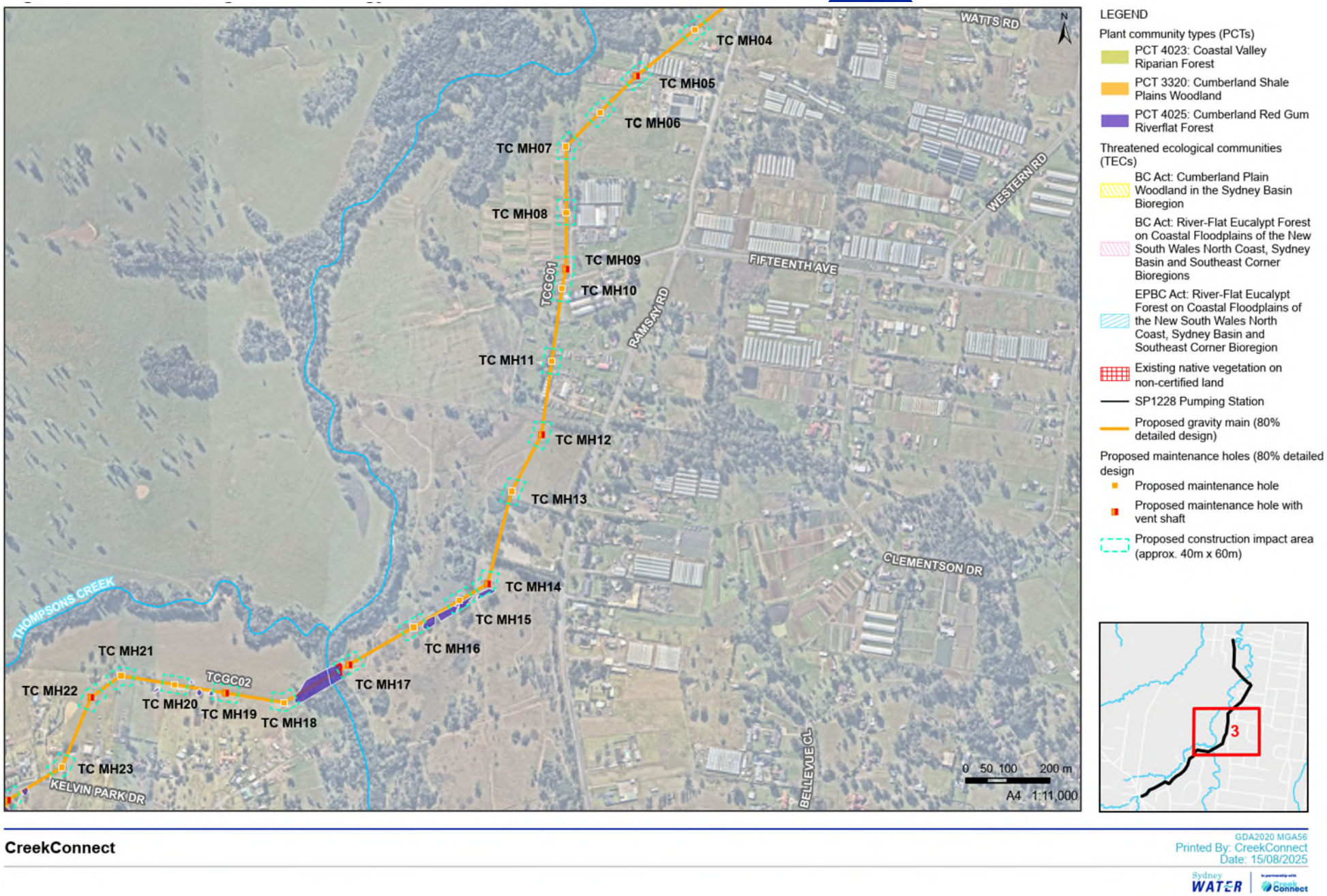


Figure 4-3: Ecology constraints (3 of 5)

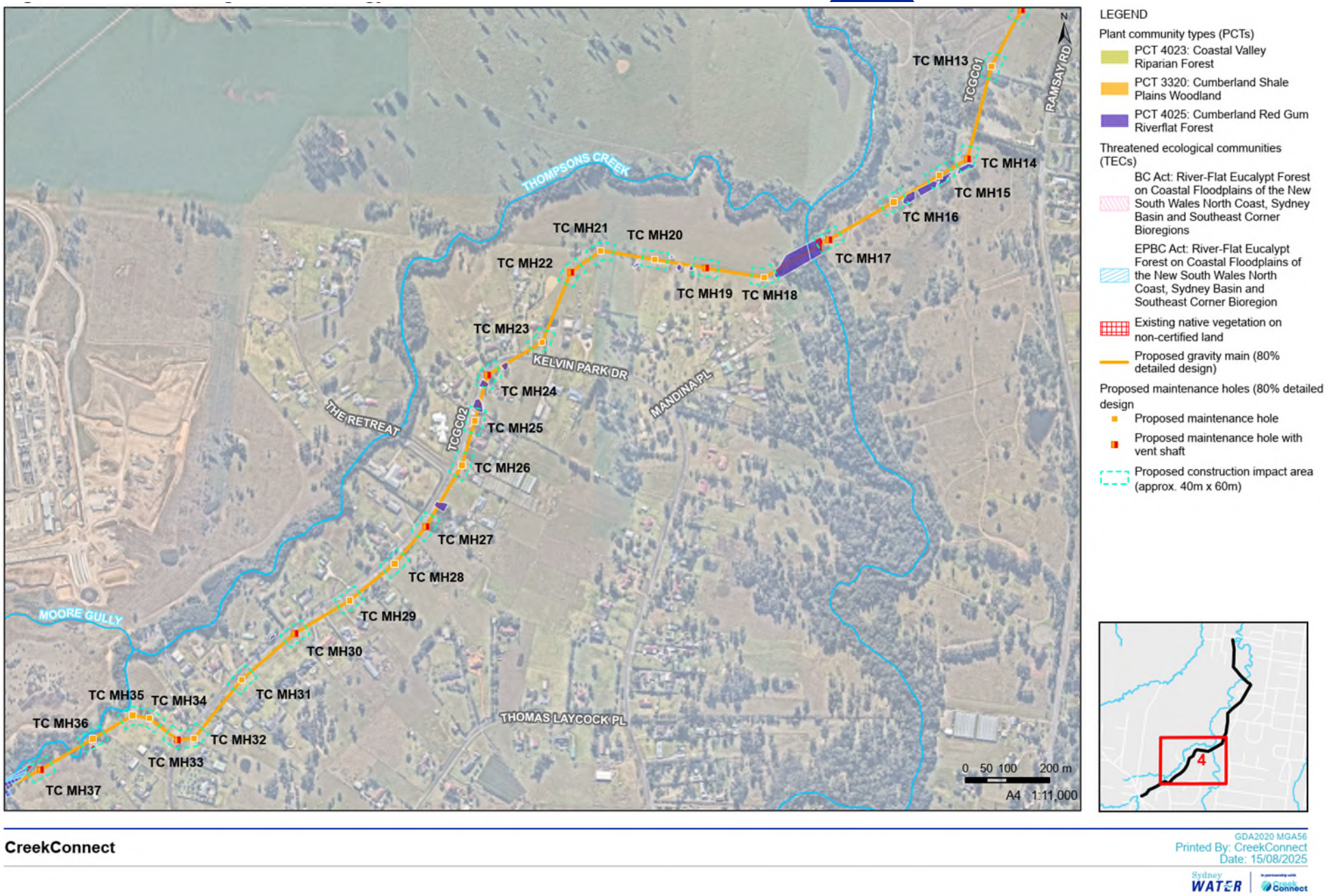


Figure 4-4: Ecology constraints (4 of 5)

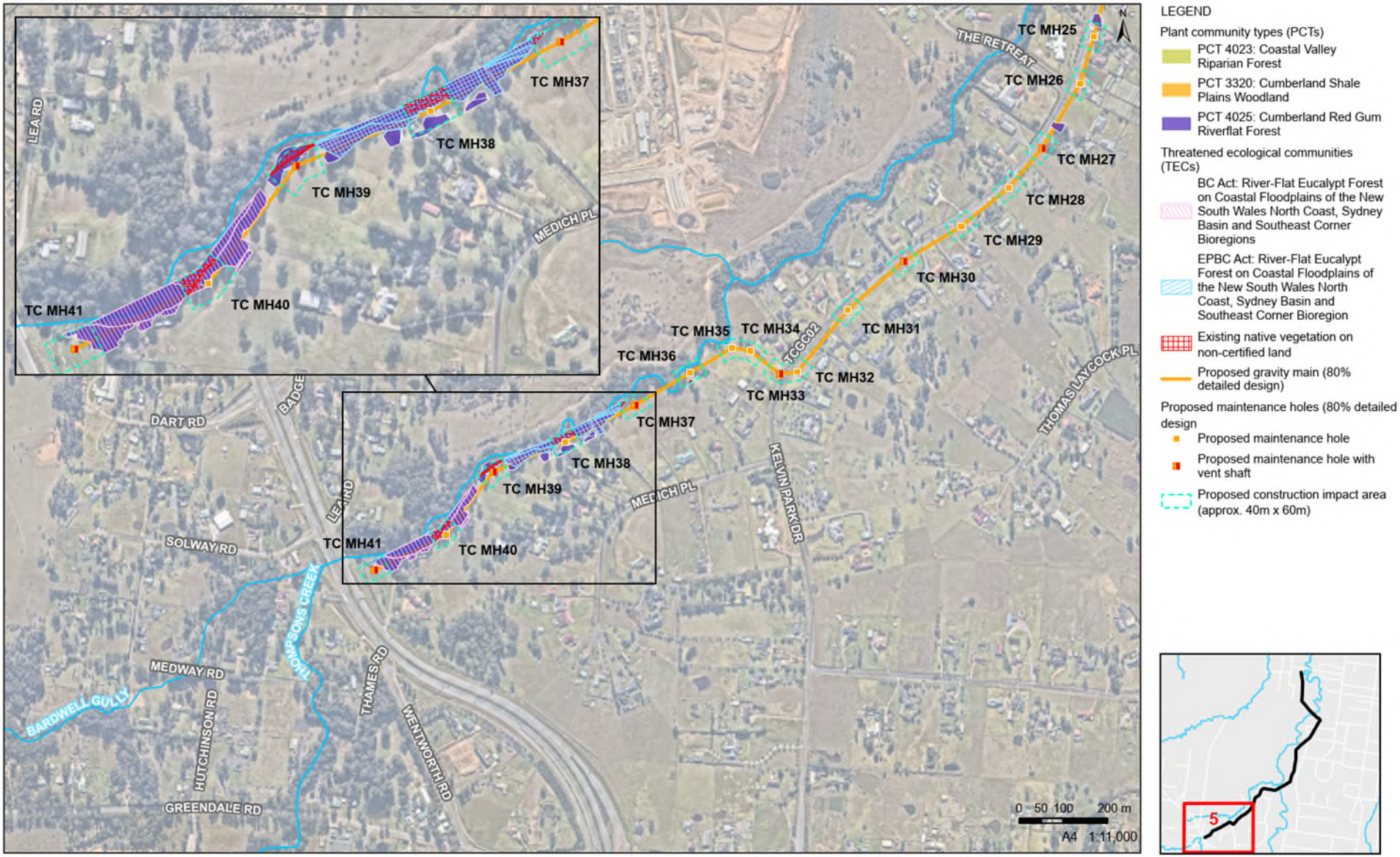


Figure 4-5: Ecology constraints (5 of 5)



Figure 4-6: Focused view of vegetation triggering statutory offsets (1 of 3)

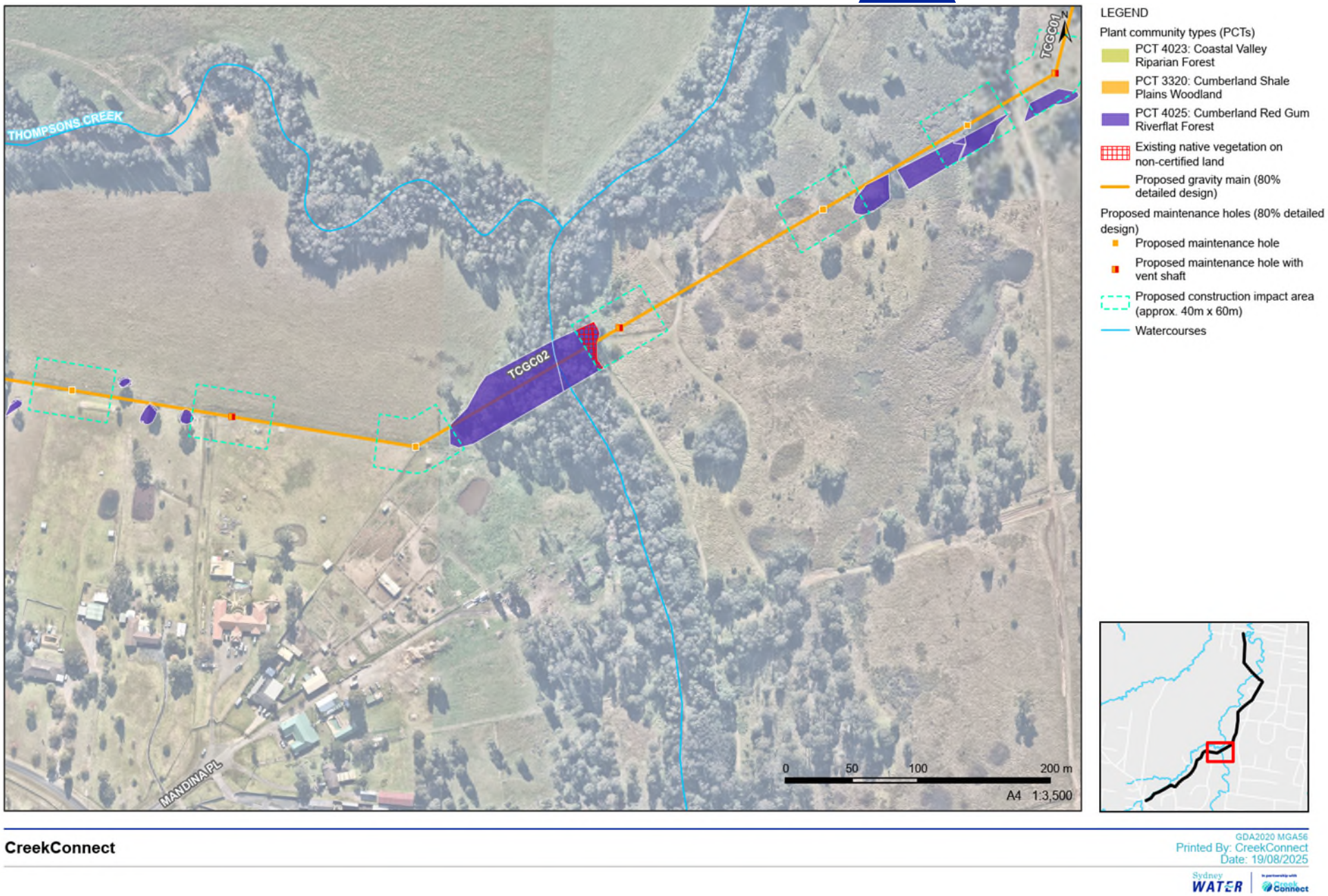


Figure 4-7: Focused view of vegetation triggering statutory offsets (2 of 3)

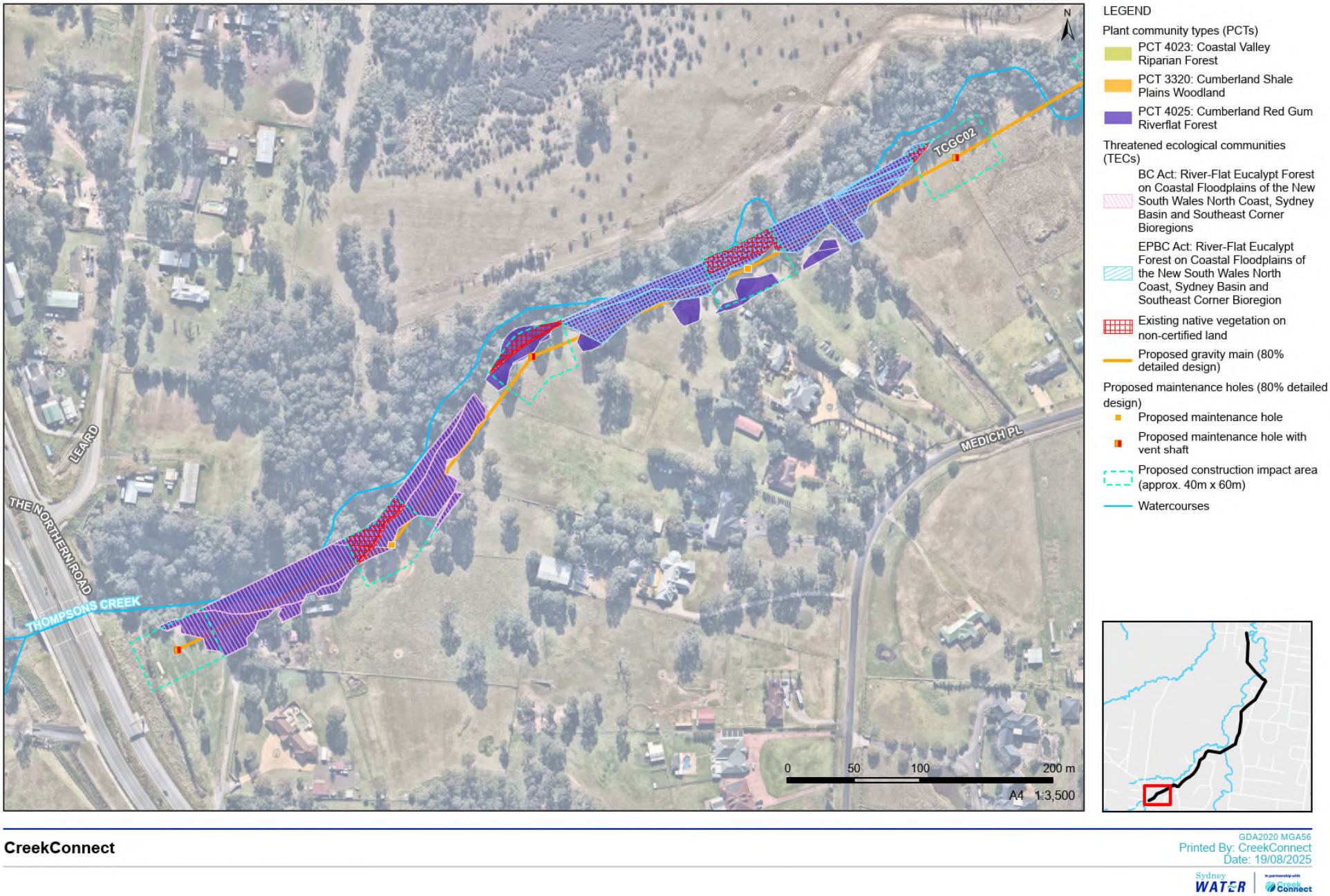


Figure 4-8: Focused view of vegetation triggering statutory offsets (3 of 3)

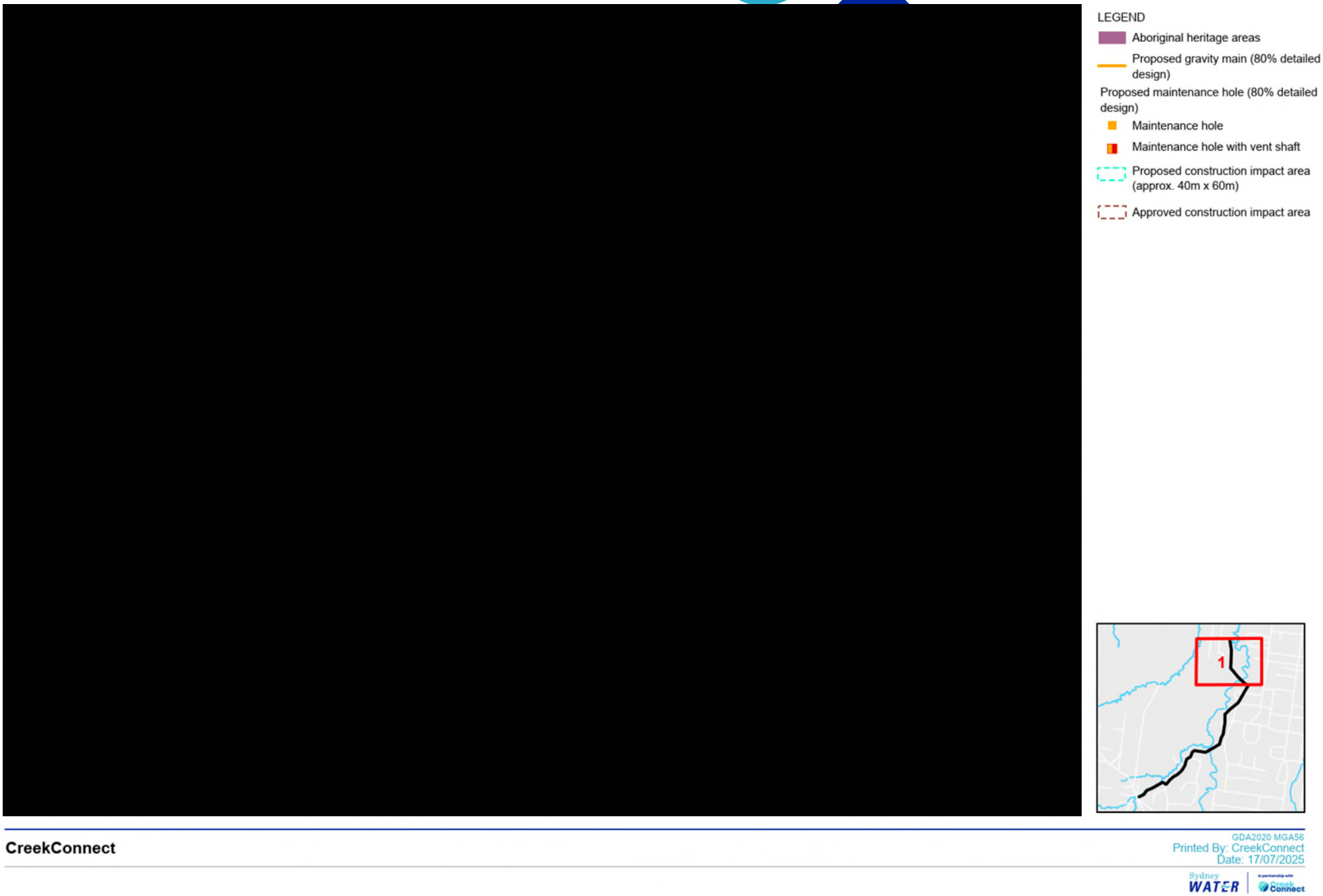
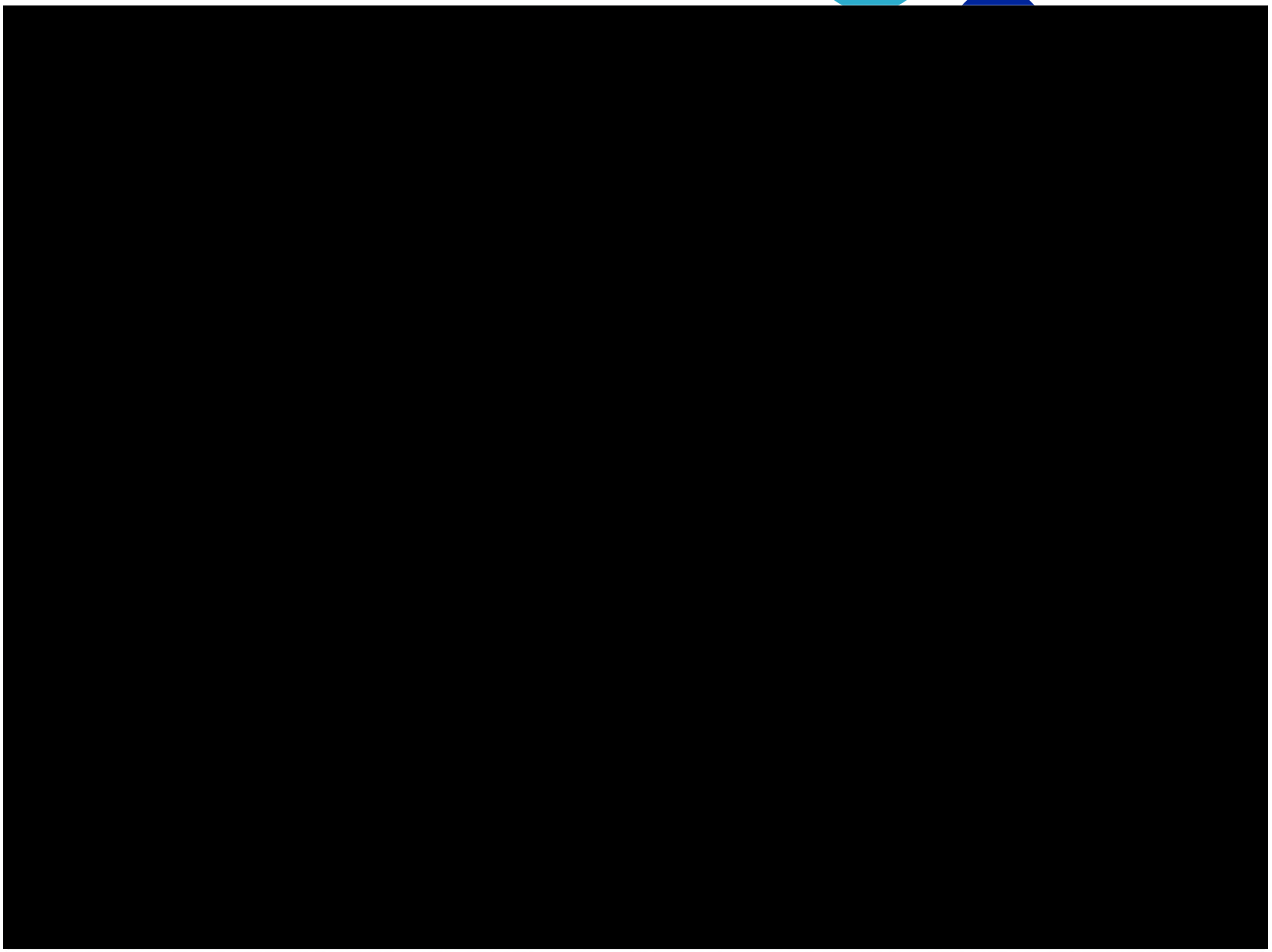


Figure 4-9: Heritage constraints (1 of 5)



LEGEND

Aboriginal heritage areas

Proposed gravity main (80% detailed design)

Proposed maintenance hole (80% detailed design)

Maintenance hole

Maintenance hole with vent shaft

Proposed construction impact area (approx. 40m x 60m)

Approved construction impact area



CreekConnect

GDA2020 MGA56
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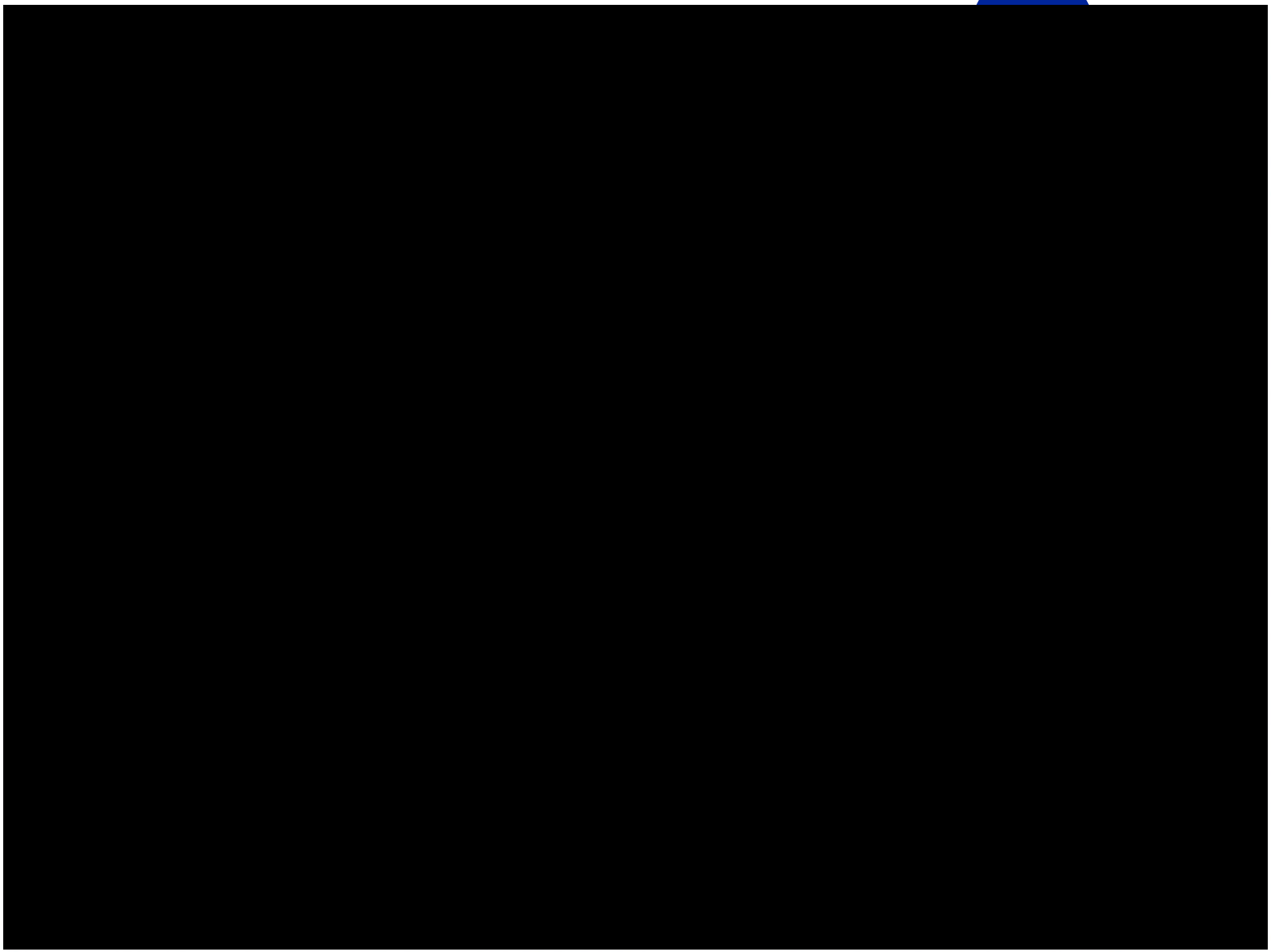
Figure 4-10: Heritage constraints (2 of 5)



Figure 4-11: Heritage constraints (3 of 5)



LEGEND

- Aboriginal heritage areas
- Proposed gravity main (80% detailed design)
- Proposed maintenance hole (80% detailed design)
- Maintenance hole
- Maintenance hole with vent shaft
- Proposed construction impact area (approx. 40m x 60m)



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Figure 4-12: Heritage constraints (4 of 5)

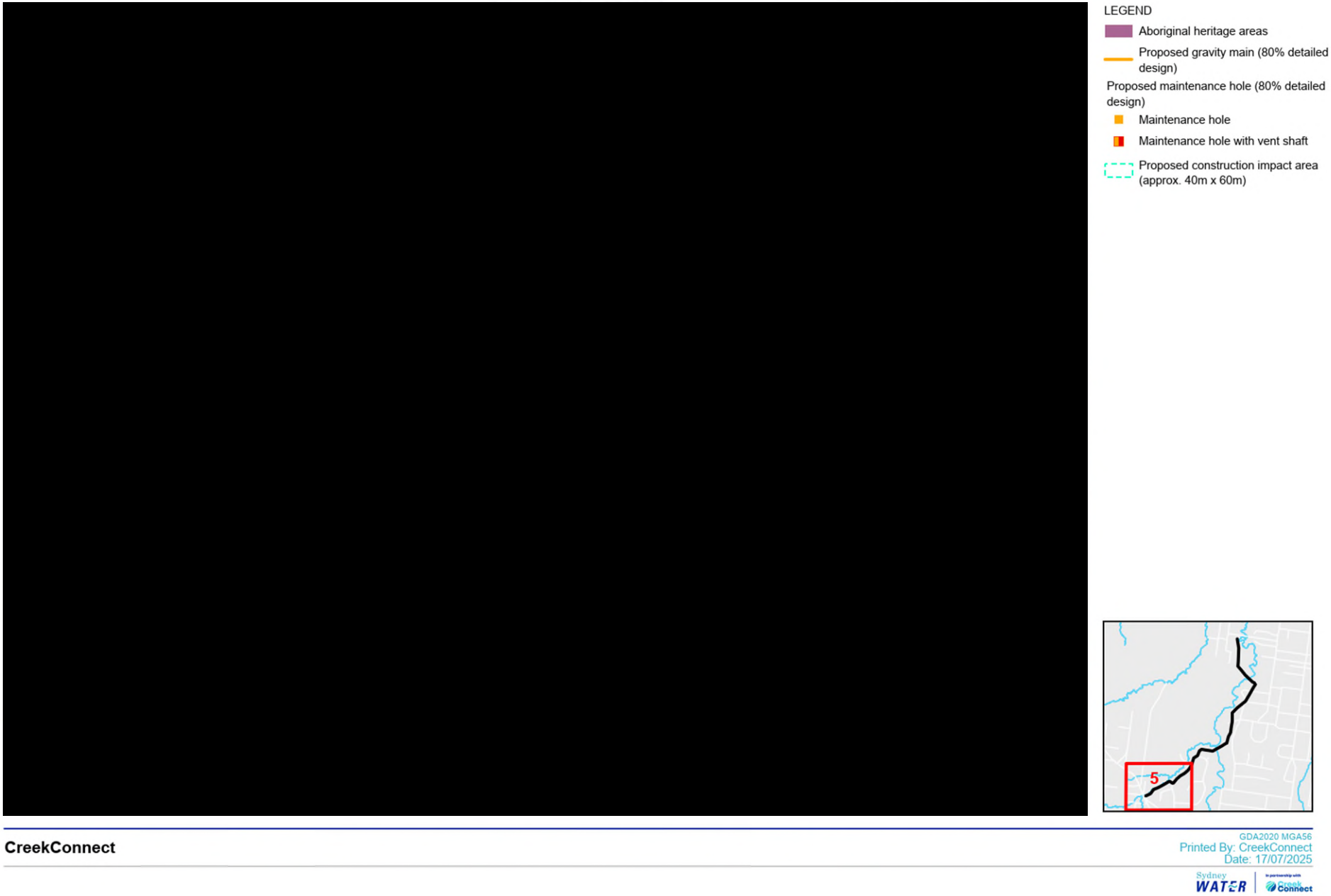

Figure 4-13: Heritage constraints (5 of 5)

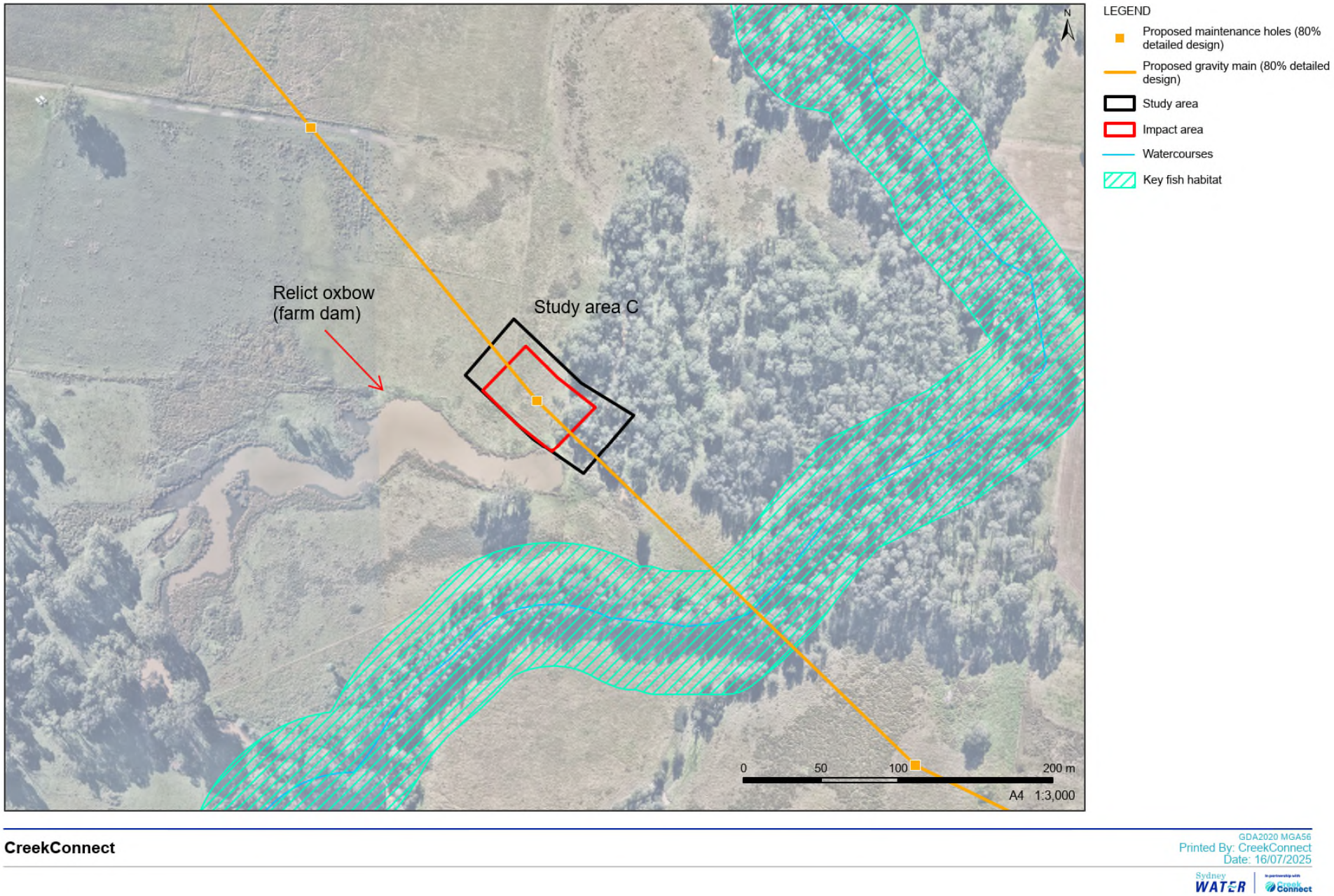

Figure 4-14: Relict oxbow (farm dam) adjacent to Study Area C

5. Conclusion

Sydney Water has prepared this REFA to assess the potential environmental impacts of South Creek Extension and Thompsons Creek Optimisation. The proposal change is required to meet Sydney Water's objective to provide timely delivery of reliable wastewater infrastructure to support development and growth expected in the SWGA and WSAGA. It will create an efficient wastewater management system while minimising impacts to landowners in the area.

The main potential construction environmental impacts of the proposal change include impacts to biodiversity and Aboriginal heritage. Overall, the proposal change will reduce potential construction impacts to soils and water by reducing the volume of excavated materials and groundwater extraction. The proposal change also incorporates landowner feedback into the design, minimising potential impacts on the community.

Given the nature, scale and extent of impacts and implementation of the mitigation measures outlined in this REFA, the proposal change is unlikely to have a significant impact on the environment. Therefore, an e nvironmental impact statement is not required under Division 5.1 of the EP&A Act.

The proposal change aligns with the principles of Ecologically Sustainable Development (ESD) listed in the approved REF (**Appendix B**). The proposal change will not result in the degradation of the quality of the environment and will not pose a risk to the safety of the environment.

Appendix A – Section 171 checklist

There are no requirements in addition to those considered in the approved REF.

Section 171 checklist	REF finding
Any environmental impact on a community	The proposal change involves temporary disturbance in the form of noise, air quality, visual impacts and occasional residential access disruptions. While impacts are consistent with the approved REF, new sensitive receivers have been identified. However, it is not anticipated that these impacts will cause significant disruption to the community. There will be environmental improvements by providing a reliable wastewater service to the community.
Any environmental impact on the ecosystems of the locality	The proposal change will result in a minor increase of native vegetation clearing by 0.065 ha compared to the approved REF. Clearing of ENV within non-certified lands has decreased by 0.056 ha from the approved REF and will be offset accordingly. Ongoing design development and construction planning will continue to identify and explore opportunities to limit clearing of native vegetation. The proposal change is not expected to have a significant impact to the ecosystem. It is expected to reduce future ecosystem impacts by ensuring reliable wastewater collection and treatment.
Any effect upon a locality, place or building having aesthetic, anthropological, archaeological, architectural, cultural, historical, scientific or social significance or any other special value for present or future generations	The Proposal will have a minor impact upon a locality, place or building having aesthetic, anthropological, archaeological, architectural, cultural, historical, scientific or social significance or any other special value for present or future generations. This includes impact to Aboriginal heritage items. The proposal change will alter the approved REFs impacts on Aboriginal heritage. One newly identified archaeological site (Martin Road South Creek AFT 1) will be impacted by the proposal change. However, impacts to one previously impacted Aboriginal heritage area (BCBW18 AS 02) will be avoided as the proposal change removes the need to construct TCPM01. Impacts to Aboriginal heritage have been minimised by implementing trenchless methods. As detailed in the approved REF, all works that have the potential to impact Aboriginal heritage will be managed by AHIP requirements. Controls will be implemented to prevent impacts to Aboriginal heritage objects outside of the AHIP areas.
Any impact on the habitat of any protected animals (within the meaning of the *Biodiversity Conservation Act 2016*)	The proposal change has potential for minor, localised impacts on the habitat of protected animals. Clearing of native vegetation will result in removing potential foraging habitat. The proposal change is unlikely to have a significant impact on any threatened species or populations listed under the BC Act.

Appendix B – Consideration of Ecologically Sustainable Development

There are no ESD consideration in addition to those covered in the approved REF.

Appendix C – Consideration of TISEPP consultation

TISEPP section	Yes	No
Section 2.10, council related infrastructure or services – consultation with council		
Will the work:		
Potentially have a substantial impact on stormwater management services provided by council?		X
Be likely to generate traffic that will strain the capacity of the road system in the LGA?		X
Connect to, and have a substantial impact on, the capacity of a council owned sewerage system?		X
Connect to, and use a substantial volume of water from a council owned water supply system?		X
Require temporary structures on, or enclose, a public space under council's control that will disrupt pedestrian or vehicular traffic that is not minor or inconsequential?		X
Excavate a road, or a footpath adjacent to a road, for which the council is the roads authority, that is not minor or inconsequential?		X
Section 2.11, local heritage – consultation with council		
Is the work likely to affect the heritage significance of a local heritage item, or of a heritage conservation area (not also a State heritage item) more than a minor or inconsequential amount?		X
Section 2.12, flood liable land – consultation with council		
Will the work be on flood liable land (land that is susceptible to flooding by the probable maximum flood event) and will works alter flood patterns other than to a minor extent?		X
Section 2.13, flood liable land – consultation with State Emergency Services		
Will the work be on flood liable land (land that is susceptible to flooding by the probable maximum flood event) and undertaken under a relevant provision*, but not the carrying out of minor alterations or additions to, or the demolition of, a building, emergency works or routine maintenance? * (e) Div.14 (Public admin buildings), (g) Div.16 (Research/ monitoring stations), (i) Div.20 (Stormwater systems)?		X
Section 2.14, development with impacts on certain land within the coastal zone– council consultation		
Is the work on land mapped as coastal vulnerability area and inconsistent with a certified coastal management program?		X
Section 2.15, consultation with public authorities other than councils		

TISEPP section	Yes	No
Will the proposal be on land adjacent to land reserved under the *National Parks and Wildlife Act 1974* or land acquired under Part 11 of that Act*? If so, consult with DPE (NPWS).*		X
Will the proposal be on land in Zone C1 National Parks and Nature Reserves or on a land use zone that is equivalent to that zone? *If so, consult with DPE (NPWS).*		X
Will the proposal include a fixed or floating structure in or over navigable waters? *If so, consult TfNSW.*		X
Will the proposal be on land in a mine subsidence district within the meaning of the *Coal Mine Subsidence Compensation Act 2017*? *If so, consult with Subsidence Advisory NSW.*		X
Will the proposal be on land in a Western City operational area specified in *the Western Parkland City Authority Act 2018,* Schedule 2 and have a capital investment value of $30 million or more? *If so, consult the Western Parkland City Authority*.		X
Will the proposal clear native vegetation on land that is not subject land (i.e. non-certified land)? *If so, notify DPE at least 21 days prior to work commencing. (Requirement under s3.24 Chapter 3 Sydney Region Growth Centres - of the SEPP (Precincts – Central River City) 2021).*	X	

Appendix D – Addendum Biodiversity Assessment Report

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Thompsons Creek Addendum Biodiversity Assessment Report

Document no: CCC020_04-JSW-ENV-RPT-000001
Version: Final

Sydney Water
Upper South Creek Network

Thompsons Creek and South Creek Networks Stage 1
15 August 2025



Thompsons Creek Addendum Biodiversity Assessment Report

Client name:	Sydney Water		
Project name:	Thompsons Creek and South Creek Networks Stage 1		
Client reference:	Upper South Creek Network	**Project no:**	IA328300
Document no:	CCC020_04-JSW-ENV-RPT-000001	**Project manager:**	[redacted]
Version:	Final	**Prepared by:**	[redacted]
Date:	15 August 2025	**File name:**	USCN_TC_Biodiversity Assessment Report_Rev3
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Acronyms and abbreviations

AOBV	Areas of Outstanding Biodiversity Value
ASL	Above Sea Level
AWRC	Advanced Water Recycling Centre
BAM	Biodiversity Assessment Method 2020
BC Act	*Biodiversity Conservation Act 2016* (NSW)
BCO	Biodiversity Certification Order
BC Regulation	Biodiversity Conservation Regulation 2017 (NSW)
BDAR	Biodiversity Development Assessment Repot
BOM	Bureau of Meteorology
BV Map	Biodiversity Values Map
CAMBA	China–Australia Migratory Bird Agreement
CEMP	Construction Environmental Management Plan
DBH	Diameter at Breast Height
DEC	Department of Environment and Conservation (NSW)
DEWHA	Department of the Environment, Water, Heritage and the Arts (Commonwealth)
DoE	Department of the Environment (Commonwealth)
DoEE	Department of the Environment and Energy (Commonwealth)
DPE	Department of Planning and Environment (NSW)
DPI	Department of Primary Industries (NSW)
DPIE	Department of Planning, Industry and Environment (NSW)
EP&A Act	*Environmental Planning and Assessment Act 1979* (NSW)
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth)
EIA	Environmental Impact Assessment
ENV	Existing Native Vegetation
Federal DCCEEW	Department of Climate Change, Energy, the Environment and Water (Commonwealth)
FM Act	*Fisheries Management Act 1994* (NSW)
GPS	Global Positioning System
IBRA	Interim Biogeographic Regionalisation for Australia
JAMBA	Japan–Australia Migratory Bird Agreement

KFH	Key Fish Habitat
KTP	Key Threatening Process
LGA	Local Government Area
LLS	Local Land Services
MNES	Matters of National Environmental Significance
NSW	New South Wales
NSW DCCEEW	Department of Climate Change, Energy, the Environment and Water (NSW)
PCT	Plant Community Type
REF	Review of Environmental Factors
REFA	Addendum Review of Environmental Factors
ROKAMBA	Republic of Korea–Australia Migratory Bird Agreement
SEPP	State Environmental Planning Policy
SIS	Species Impact Statement
SVTM	State Vegetation Type Map
SWGA	South West Growth Area
TBDC	Threatened Biodiversity Data Collection (NSW BioNet)
TEC	Threatened Ecological Community
TSSC	Threatened Species Scientific Committee
USCN	Upper South Creek Network
VI	Vegetation Integrity
WoNS	Weeds of National Significance
WSA	Western Sydney Airport
WSAGA	Western Sydney Aerotropolis Growth Area

1. Introduction

1.1 Background

Greater Sydney's population is forecast to reach 8 million people over the next 40 years, with approximately half of those people expected to live in Western Sydney. By 2056, an estimated 193,000 new dwellings and 250,000 jobs are forecast in the South West Growth Area (SWGA) and Western Sydney Aerotropolis Growth Area (WSAGA). The Upper South Creek Network (USCN) Program (the Program) will provide wastewater infrastructure to service that growth.

Sydney Water will deliver five wastewater infrastructure projects within the Upper South Creek Catchment region as part of the USCN Program. These include Badgerys Creek, South Creek, Thompsons Creek, Cosgrove and Agribusiness, and Lowes Creek. These works will be delivered in a series of stages. Stage 1 combines two (Thompsons Creek and South Creek) of five (including Badgerys Creek, Cosgroves and Agribusiness, and Lowes Creek) wastewater infrastructure projects under the Program.

The objective of the Thompsons Creek and South Creek Catchment Wastewater Network Stage 1 Project (the Project) is to connect Western Sydney Airport (WSA) wastewater systems to Sydney Water's Upper South Creek Advanced Water Recycling Centre (AWRC) by mid-2026. The Project was approved in a Review of Environmental Factors (REF) under Part 5 of the *Environmental Planning and Assessment Act 1979* (EP&A Act), and consists of the construction and operation of wastewater mains, including gravity carriers and pressure mains, and two new wastewater pumping stations.

Sydney Water is preparing an additional REF Addendum (REFA) to assess proposed changes to the approved Project. The proposed changes include modifying sections of the Thompsons Creek gravity carrier alignment, relocating and removing maintenance holes, and extending the South Creek gravity carrier, which will be constructed as part of the Thompsons Creek alignment. As a result, some of the works approved as part of the Thompsons Creek and South Creek Catchment Wastewater Network Stage 1 Project REF (Sydney Water, 2025a) are no longer required, including construction and operation of the 3.1km pressure main.

Specifically, this biodiversity assessment focuses on proposed changes to the Thompsons Creek gravity carrier alignment, including the South Creek extension, and three associated maintenance holes (the Proposal).

1.2 Site location and proposed works

The Project is located within the SWGA, about 40km southwest of the Sydney CBD in the suburbs of Badgerys Creek, Bradfield, Rossmore, and Kemps Creek. It is in the local government areas (LGA) of Liverpool City Council (south of Elizabeth Drive) and Penrith City Council (north of Elizabeth Drive).

The Proposal is located near Ramsay Road, Badgerys Creek and Martin Road, Badgerys Creek and consists of modifications to the Thompsons Creek gravity carrier alignment approved in the REF (study area A and B) and an extension of the approved South Creek gravity carrier alignment (study area C).

The proposed works would generally comprise:

- Setup activities including fencing, signage, scaffolding, and installing environment controls, where required
- Vegetation clearing and trimming
- Commissioning including testing and running the new equipment to ensure the equipment is working correctly

- Construction of approximately 1.2km of pipeline using trenchless construction methods and three associated maintenance holes which are required for construction and operation; and
- Revegetation and rehabilitation of disturbed areas.

The location of three study areas and three impact areas are shown in Figure 1-1.

1.3 Mapped land categories

The three study areas are located within the SWGA boundary under the State Environmental Planning Policy (SEPP) (Precincts – Western Parkland City) 2021. In Chapter 3 of this SEPP, the SWGA has been established and designated by the NSW Government as land for future urban development.

Under the SEPP, all certified land within the SWGA has been subject to biodiversity certification, meaning that activities undertaken within certified areas do not need to undertake assessment of impacts on threatened species, populations, or ecological communities, or their habitats that would normally be required by Division 5.1 of the EP&A Act.

Impacts to vegetation within areas classified as "existing non-certified" require biodiversity assessment for significance of impact, and potential offsets. Statutory offsets are required for any impacts to existing native vegetation (ENV) in non-certified land.

Refer to Figure 1-1 for certified and non-certified land within the study areas.

1.4 Purpose of this Report

The purpose of this Addendum Biodiversity Assessment Report (BAR) is to inform the preparation of a REFA by Sydney Water under Part 5 of the EP&A Act. Specifically, the scope of this addendum BAR is to:

- Describe the ecological environment and values within the study areas
- Describe the legislative and policy context of the Proposal in relation to biodiversity
- Identify the likely presence of, or suitable habitat for, any threatened species, populations and/or ecological communities (threatened biota), listed under the NSW *Biodiversity Conservation Act 2016* (BC Act), *Fisheries Management Act 1994* (FM Act) and/or Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) within the study areas
- Assess the potential construction and operational impacts of the Proposal on biodiversity values within the study areas
- Provide suitable avoidance and mitigation measures to minimise impacts to biodiversity values within the study areas and surrounding locality
- Identify any required offsetting for residual impacts in accordance with the Sydney Water policy.

1.5 Terms and definitions

The following terms are used throughout this addendum BAR to describe project features and geographic areas:

- **The Program:** The Upper South Creek Network Program
- **The Project / Approved Project**: Thompsons Creek and South Creek Catchments Wastewater Network Stage 1
- **The Proposal**: the three maintenance hole locations assessed in this addendum BAR
- **Revised design**: the proposed amendments to pipeline alignments, in particular the revised maintenance hole locations across the entire Thompsons Creek project

- **Study areas**: the three areas surveyed during the field survey
- **Impact areas:** approximately a 40m wide by 60m in length area around each maintenance hole where vegetation removal will occur:
  - Impact area A is located at 63 Victor Avenue, Kemps Creek on Lot 35 DP28050
  - Impact area B is located at 100- and 115-Watts Road Kemps Creek across Lots 10 and 36 DP28050
  - Impact area C is located at 260 Martin Road, Badgerys Creek across Lots 55 and 56 DP3050.
- **Locality**: a 10 kilometre (km) buffer around the study areas used to consider the broader context of local biodiversity
- **Vegetation clearing:** as defined in section 60C of the *Local Land Services Act 2013* (LLS Act), clearing of native vegetation includes the cutting down, felling, uprooting, thinning, killing, destroying, poisoning, ringbarking or burning native vegetation. As such, the extent of the 'impact areas' are considered as 'clearing' of vegetation.
- **Vegetation trimming:** removal of small branches of established vegetation. Trimming would be reserved to overhanging branches on edges of impact areas and would not compromise the integrity or survival of the plant.

1.6 Legislation and planning instruments

The legislation and policy reviewed in this BAR remains consistent with the Approved REF. For further details of specific legislation and policy, refer to the Approved REF (Sydney Water 2025a).

Figure 1-1: Site Location and Layout

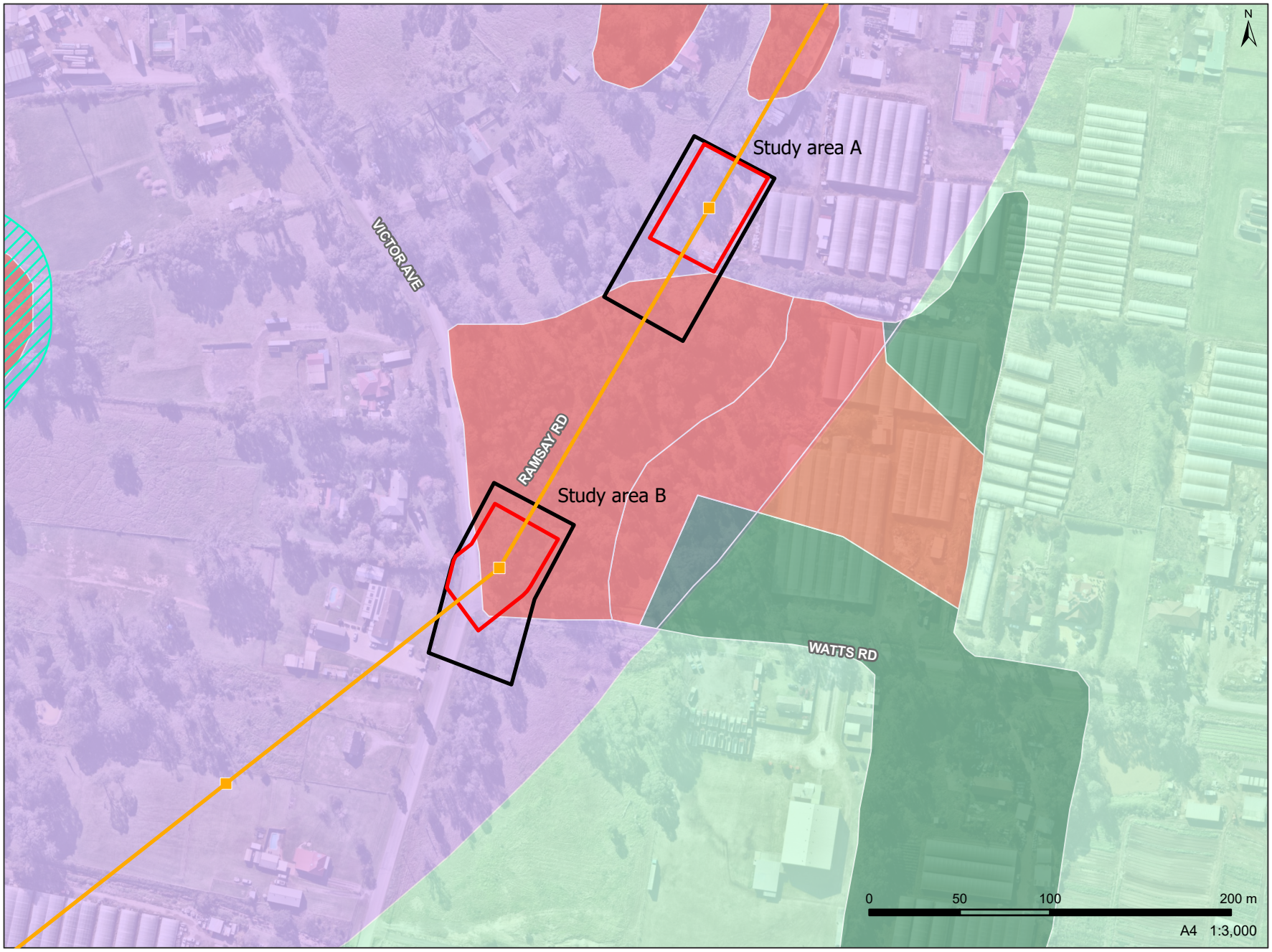
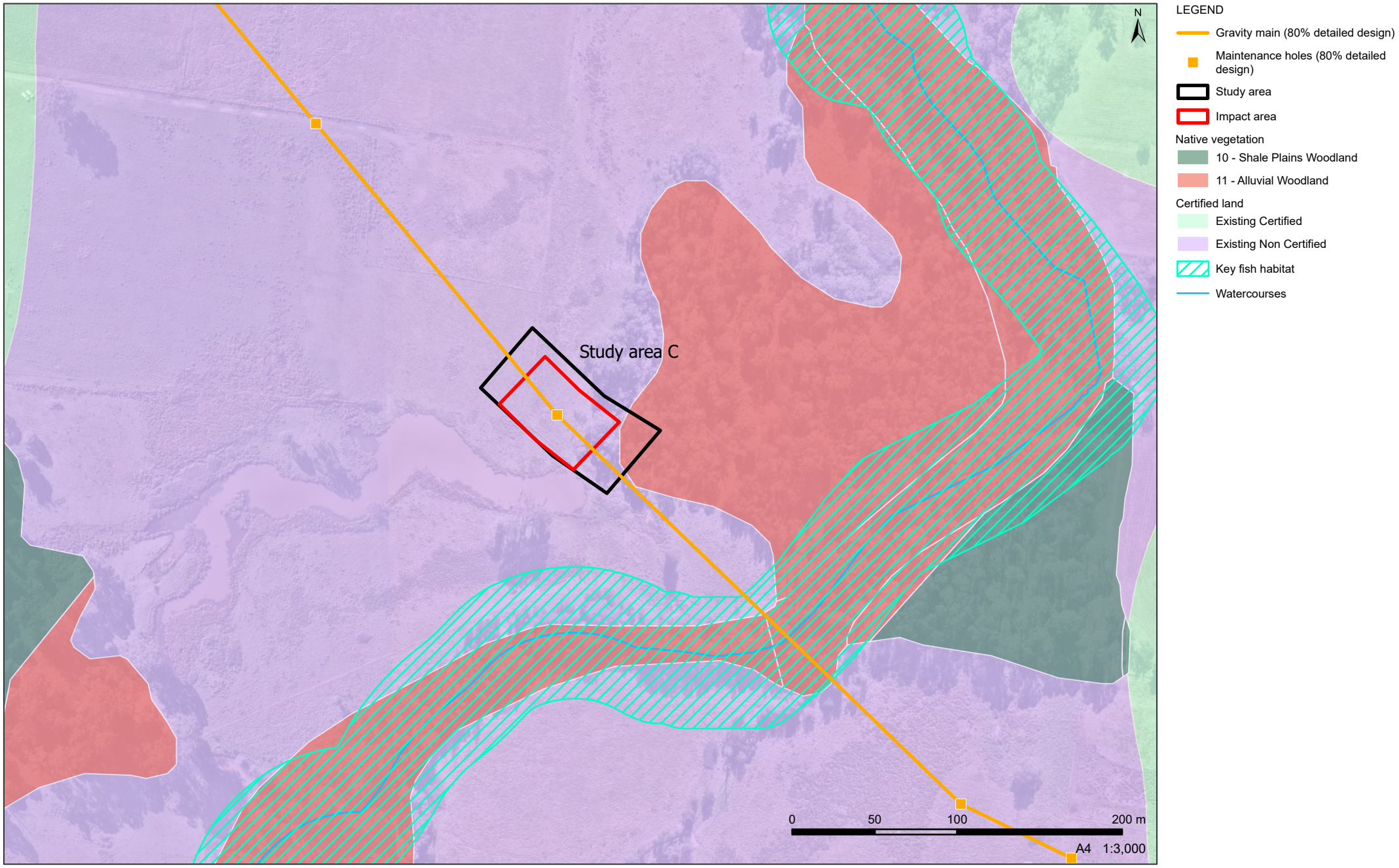


Figure 1-1: Site Location and Layout



2. Methods

2.1 Desktop assessment

A revised desktop review was completed to identify any newly listed species, population or communities. The desktop assessment comprised review of:

- Regional vegetation mapping and PCT descriptions within the study areas, comprising:
  - NSW State Vegetation Type Map (SVTM), vC2.0M2.1 (NSW DCCEEW 2024a)
  - NSW BioNet Vegetation Classification (NSW DCCEEW 2025a)
- Spatial mapping and spatial data pertaining to the site and surrounding area (DCS 2025)
- Soil type mapping (NSW DPIE 2025)
- Records of all threatened species, populations, and ecological communities (collectively known as threatened entities) within a 10 km buffer of the study areas, comprising:
  - NSW BioNet Atlas (NSW DCCEEW 2025b)
  - NSW Fisheries NSW Spatial Data Portal (DPI 2025)
  - EPBC Protected Matters Search Tool (DCCEEW 2025a)
- NSW BioNet Threatened Biodiversity Data Collection (TBDC) (NSW DCCEEW 2025c)
- Biodiversity Values Map (BV Map) and Threshold Tool (NSW DCCEEW 2025d)

2.1.1 Threatened species likelihood of occurrence

A revised habitat assessment was completed to identify whether the study areas contain suitable habitat features to support threatened entities. The habitat assessment is central to understanding important indicators of habitat condition, quality and complexity with consideration afforded to understanding historic and recent disturbances and abiotic influencers such as geology, altitude, and soil type.

A shortlist of potential terrestrial and aquatic species with potential to occur, or have suitable habitat, within 10 km of the study areas was generated from various sources of threatened biodiversity records (refer to Section 2.1). A likelihood of occurrence assessment was undertaken for all entities to identify the possibility that these species would occur within the study areas. The criteria used in the assessment are detailed in Table 2-1. The results of this assessment are provided in Section 3.3.3 and Appendix A.

Table 2-1 Likelihood of occurrence criteria

Likelihood of Occurrence	Criteria
Unlikely	▪ Species highly restricted to certain geographical areas not within the locality ▪ Species that have specific habitat requirements are not present in the study area.
Low	Species that fit into one or more of the following criteria: ▪ Have not been recorded previously in the locality and for which the study areas are beyond the current distribution range ▪ Use specific habitats or resources are not present in the study area ▪ Are a non-cryptic perennial flora species that were specifically targeted by surveys and not recorded.
Moderate	Species that fit one or more of the following criteria: ▪ Have infrequently been recorded previously in the locality

Likelihood of Occurrence	Criteria
	▪ Use specific habitats or resources present in the study area but in a poor or modified condition ▪ Are unlikely to maintain sedentary populations, however, may seasonally use resources within the Study area opportunistically or during migration ▪ Are cryptic flowering flora species that were not seasonally targeted by surveys and that have not been recorded.
High	Species that fit one or more of the following criteria: ▪ Have frequently been recorded previously in the locality ▪ Use habitat types or resources that are present in the study areas that are abundance and/or in good condition within the study area ▪ Are known or likely to maintain resident populations surrounding the study area ▪ Are known or likely to visit the site during regular seasonal movements or migration.

2.2 Field survey

A site investigation was undertaken over one day in autumn (1st May 2025) by two CreekConnect ecologists to ground truth the desktop assessment and survey the biodiversity values in the study areas. Field survey was undertaken across the three study areas and focused on areas of high biodiversity value (as identified in the desktop assessment). Field survey comprised the following activities:

- Walked meanders
- Collection of rapid data points
- Targeted survey of threatened flora and fauna species with a high likelihood of occurrence and that may be detected during the survey period.

Weather conditions during the field survey were sunny with temperatures between 15-20˚C.

2.2.1 Vegetation surveys

The vegetation communities were verified via random meander and rapid point-based assessment utilising visual assessment of vegetation structure and composition. Plant Community Types as described in the NSW BioNet Vegetation Classification database (NSW DCCEEW 2025a) were assigned based on the observed plant species composition, vegetation structure, landscape position, and underlying geology and soils. Broad condition classes were assigned for each PCT based on the best fit of the criteria as outlined in Table 2-2. No plot-based assessments were undertaken.

Table 2-2 Broad condition class criteria

Condition class	Structure	Species richness	Weediness	Patch size	Human disturbance*
High	All relevant structural layers present	>20 native species recorded in study area	Exotic species sparse to absent <10% cover	Large, >1 hectare (ha)	Minimal
Moderate	One structural layer absent	>8 native species recorded in study area	Exotic species abundant 10-75% cover	Moderate, 0.3-1ha	Moderate

Condition class	Structure	Species richness	Weediness	Patch size	Human disturbance*
Low	Two or more structural layers absent	<8 native species recorded in study area	Exotic species prevalent >75% cover	Small, <0.3ha	High

*e.g., tracks, rubbish.

2.2.2 Habitat field assessment

A habitat assessment was undertaken to identify habitat suitable for threatened species recorded from the desktop assessment. Key habitat features for fauna species (i.e., hollow bearing trees, nests, fallen timber) were recorded with a Global Positioning System (GPS) device. Eight species with a moderate to high likelihood of occurring within the study areas can be predicted to occur by vegetation surrogates and landscape features. These species are assumed to occur and assessment of significance completed (Appendix C). Species that can be predicted to occur include the following:

- Dusky Woodswallow (*Artamus cyanopterus cyanopterus)*
- Varied Sittella (*Daphoenositta chrysoptera)*
- Eastern Coastal Free-tailed Bat (*Micronomus norfolkensis)*
- Little Bent-winged Bat (*Miniopterus australis)*
- Large Bent-winged Bat (*Miniopterus orianae oceanensis)*
- Grey-headed Flying-fox (*Pteropus poliocephalus)*
- Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris)*
- Greater Broad-nosed Bat (*Scoteanax rueppellii)*.

2.2.3 Targeted threatened species survey

Targeted surveys were undertaken for the two threatened species identified as having a moderate to high likelihood of occurring within the study areas that cannot be predicted to occur and have specific habitat requirements. Targeted searches were completed for the following species:

- Juniper-leaved Grevillea *(Grevillea juniperina* subsp. *juniperina*)
- Cumberland Plain Land Snail (*Meridolum corneovirens*).

The target species and their relevant survey timing are provided in Table 2-3.

Threatened flora searches were conducted for *Grevillea juniperina* subsp. *juniperina* in accordance with 'Surveying threatened plants and their habitats – NSW survey guide for the Biodiversity Assessment Method' (DPIE 2020a), where relevant survey timing requirements were met including *Grevillea juniperina* subsp. *juniperina*. As *Grevillea juniperina* subsp. *juniperina* is a distinct species and observable all year, targeted surveys were completed in areas of associated PCTs (i.e. PCT 4025).

Survey requirements outlined in the TBDC prescribe both diurnal and nocturnal surveys for the Cumberland Plain Land Snail. Diurnal surveys are used to locate empty shells and nocturnal surveys to locate live individuals. The presence of Cumberland Plain Land Snail shells confirms the presence of this species (NSW DCCEEW 2025c).

Diurnal targeted surveys for the Cumberland Plain Land Snail were conducted in areas of suitable habitat (i.e. PCT 4025) and focused on habitat features that provide sheltering habitat such as rocks, bark, logs, woody debris, leaf litter and ground vegetation at the base of mature *Eucalyptus* species. However, as both diurnal and nocturnal surveys were not conducted for the Cumberland Plain Land Snail, its absence cannot be confirmed, and as such has been included in the assessment of significance.

Targeted surveys were not conducted for Southern Myotis (*Myotis macropus*), and given presence of suitable habitat features within the study areas such as waterways and culverts, likely presence has been assumed and included within the assessment of significance (Appendix C).

Table 2-3 Threatened species seasonal survey timing

Species	BC Act Status	EPBC Act Status	Recommended survey timing	Comment
Fauna				
Cumberland Plain Land Snail *(Meridolum corneovirens)*	E	-	All year	Both diurnal and nocturnal surveys must be undertaken for the species. Diurnal surveys can be undertaken in any conditions. Nocturnal surveys are to be undertaken between dusk and dawn after rainfall at the survey location.
Flora				
Juniper-leaved Grevillea *(Grevillea juniperina* subsp. *juniperina)*	V	-	All year	Can be found in open and disturbed sites and wetted areas.

V: Vulnerable, E: Endangered

2.3 Limitations

The field surveys were conducted over one day in May 2025. As the surveys were undertaken at a discrete time of the year and during the day, many species that may utilise the study areas would not have been recorded (e.g., migratory species, species present in soil bank, nocturnal and cryptic species). These limitations have been partly addressed by identifying potential habitats for species and assessing the potential for these species to occur within the study area through the likelihood of occurrence assessment.

All spatial data collected used a hand-held GPS and FieldMaps tablet which are accurate to about 5 m.

3. Existing environment

3.1 Landscape and regulatory mapping features

Key landscape features and regulatory mapping features within the study area are outlined in Table 3-1.

Table 3-1 Landscape and regulatory mapping features

Feature		Description
Landscape and soils	Interim Biogeographic Regionalisation for Australia (IBRA) region and sub region	The study area is within the Sydney Basin bioregion and the Cumberland sub region.
	Elevation and topography	49-52 m above sea level (ASL). The topography is relatively flat, with gentle slopes grading towards South Creek.
	Rainfall	Mean annual rainfall is approximately 728 mm (Badgerys Creek AWS #067108).
	Connectivity	The vegetation within the study area is connected to adjacent vegetation extending along the South Creek corridor, ranging from approximately 50 m to 320 m in width. However, given development of the surrounding area, the vegetated corridor of South Creek is largely fragmented from any further significant remnant vegetation patches.
	Soil Type	The study areas are on 'South Creek' soil landscape which is derived from Wianamatta Group shales and Hawkesbury Sandstone, comprising floodplains, valley flats and drainage depressions of the channels on the Cumberland Plain. Soils typically range from clay to clay loams with limitations including high erodibility, hard setting surfaces, stoniness and low fertility.
	Salinity	Nil.
	Acid sulfate soils	Nil.
Biodiversity values	Biodiversity Values Map (BV Map)	The South Creek corridor is mapped on the BV Map as 'Biodiverse riparian land' and is adjacent to study area B.
	AOBV	Nil.
	National Parks	Nil. The closest National Parks and Wildlife Service (NPWS) Estate is Kemps Creek Nature Reserve, roughly 2.8 km east of the study areas.
	Other protected lands	Nil.
	Biobanking/Biodiversity Stewardship sites	Nil. However, there are nine Biobanking Agreements/ Biodiversity Stewardship sites within 10 km of the study areas: - Twin Creeks Biobanking Agreement (#BA00413) - Kemps Creek Biobanking Agreement (#BA00120) - Horsley Park (#BS0078) - Cecil Park South East & Chandos West Biobanking Agreement (#BA00070) - M7 West – Variation (#BA00119)

Feature		Description
		- Middleton Grange (#BS0111) - Emerald Hills Biobanking Agreement (#BA00159)
Waterways and hydrology	Waterways and waterbodies	South Creek is located adjacent to study area C, which flows north joining several other creeks before discharging into the Hawkesbury River approximately 35 km north of the study areas. There is also a relict oxbow branching off South Creek adjacent to Study area C. Several drainage ditches are located within study areas A and B, likely draining into South Creek at various locations.
	Key Fish Habitat (KFH)	South Creek, located adjacent to study area C is mapped as KFH in the Hawkesbury-Nepean catchment. None of the study areas overlap with the mapped KFH.
	Federal Directory of Important Wetlands	Nil within 10km.
	Coastal wetlands and littoral rainforest	Nil.
	Flood prone lands	Nil.
Risk	Bushfire prone land (BFPL)	Vegetation within the South Creek corridor is mapped as Category 1 BFPL, with surrounding land mapped as Category 3 BFPL.
	Landslide risk	Nil.

3.2 Vegetation communities

3.2.1 Regional vegetation mapping

The desktop review of regional vegetation mapping using the NSW SVTM (NSW DCCEEW 2024a), indicates that vegetation surrounding the South Creek corridor comprises PCT 4025 'Cumberland Red Gum Riverflat Forest', and overlaps with portions of all three study areas. The desktop review also indicates that PCT 4023 'Coastal Valleys Swamp Oak Riparian Forest' and PCT 3320 'Cumberland Shale Plains Woodland' are adjacent to the study areas.

The study areas also overlap with existing native vegetation (ENV) areas in non-certified land as shown on Growth Centre Sydney Existing Native Vegetation Protected Land Map (NSW DCCEEW, 2015)..

3.2.2 Ground-truthed vegetation

The field survey found the regional vegetation mapping to be partly accurate. Slight modifications to the PCT boundaries interpreted from the regional mapping was required. The vegetation observed across the study areas is summarised as follows:

- PCT 4023 'Coastal Valleys Swamp Oak Riparian Forest' (low condition) (study area A)
- PCT 4025 'Cumberland Red Gum Riverflat Forest' (moderate condition) (study areas A, B and C)

Descriptions of vegetation within the study areas, are provided in Table 3-2 and Table 3-3 and shown in Figure 3-1.

Table 3-2 PCT 4023 Coastal Valleys Swamp Oak Riparian Forest

Feature	Description
PCT ID	4023
PCT Name	Coastal Valleys Swamp Oak Riparian Forest
Vegetation formation	Forested Wetlands
Condition class	**Low**
Description	The canopy is dominated by *Casuarina glauca* with occasional *Melaleuca linariifolia* and a low abundance of *Eucalyptus amplifolia*. The mid-storey includes *Lobelia purpurascens*, with exotic species *Ligustrum lucidum*, *Conyza sumatrensis* and *Nasturtium officinale*. The ground storey includes native species such as *Juncus usitatus* and *Carex inversa* but is heavily dominated by the exotic species *Tradescantia fluminensis*.
Patch size	>100 ha (the vegetated canopy extends along South Creek to the north and south with less than 100 m gaps in continuous canopy).
Area in study area	Study Area A 0.101 ha
Image	Refer to Plate 3-1
Confirmed TECs (also refer to Section 3.2.3	▪ This PCT is associated with Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions – Endangered (BC Act), where it occurs in low elevations <20m ASL in saline soils
Similar eliminated PCTs.	PCT 4023 was selected over PCT 4025 as *Casuarina glauca* was recorded as dominant and rarely appears in PCT 4025. Additionally, the study area is not located on sandstone escarpments, or derived soils and as a such PCT 4058 was not selected. PCTs 3320 and 3315 have some floristic overlap with PCT 4023 but were also not selected as *Casuarina glauca* is rare in these PCTs.

Table 3-3 PCT 4025 Cumberland Red Gum Riverflat Forest

Feature	Description		
PCT ID	4025		
PCT Name	Cumberland Red Gum Riverflat Forest		
Vegetation formation	Forested Wetlands		
Condition class	**Moderate**		
Description	A canopy dominated by *Melaleuca linariifolia* and *Eucalyptus amplifolia*, with occasional *Angophora subvelutina,* and *Casuarina glauca.* The shrub layer includes *Bursaria spinosa* and *Acacia parramattensis*, with exotic species including *Araujia sericifera* and *Senecio madagascariensis*. The ground storey is a mixture of native and exotic grasses and forbs but is largely dominated by the exotic *Tradescantia fluminensis*.		
Patch size	>100 ha (the vegetated canopy extends along South Creek to the north and south with less than 100 m gaps in continuous canopy).		
Area in study area	Study Area A	Study Area B	Study Area C

Feature	Description		
	0.196 ha	0.280 ha	0.173 ha
Image	Refer to Plate 3-2 and Plate 3-3.		
Confirmed TECs (also refer to Section 3.2.3	▪ River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (Endangered under BC Act)		
Similar eliminated PCTs.	PCT 4025 was selected over PCT 4023 as *Casuarina glauca* was not recorded as dominant and given the lack of saline soils. Additionally, the study area is not located on sandstone escarpments, or derived soils and as a such PCT 4058 was not selected. PCT 3220, which is mapped in the surrounding area was also not selected as it is characterised by *Eucalyptus tereticornis* and *Eucalyptus moluccana* which were not recorded within the study areas.		

Plate 3-1 Example of PCT 4023 Coastal Valleys Swamp Oak Riparian Forest – low condition (study area A)



Plate 3-2 Example of PCT 4025 Cumberland Red Gum Riverflat Forest - moderate condition (study area B)



Plate 3-3 Example of PCT 4025 Cumberland Red Gum Riverflat Forest - moderate condition (study area C)



3.2.2.1 Disturbed exotic grassland

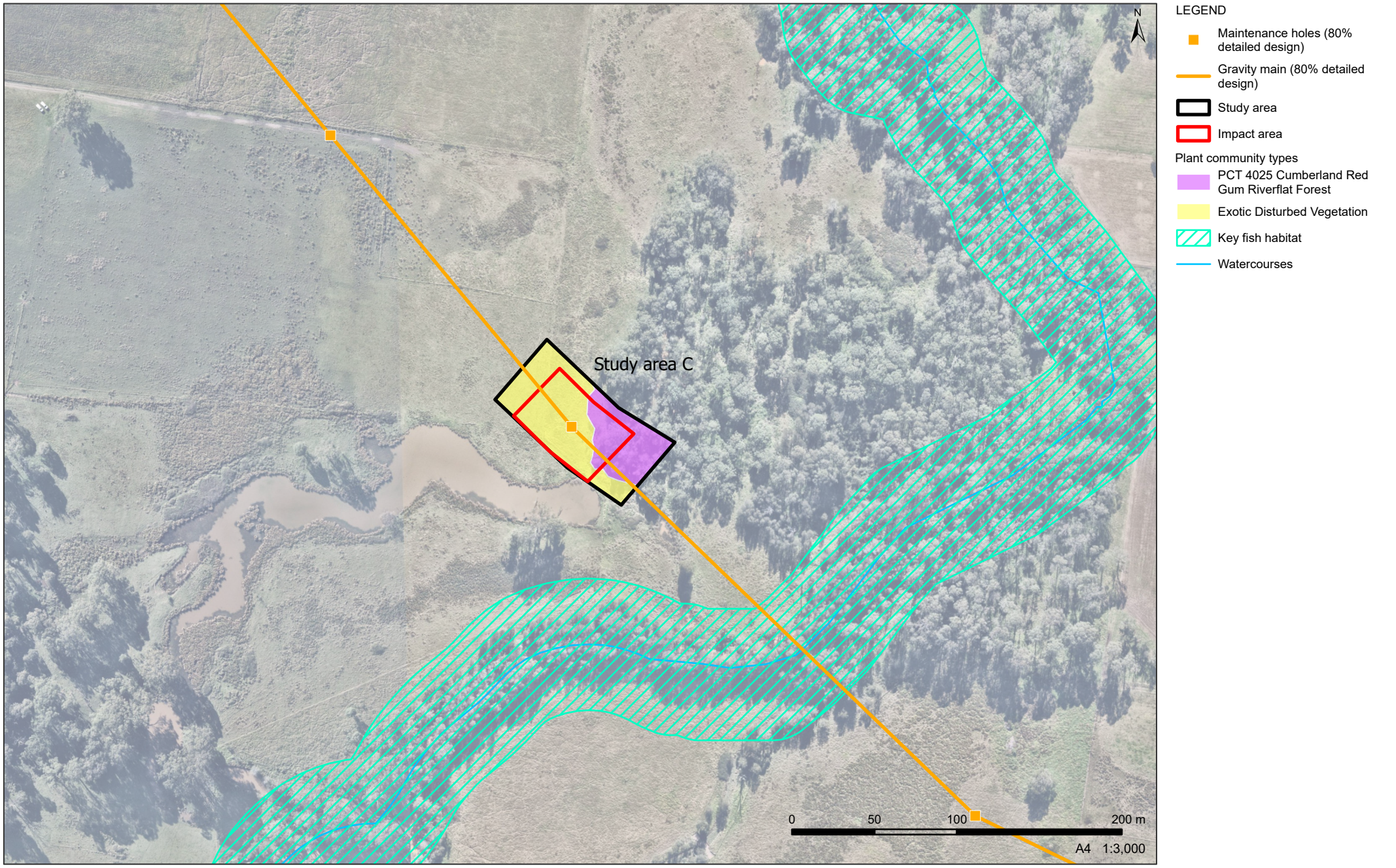
The vegetation across study area C comprises disturbed exotic grassland. This vegetation cannot be assigned a 'best-fit' PCT as species are predominantly exotic, within a highly modified landscape, and/or are providing negligible ecosystem services.

Key species in the area mapped as 'Disturbed exotic grassland' include *Paspalum urvillei*, *Chloris gayana, Verbena bonariensis*, *Conyza sumatrensis* and *Sida rhombifolia* with additional exotic grasses and forbs.

Figure 3-1: Vegetation mapping



Figure 3-1: Vegetation mapping



3.2.3 Threatened Ecological Communities

There is one TEC present within the study areas (shown in Figure 3-2) which meets the description within the final determination, comprising:

- River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions – Endangered (BC Act)

There are an additional three EPBC Act TECs that do not meet TEC listing criteria requirements based on the location of the study areas and/or condition thresholds, comprising:

- River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria – Critically Endangered (EPBC Act)
- Elderslie Banksia Scrub Forest in the Sydney Basin Bioregion – Critically Endangered (EPBC Act).
- Coastal Swamp Oak (*Casuarina glauca*) Forest of New South Wales and South East Queensland ecological community – Endangered (EPBC Act)

There is an additional two BC Act TECs, that do not meet within the final determination, comprising:

- Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions – Endangered (BC Act)
- Elderslie Banksia Scrub Forest – Critically Endangered (BC Act)

The justification for all associated TECs against the relevant listings criteria is provided in Table 3-4.

Figure 3-2: Threatened biodiversity

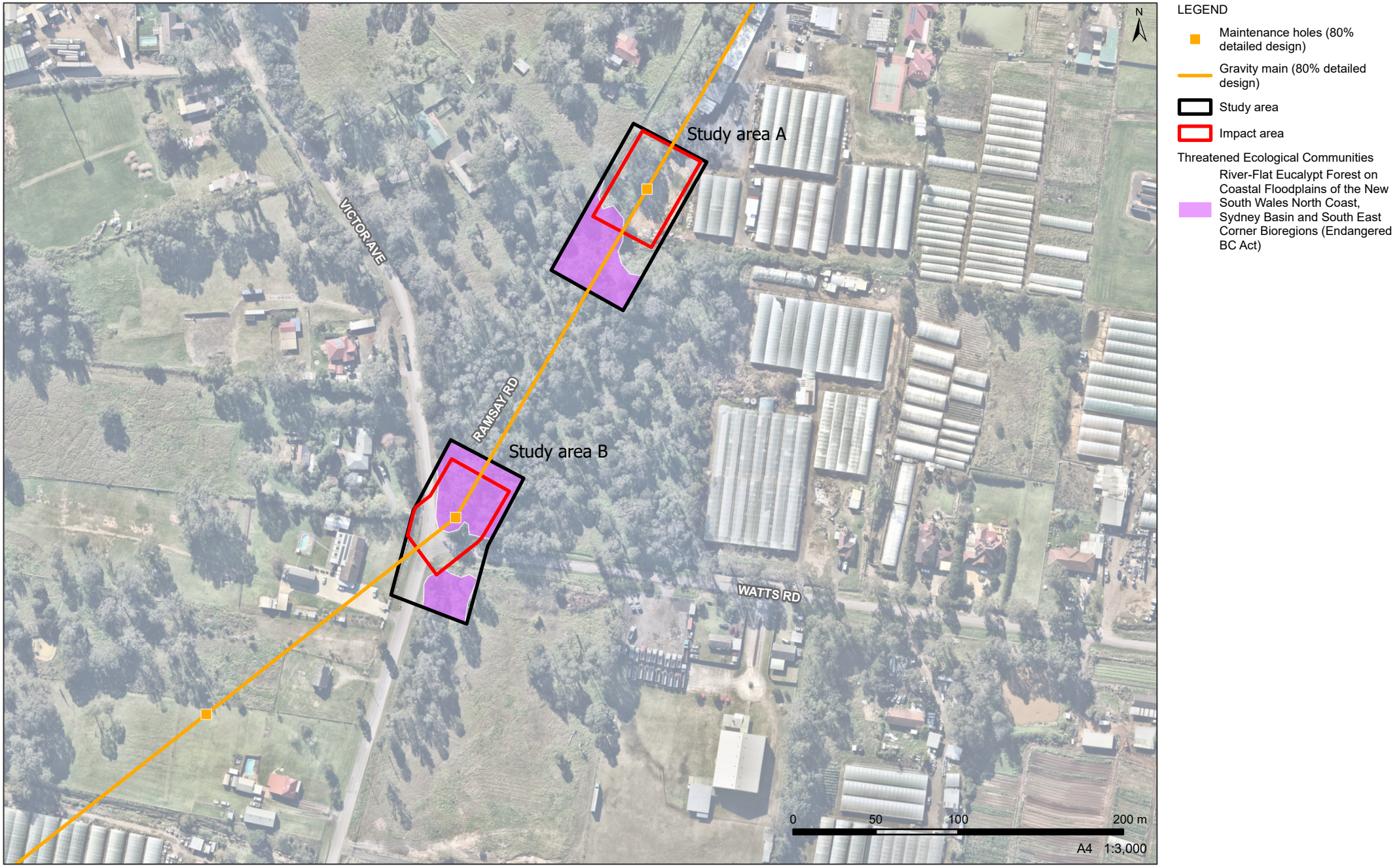


Figure 3-2: Threatened biodiversity

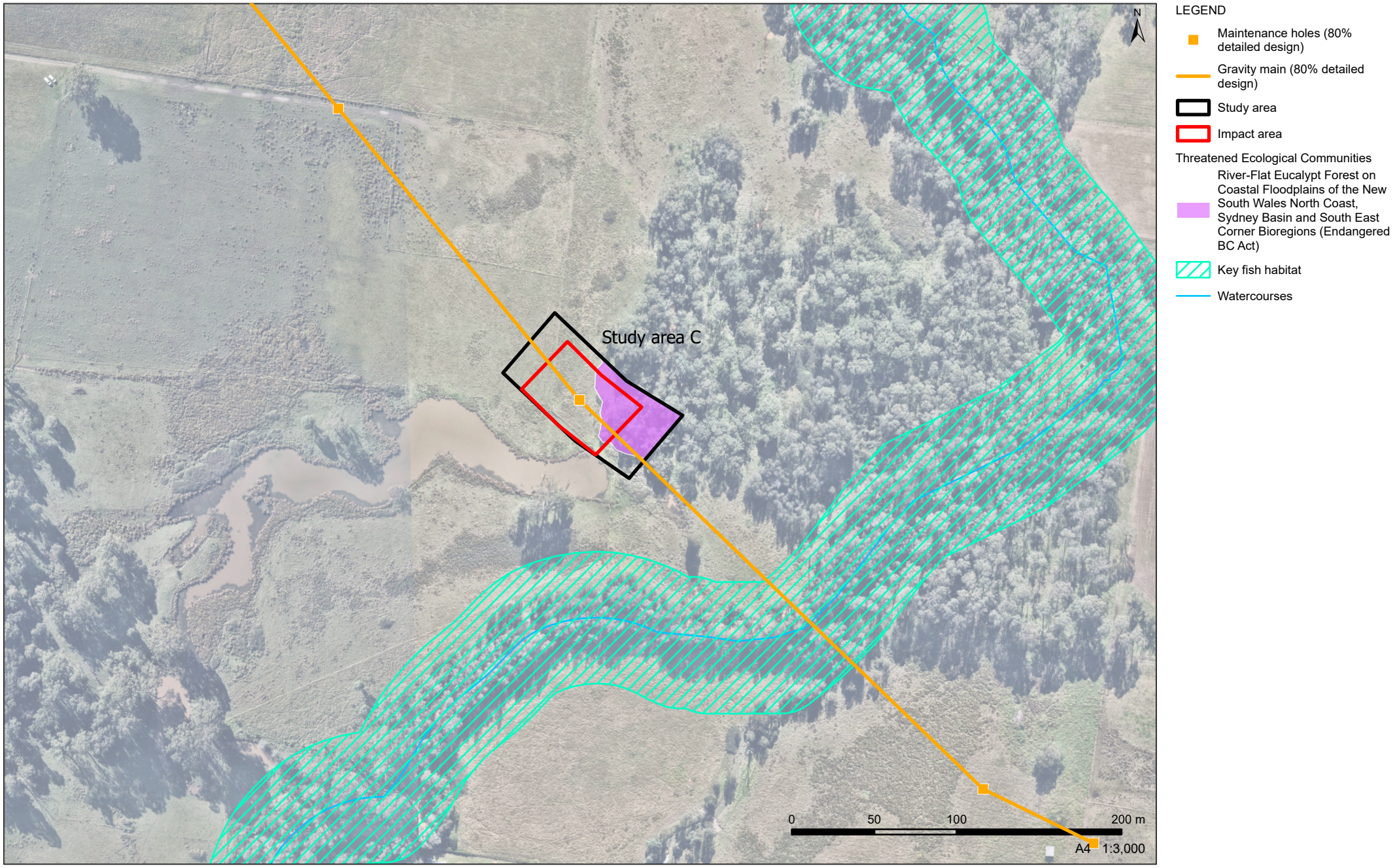


Table 3-4 Justification for classifying the TECs in the study area

Source	Listing Criteria	Justification from site data and location	Consistency with listing
Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions – Endangered (BC Act)			
(NSW TSSC 2011b)	<u>Species composition and structure:</u> 1. Dense to sparse tree layer in which *Casuarina glauca* is the dominant species. Other trees including *Acmena smithii*, *Glochidion* spp. and *Melaleuca* spp. may be present as subordinate species. 2. The composition of the ground stratum varies depending on levels of salinity in the groundwater. Under less saline conditions prominent ground layer plants include forbs such as *Centella asiatica*, *Commelina cyanea*, *Persicaria decipiens* and *Viola banksii*; graminoids such as *Carex appressa*, *Gahnia clarkei*, *Lomandra longifolia*, *Oplismenus imbecillis*; and the fern *Hypolepis muelleri*.	1. The vegetation is a small area of dense trees dominated by *Casuarina glauca* with the occasional *Melaleuca linariifolia*. 2. Ground storey vegetation is dominated by exotic species.	**Not consistent -** Although the study area is in the correct geographic location and contains characteristic species, it is located at an elevation too high for TEC to occur.
	<u>Geographic location:</u> 1. Within the New South Wales North Coast, Sydney Basin and South East Corner Bioregions.	1. The study areas are within the Sydney Basin bioregion.	
	<u>Abiotic features:</u> 1. Associated with grey-black clay-loams and sandy loams, where the groundwater is saline or sub-saline, on waterlogged or periodically inundated flats, drainage lines, lake margins and estuarine fringes associated with coastal floodplains. 2. Generally, occurs below 20 m ASL (rarely above 10 m).	1. The study areas are located on a 'South Creek' soil landscape and consists of clay to clay loam soils. 2. The study areas are at a higher elevation (49-52 m ASL), than the TEC occurs.	
Coastal Swamp Oak (Casuarina glauca) Forest of New South Wales and South East Queensland ecological community – Endangered (EPBC Act)			
(DAWE 2018)	<u>Key diagnostic characteristics:</u> 1. An open woodland, woodland, forest, or closed forest structure, with a tree canopy that has a total crown cover of at least 10 percent.	1. Canopy is dominated by *Casuarina glauca* with occasional *Melaleuca linariifolia* with a total crown cover over 10 percent.	**Not consistent –** Although the study area is in the correct

Source	Listing Criteria	Justification from site data and location	Consistency with listing
	2. Has a canopy of trees dominated by *Casuarina glauca*. A number of *Eucalyptus* spp. and *Melaleuca* spp. may occur in the canopy.		geographic location and contains characteristic species, does not meet condition class thresholds for listing.
	<u>Geographic location and abiotic features:</u> 1. Found within the South Eastern Queensland, NSW North Coast, Sydney Basin, or South East Corner bioregions. 2. Typically found at elevations of less than 20 m ASL, although it can occur up to 50 m ASL. 3. Occurs on soils derived from unconsolidated sediments (including alluvium), typically hydrosols (grey-black clay-loam and/or sandy loam soils) and sometimes organosols (peaty soils).	1. The study areas are within the Sydney Basin bioregion. 2. The study areas are at an elevation of 49-52 m ASL. 3. Located on alluvial soils including clay loams, with underlying 'South Creek' soil landscape.	
	<u>Condition classes:</u> 1. High condition: non-native species comprise <20% of total understory vegetation cover. 2. Good condition: Non-native species comprise <50% of total understorey vegetation cover AND transformer species comprise <30% of total understorey vegetation cover. 3. Moderate condition: Non-native species comprise <80% of total understorey vegetation cover AND transformer species comprise <50% of total understorey vegetation cover.	1. Non-native species comprise >80% of the total understory vegetation cover. 2. Transformer species (specifically *Tradescantia fluminensis*) comprise >50% of the total understory vegetation cover.	
River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions – Endangered (BC Act)			
(NSW TSSC 2011a)	<u>Species composition and structure:</u> 1. Tall open tree layer of eucalypts, which may exceed 40 m in height, but can be considerably shorter in regrowth stands or under conditions of lower site quality. 2. While the composition of the tree stratum varies considerably, the most widespread and abundant dominant trees include *Eucalyptus tereticornis*	1. The vegetation is an open woodland with a ground-storey dominated by exotic species. 2. The canopy is dominated by *Melaleuca linariifolia* and *Eucalyptus amplifolia*, with occasional *Angophora subvelutina,* and *Casuarina glauca.*	**Consistent –** The vegetation contains the correct structure, composition and is in the correct geographic area. Areas of

Source	Listing Criteria	Justification from site data and location	Consistency with listing
	(forest red gum), *E. amplifolia* (cabbage gum), *Angophora floribunda* (rough-barked apple) and *A. subvelutina* (broad-leaved apple). A layer of small trees may be present, including *Melaleuca decora*, *M. styphelioides* (prickly-leaved tea tree), *Backhousia myrtifolia* (grey myrtle), *Melia azedarach* (white cedar), *Casuarina cunninghamiana* subsp. *cunninghamiana* (river oak) and *C. glauca* (swamp oak).		moderate condition PCT 4025 are consistent with this TEC.
	<u>Geographic location:</u> 1. Within the New South Wales North Coast, Sydney Basin and South East Corner Bioregions.	1. The study areas are within the Sydney Basin bioregion.	
	<u>Abiotic features:</u> 1. Associated with silts, clay-loams and sandy loams, on periodically inundated alluvial flats, drainage lines and river terraces associated with coastal floodplains. 2. Generally, occurs below 50 m elevation, but may occur on localised river flats up to 250 m ASL.	1. The study areas are located on a 'South Creek' soil landscape and consists of brown clay loam soils. 2. The study areas are at an elevation of 49-52 m ASL.	
River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria – Critically Endangered (EPBC Act)			
(DAWE 2020a)	<u>Key diagnostic characteristics:</u> 1. In the canopy, the two genera that characterise the ecological community are Eucalyptus and Angophora, notably: *Angophora floribunda* (Rough-barked Apple), *A. subvelutina* (Broad-leaved Apple), and members of the 'red gum' group of eucalypts (Exsertaria), notably *E. tereticornis* (Forest Red Gum, Red Irongum) and *Eucalyptus amplifolia* (Cabbage Gum). 2. Non-eucalypt tree species may be part of the ecological community, mostly as an open sub-canopy. These include: *Allocasuarina littoralis* (Black Sheoak), *Elaeocarpus reticulatus* (Blueberry Ash, Blue Olive-berry), *Brachychiton populneum* (Kurrajong), *Casuarina cunninghamiana* (River	1. Canopy is dominated by *Eucalyptus amplifolia* and *Melaleuca linariifolia* with occasional *Angophora subvelutina*. 2. Non-eucalypt species include *Casuarina glauca*.	**Not consistent -** Although the study area is in the correct geographic location and contains characteristic species, does not meet condition class thresholds for listing.

Source	Listing Criteria	Justification from site data and location	Consistency with listing
	Oak, River Sheoak), *Casuarina glauca* (Swamp Oak, Swamp Sheoak) and *Pittosporum undulatum* (Sweet Pittosporum).		
	<u>Geographic location and abiotic features:</u> 1. Found in the South East Corner and Sydney Basin IBRA Bioregions 2. Typically found below 50 m ASL, although it can occur up to 250 m ASL 3. Occurs on alluvial soils of various textures, including silts, clay loams and sandy loams, gravel and cobbles	1. The study areas are within the Sydney Basin bioregion. 2. The study areas are at an elevation of 49-52 m ASL. 3. Located on alluvial soils including brown clay loams, with underlying 'South Creek' soil landscape.	
	<u>Condition classes</u> 1. High condition: ≥ 80% of its total perennial understorey vegetation cover is comprised of native species AND ground cover richness ≥ 10 native species per sample plot AND ≥ 20 large trees per ha. 2. Good condition: ≥ 50% of its total perennial understorey vegetation cover is comprised of native species AND ground cover richness ≥ 6 native species per sample plot AND at least 10 large trees per ha. 3. Moderate condition: ≥ 30% of its total perennial understorey vegetation cover is comprised of native species AND ground cover richness ≥ 4 native species per sample plot. In a large or contiguous patch in moderate condition.	1. The study areas are located within a large patch (>2 ha), however does not have >30% of its total perennial understorey vegetation cover comprised of native species. Exotic grasses and forbs dominate the understorey of the study areas.	
Elderslie Banksia Scrub Forest – Critically Endangered (BC Act)			
(NSW TSSC 2015)	<u>Species composition and structure:</u> 1. In drier areas, *Banksia integrifolia* occurs as the characteristic canopy species, together with *Angophora subvelutina* and *Duboisia myoporoides*; other species include *Brachyloma daphnoides, Clerodendrum tomentosum, Pteridium esculentum, Pimelea linifolia, Dillwynia glaberrima, Ricinocarpos*	1. *Banksia integrifolia* not observed within the patch, with no other characteristic species present.	**Not Consistent –** Not consistent with the TEC due to study areas

Source	Listing Criteria	Justification from site data and location	Consistency with listing
	pinifolius, Hibbertia diffusa, Kunzea ambigua, Exocarpos cupressiformis, Persoonia linearis and *Dianella revoluta*. In lower-lying areas with poorer drainage, the canopy changes to *Eucalyptus botryoides* with other species including *Platysace lanceolata, Aotus ericoides, Pteridium esculentum and Imperata cylindrica. Melaleuca decora, Gahnia clarkei* and *Gleichenia dicarpa* occur along watercourses.		location outside known TEC range.
	<u>Geographic location:</u> 1. Recorded in the Camden LGA (within the Sydney Basin Bioregion), principally near Elderslie in the area known as Spring Farm.	1. The study areas are located within the Sydney Basin Bioregion, however not within or nearby to the Camden LGA.	
	<u>Abiotic features:</u> 1. Generally associated with alluvium of Tertiary age, on soils which are sandy, with drainage varying from good to poor. 2. Elevations up to approximately 350 m ASL.	1. The study areas are located on a 'South Creek' soil landscape, with brown clay loam soils 2. The study areas are at an elevation of 39-43 m ASL.	
Elderslie Banksia Scrub Forest in the Sydney Basin Bioregion – Critically Endangered (EPBC Act)			
(DAWE 2020b)	<u>Key diagnostic characteristics:</u> 1. The ecological community described is a type of scrubby forest or woodland. Key elements of the canopy include *Banksia integrifolia* subsp. *integrifolia* (Coast Banksia), *Angophora subvelutina* (Broad-leaved Apple), *Eucalyptus botryoides* x *E. saligna* (a natural hybrid of Bangalay and Sydney Blue Gum) and various other species of Eucalyptus over a mostly shrubby understorey.	1. Characteristic *Banksia integrifolia* subsp. *integrifolia* species not present.	**Not consistent –** Not consistent with the TEC due to study area location outside known TEC range.
	<u>Geographic location:</u> 1. Primarily in the Camden area within the Macarthur District of south-western Sydney, NSW.	1. The study area is within the Sydney Basin bioregion, however not within the Camden area.	

Source	Listing Criteria	Justification from site data and location	Consistency with listing
	<u>Abiotic features:</u> 1. Limited to sandy substrates associated with deep Tertiary sand deposits above the present day Nepean River floodplain. 2. The ecological community occurs at low elevations, of around 60 to 100 m ASL.	1. The study areas are located on a 'South Creek' soil landscape, with brown clay loam soil. 2. The study areas are at an elevation of 39-43 m ASL.	
	<u>Condition classes:</u> 1. Moderate condition class: patch size is >0.5 ha and >30% of the perennial understorey vegetation cover is made up of native species. 2. High condition class: patch size is >0.5 ha and >70% of the perennial understorey vegetation cover is made up of native species.	1. Understorey vegetation cover across the study areas is made up of less than 30% native species.	

3.3 Threatened species and habitats

3.3.1 Fauna habitat features

The native vegetation within the study areas and locality is moderately connected, with a persistent native canopy about 50 m to 320 m wide along the creek corridors of South Creek.

Within the study areas, no hollow-bearing trees, stick nests or other specific habitat features were observed and as such are unlikely to be impacted by the works.

3.3.2 Fauna habitat types

3.3.2.1 Forested wetlands

Native vegetation within the three study areas is forested wetlands (PCT 4023 and 4025). This habitat provides foraging and sheltering habitat for various woodland birds, mammals, and reptiles. The canopy vegetation and the native mid-storey of shrubs provide flowering and fruiting food resources for many fauna species.

The majority of trees are young and provide persistent canopy cover across the patch. Therefore, whilst this area of native vegetation has potential to provide opportunistic foraging and sheltering habitat for birds, small mammals, and reptiles, due to the lack of hollows is unlikely to provide suitable roosting or nesting habitat for raptors, owls, or large arboreal mammals. Additionally, given dominance of exotic species in the mid- and ground stories, with historical disturbance of the soil profile and seed bank during establishment of surrounding agricultural land, the likelihood of providing suitable habitat for threatened flora species, or preferred threatened fauna habitat is limited.

Despite dominance of exotic flora, canopy connectivity is maintained with surrounding vegetation and is likely to provide suitable flyways and foraging habitat for microbats.

3.3.2.2 Riparian vegetation and waterways

Study areas A and B contain temporary drainage channels bordered by riparian vegetation (see Plate 3-4). Ephemeral drainage channels and associated riparian vegetation are unlikely to provide suitable fish habitat, but may provide habitat for invertebrates, and amphibians. A relict oxbow extends from South Creek adjacent to study area C. South Creek is classified as Key Fish Habitat (KFH) and the relict oxbow and surrounding riparian vegetation is likely to provide habitat for fish, invertebrates, and amphibians.

Plate 3-4 Ephemeral drainage channel in study area B



3.3.2.3 Artificial dam with emergent vegetation

Adjacent to Study Area C, there is suitable habitat for the green and golden bell frog (*Litoria aurea*), characterised by an artificial dam that supports emergent vegetation (Plate 3-3). This habitat provides key ecological features known to support the species, including permanent water, vegetative cover, and basking sites.

3.3.3 Threatened species likelihood of occurrence

The desktop assessment identified 12 threatened species that have a moderate or high likelihood of occurring within the study areas, as identified in the likelihood of occurrence assessment (Appendix A). These species are listed in Table 3-5.

Table 3-5 Threatened species with a moderate to high likelihood of occurrence in the study area

Taxa	Scientific name	Common name	BC Act status	EPBC Act status
Highly likely to occur				
Gastropoda	*Meridolum corneovirens*	Cumberland Plain Land Snail	E	-
Flora	*Grevillea juniperina* subsp. *juniperina*	Juniper-leaved Grevillea	V	-
Moderately likely to occur				
Amphibia	*Litoria aurea*	Green and Golden Bell Frog	E	V
Aves	*Artamus cyanopterus cyanopterus*	Dusky Woodswallow	V	-
	Daphoenositta chrysoptera	Varied Sittella	V	-
Mammalia	*Micronomus norfolkensis*	Eastern Coastal Free-tailed Bat	V	-
	Miniopterus australis	Little Bent-winged Bat	V	-
	Miniopterus orianae oceanensis	Large Bent-winged Bat	V	-
	Myotis macropus	Southern Myotis	V	-
	Pteropus poliocephalus	Grey-headed Flying-fox	V	V
	Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V	-
	Scoteanax rueppellii	Greater Broad-nosed Bat	V	

V: Vulnerable, E: Endangered

3.3.4 Threatened species

3.3.4.1 Flora species

No threatened flora species were recorded during the field surveys. As adequate targeted survey was undertaken for *Grevillea juniperina* subsp. *juniperina*, it is likely that populations are absent from the study areas.

See Appendix B for list of all flora species observed within study areas during walked meanders.

3.3.4.2 Fauna species

Diurnal targeted survey was conducted for the Cumberland Plain Land Snail across portions of suitable habitat within the study areas (refer to Section 2.2.2). No signs of presence (i.e., live snails or shells) were observed. It is likely that due to the dominance of exotic flora species across the understorey, limited native leaf litter, disturbance of surrounding areas and fragmentation from larger suitable patches in the nearby Kemps Creek Nature Reserve, the species may not occur within the study areas. However, as sufficient survey effort was not met for this species (i.e. no nocturnal survey completed), species is assumed present as well as potential impacts on suitable habitat.

See Appendix B for list of fauna species incidentally observed during the field survey.

3.4 Weeds and pathogens

Several priority weeds for Greater Sydney and Weeds of National Significance (WoNS) have been recorded in the study areas and are summarised in Table 3-6. Majority of exotic species were observed within patches of disturbed exotic grassland, and within the understorey of adjacent patches of native vegetation.

No signs of pathogens or dieback was observed.

Table 3-6 Key exotic species in study are including Priority weeds and WoNS

Scientific name	Common name		Priority (LLS 2022)	WoNS
Alternanthera philoxeroides	Alligator Weed		State priority	Yes
Cestrum parqui	Green Cestrum		Regional priority	No
Rubus fruticosus sp. agg.	Blackberry		State priority	Yes
Senecio madagascariensis	Fireweed		State priority	Yes
Other exotic species				
Araujia sericifera	Moth Vine	*Bidens pilosa*	Cobbler's Pegs	
Cenchrus clandestinus	Kikuyu Grass	*Chloris gayana*	Rhodes Grass	
Cirsium vulgare	Spear Thistle	*Conyza sumatrensis*	Tall fleabane	
Crepis spp.		*Cucurbita maxima*	Ironbark Pumpkin	
Cyperus eragrostis	Umbrella Sedge	*Galium aparine*	Goosegrass	
Hypochaeris radicata	Catsear	*Ligustrum lucidum*	Large-leaved Privet	
Ligustrum sinense	Small-leaved Privet	*Modiola caroliniana*	Red-flowered Mallow	
Morus alba	White Mulberry	*Nasturtium officinale*	Watercress	
Paspalum urvillei	Vasey Grass	*Plantago lanceolata*	Lamb's Tongues	
Setaria parviflora		*Sida rhombifolia*	Paddy's Lucerne	
Solanum pseudocapsicum	Madeira Winter Cherry	*Taraxacum officinale*	Dandelion	
Tradescantia fluminensis	Wandering Jew	*Trifolium repens*	White Clover	
Verbena bonariensis	Purpletop			

4. Impact assessment

4.1 Direct impacts

4.1.1 Vegetation impacts

Direct impacts on vegetation types have been calculated for each impact area and the total impact for all the Proposal impact areas. The direct vegetation impacts required by the Proposal are summarised in Table 4-1.

Table 4-1 Summary of all direct vegetation impacts

Vegetation type	Impact Area A	Impact Area B	Impact Area C	Total Proposal impact
PCT 4023 Coastal Valleys Swamp Oak Riparian Forest	0.100 ha	-	-	**0.100 ha**
PCT 4025 Cumberland Red Gum Riverflat Forest	0.017 ha	0.134 ha	0.060 ha	**0.211 ha**
Total vegetation impacts	0.117 ha	0.134 ha	0.060 ha	**0.311 ha**

Overall, the extent of native vegetation impact is approximately 0.311 ha. Of this, approximately 0.131 ha is ENV on non-certified land and would require statutory offsets in accordance with the Biodiversity Certification Order for the South West Growth Centres. The impact to native vegetation primarily occurs within moderate condition PCT 4025 Cumberland Red Gum Riverflat Forest which also includes impact to BC Act listed TEC (refer to Section 4.1.2) and would comprise the permanent removal of all strata within the impact areas. Minor trimming of adjacent vegetation may also be required to manage overhanging branches where present.

Vegetation removal in areas with non-native vegetation (i.e. disturbed exotic grassland) would comprise approximately 0.401 ha. Clearance would require the permanent removal of disturbed exotic grassland across all three impact areas. Due to the contamination of weed material within the ground-storey vegetation, cleared vegetation would be mulched and suitably disposed of off-site.

4.1.2 Threatened Ecological Communities

The total impact to a BC Act listed TEC in moderate condition is up to approximately 0.211 ha:

- River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and Southeast Corner Bioregions, Endangered (BC Act)

The removal of the TEC is expected to be permanent and could potentially provide foraging habitat for several highly mobile bat and bird species (Table 3-5). However, this removal is unlikely to result in a significant impact given the modified nature of the environment and the suitability of remaining habitat within the riparian margin of South Creek (outside of the impact areas).

4.1.3 Habitat loss

Direct impacts to threatened and non-threatened species and their habitat generally comprise the permanent loss of habitat due to vegetation removal. The removal of native vegetation would remove potential foraging habitat for various terrestrial species, including threatened woodland birds and mammals. South of the impact areas, the riparian habitat of South Creek is continuous and therefore, will provide foraging and nesting habitat for a range of mobile fauna species (specifically bats and birds). As such, habitat removal in the impact areas comprises a relatively small extent compared to the surrounding available habitat for

threatened species, should they be present. Based on this, native vegetation removal is not considered to impact on species potentially utilising these areas.

A habitat assessment was undertaken (see Section 3.2.2) and no key habitat features such as hollow bearing trees, stick nests, or dreys were recorded within the three study areas. As such, clearance of native vegetation, including large trees, is unlikely to result in the direct removal of suitable roosting or nesting habitat. A farm dam near Study area C was identified to have suitable habitat features that could support an amphibian such as the Green and Golden Bell Frog. Although outside the direct impact zone, the proximity of this habitat warrants an Assessment of Significance (AoS) to ensure potential indirect impacts are appropriately considered and managed (refer to Appendix C).

The works are unlikely to result in a 'significant impact' on any threatened species or populations (refer to Section 5.7). Further assessment of specific potential impacts is provided in the following sections.

4.2 Indirect impacts

4.2.1 Direct injury and mortality

During construction, direct impact to fauna by strikes with vehicles, mechanical plant and equipment is possible. Direct strikes and associated stress can result in injury and death to fauna. However, with the implementation of the management measures, risk to fauna is low.

As construction and vegetation clearance works will occur during daylight hours there is likely to be minimal risks to foraging bats, and as there is no roosting habitat within the impact areas, there is anticipated to be no impacts to roosting bats.

4.2.2 Habitat fragmentation

During construction, the clearing of vegetation would permanently remove localised patches of vegetation within the impact areas. This would comprise of up to approximately 0.311 ha of native vegetation. Vegetation clearance would require the clearance of all strata (i.e. ground-storey, mid-storey and canopy) and remove connected canopy of about 60 m at its widest point.

As these impacts are on the edge of the larger connected patch within the riparian corridor of South Creek, and the width of these impacts would not limit the movement of terrestrial species that may utilise the site (birds and arboreal mammals), the Proposal would have minor impacts to habitat connectivity and unlikely to fragment vegetation patches. Proposed works would not result in the separation of species or ecological communities into separate populations.

4.2.3 Soils, waterways, and hydrology

During construction, vegetation clearing and minor excavations would increase the risk of erosion, sedimentation, and pollution to adjacent waterways. This has potential to temporarily disturb habitat for amphibians and small fish and reduce localised water quality.

With implementation of appropriate mitigation measures, as recommended in Section 6.2, any impacts to aquatic fauna and instream habitat are considered minimal. Furthermore, given the localised scale of works long term impacts and/or impacts to downstream habitats and KFH is considered minimal. The works would not increase the risk of salinity or acid sulfate soils.

No operational impacts to soils, waterways and hydrology are expected.

4.2.4 Weeds and pathogens

During construction, the movement of plant and equipment has the potential to move weeds and pathogens within and out of the impact areas. Exotic species, particularly in areas of disturbed exotic grassland and ground storey of native vegetation patches, would be removed and disposed of at a suitable licenced facility.

With the implementation of management measures, this risk is considered to be minor.

4.2.5 Noise, vibration, and edge effects

During construction, noise, vibration, and emissions associated with vegetation clearing, excavations and personnel movements may temporarily disturb local fauna. The impacts would be localised at the construction locations and would extend for the duration of construction. Overall, this is expected to be a minor impact on local fauna foraging habitat and is not expected to impact breeding habitat or species in the long term.

During construction, the clearing of vegetation would permanently increase edge effects to vegetation within the impact areas (i.e., light and noise penetration) to a minor degree.

4.3 Cumulative impacts

In addition to the scope as assessed as a part of this addendum BAR, additional impacts across both the Project as well as additional catchments are expected to contribute to the cumulative impacts.

4.4 Assessments of significance

Following the outcomes of the likelihood of occurrence assessment and field survey, assessments of significance were prepared for threatened entities that were identified as being moderately or highly likely to occur with the study area and that are considered at risk of being impacted by the Proposal.

For threatened species, the field survey component of this assessment only included targeted survey for two species, the Cumberland Plain Land Snail and Juniper-leaved Grevillea, likely presence has therefore been assumed for other species that may occur as a precautionary measure and based on habitat suitability observed with the study areas. Due to the small degree of localised impacts from the Proposal (refer to Section 4), and to maintain a reasonable level of assessment, assessments of significance have not been conducted for species that may occur, but are unlikely to be impacted by the Proposal due to the Proposal's scope and/or the species ecology, such as the Grey-headed Flying-fox.

As discussed in the above sections, minor and localised impacts to some threatened species and their habitat is possible, however, the assessments of significance conclude that the Proposal is unlikely to have a significant impact on any threatened entities (Appendix C). Table 4-2 outlines the justification for undertaking assessments of significance considering all threatened entities that have been identified with a moderate or high likelihood of occurrence. The assessments of significance are provided in Appendix C.

Table 4-2 Justification for undertaking Assessment of Significance for threatened entities

Scientific name	Common name	BC Act status	EPBC Act status	Justification	Assessment of significance undertaken
TECs					
River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions		E	-	Permanent removal of up to 0.211 ha of the TEC.	**Yes**
Fauna					
Artamus cyanopterus cyanopterus	Dusky Woodswallow	V	-	The works would remove up to 0.311 ha of suitable foraging habitat for the species.	**Yes**
Daphoenositta chrysoptera	Varied Sittella	V	-	The works would remove up to 0.311 ha of suitable foraging habitat for the species.	**Yes**
Litoria aurea	Green and Golden Bell Frog	E	V	The works would remove up to 0.060 ha of PCT 4025, plus exotic habitat located near the farm dam that may be utilised by the species. There may be indirect impacts on the dam which contains suitable habitat features for the species from construction movement.	**Yes**
Meridolum corneovirens	Cumberland Plain Land Snail	E	-	The works would remove up to 0.311 ha of suitable foraging and sheltering habitat for the species. Targeted surveys have been conducted which did not identify the species within the study areas, however, did not meet nocturnal survey effort required for the species. As such, absence cannot be assumed.	**Yes**
Micronomus norfolkensis	Eastern Coastal Free-tailed Bat	V	-	The works would remove up to 0.311 ha of suitable foraging habitat for the species. The vegetation will not provide suitable roosting habitat for this species, as no hollow bearing trees were identified within the study area.	**Yes**
Miniopterus australis	Little Bent-winged Bat	V	-	The works would remove 0.311 ha of potentially suitable foraging habitat, however vegetation within the study areas does not provide suitable roosting habitat for this species, based on no tree hollows, caves, or man-made structures being present.	**Yes**

Scientific name	Common name	BC Act status	EPBC Act status	Justification	Assessment of significance undertaken
Miniopterus orianae oceanensis	Large Bent-winged Bat	V	-	The works would remove 0.311 ha of potentially suitable foraging habitat, however vegetation within the study areas does not provide suitable foraging habitat for this species, based on no tree hollows, caves, or man-made structures being present.	**Yes**
Myotis macropus	Southern Myotis	V	-	The works would remove 0.311 ha of potentially suitable foraging habitat, however vegetation within the study areas does not provide suitable foraging habitat for this species, based on no tree hollows, caves, or man-made structures being present.	**Yes**
Pteropus poliocephalus	Grey-headed Flying-fox	V	V	The works would remove 0.311 ha of potentially suitable foraging habitat; however, it is unlikely to be preferred foraging habitat due to the lack of prolific flowering species (e.g., *Melaleuca* sp., *Banksia sp*.) and distance to nearest camp. The closest camp is 10 km away, as such the works would not impact breeding habitat of the species. The extent of clearing would not impact connectivity of the species habitat.	No
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V	_	The works would remove 0.311 ha of potentially suitable foraging habitat, however vegetation within the study areas does not provide suitable foraging habitat for this species, based on no tree hollows, caves, mammal burrows or suitable man-made structures being present.	Yes
Scoteanax rueppellii	Greater Broad-nosed Bat	V	-	The works would remove 0.311 ha of potentially suitable foraging habitat, however vegetation within the study areas does not provide suitable foraging habitat for this species, based on no tree hollows, caves, or man-made structures being present.	**Yes**
Flora					
Grevillea juniperina subsp. *juniperina*	Juniper-leaved Grevillea	V	-	Targeted surveys for this species identified no specimens within the study areas. This species is detectable all year and was not found during the field surveys. As such, it is unlikely present in the study area and Project works will not impact this species or populations.	No

4.5 Total Direct Impacts from Revised Design

This addendum BAR focuses on assessing three maintenance holes located outside the approved REF construction corridor. However, the revised Thompsons Creek alignment being assessed in the REFA encompasses broader design changes, including:

- Modifying sections of the Thompsons Creek gravity carrier alignment
- Relocating maintenance holes
- Extending the South Creek gravity carrier alignment
- Reducing the total number of maintenance holes along the alignment

As a result of these design changes, sections of the approved alignment will no longer be constructed and will instead be replaced by the revised alignment. Consequently, some areas of native vegetation previously impacted under the approved REF will now be avoided and new areas of native vegetation not previously affected will be impacted.

The BAR prepared as part of the approved REF (Aurecon, 2025) provides vegetation data for some of the proposed changes to the alignment and the revised maintenance hole locations. This data, combined with the additional data from this addendum BAR, has been used to assess vegetation impacts for the revised Thompsons Creek alignment.

Table 4-3 presents a summary of the total direct impacts on native vegetation from the revised Thompson Creek alignment, accounting for the new impact areas as well as the previously approved areas that no longer need to be impacted.

Table 4-3 Overall native vegetation impacts for revised design

Vegetation type*	Total impacted area within non-certified land		Total
	ENV**	Non-ENV***	
PCT 3320 Cumberland Shale Plains Woodland	0.052 ha	0.076 ha	0.128 ha
PCT 3448 Castlereagh Ironbark Forest	-	-	-
PCT 4023 Coastal Valleys Swamp Oak Riparian Forest	-	0.100 ha	0.100 ha
PCT 4025 Cumberland Red Gum Riverflat Forest	0.109 ha	0.189 ha	0.298 ha
PCT Sub-total	0.161 ha	0.365 ha	0.526 ha
EPBC Act and BC Act: River-Flat Eucalypt Forest on Coastal Floodplains	0.080 ha	0.024 ha	0.104 ha
Only BC Act: River-Flat Eucalypt Forest on Coastal Floodplains	0.202 ha	0.167 ha	0.369 ha
BC Act: Cumberland Plain Woodland in the Sydney Basin Bioregion	0.075 ha	0.029 ha	0.104 ha
TEC Sub-total	0.357 ha	0.220 ha	0.577 ha

Vegetation type*	Total impacted area within non-certified land		Total
	ENV**	Non-ENV***	
Total vegetation impacts	0.518 ha	0.585 ha	1.103 ha

*Please note that some PCTs are also classified as TECs. Where this occurs, the area is included once under the relevant TEC to avoid double counting areas of native vegetation.
**Requires statutory offsets under the Growth Centre BCO (3:1).
***Voluntary offsets implemented under Sydney Water's Biodiversity Offset Guideline (3:1 for TECs and 2:1 for PCTs).

Approximately 0.518 ha of the native vegetation impacted by the revised Thompsons Creek design is ENV on non-certified land and would require statutory offsets in accordance with the Biodiversity Certification Order for the South West Growth Centres (refer to Section 5.3.1).

Refer to Figure 4-1 for native vegetation within the revised Thompsons Creek design.

Figure 4-1: Vegetation mapping for revised design



LEGEND

Plant community types (PCTs)

- PCT 4023: Coastal Valley Riparian Forest
- PCT 3320: Cumberland Shale Plains Woodland
- PCT 4025: Cumberland Red Gum Riverflat Forest

Threatened ecological communities (TECs)

- BC Act: Cumberland Plain Woodland in the Sydney Basin Bioregion
- BC Act: River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and Southeast Corner Bioregions
- EPBC Act: River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and Southeast Corner Bioregion
- Existing native vegetation on non-certified land
- SP1228 Pumping Station
- Proposed gravity main (80% detailed design)

Proposed maintenance holes (80% detailed design)

- Proposed maintenance hole
- Proposed maintenance hole with vent shaft
- Construction impact area

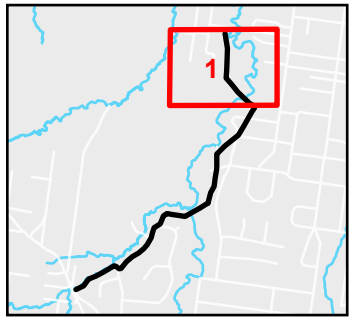


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Figure 4-1: Vegetation mapping for revised design



LEGEND

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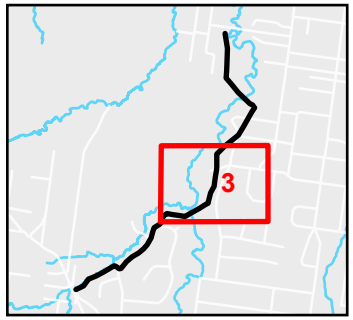

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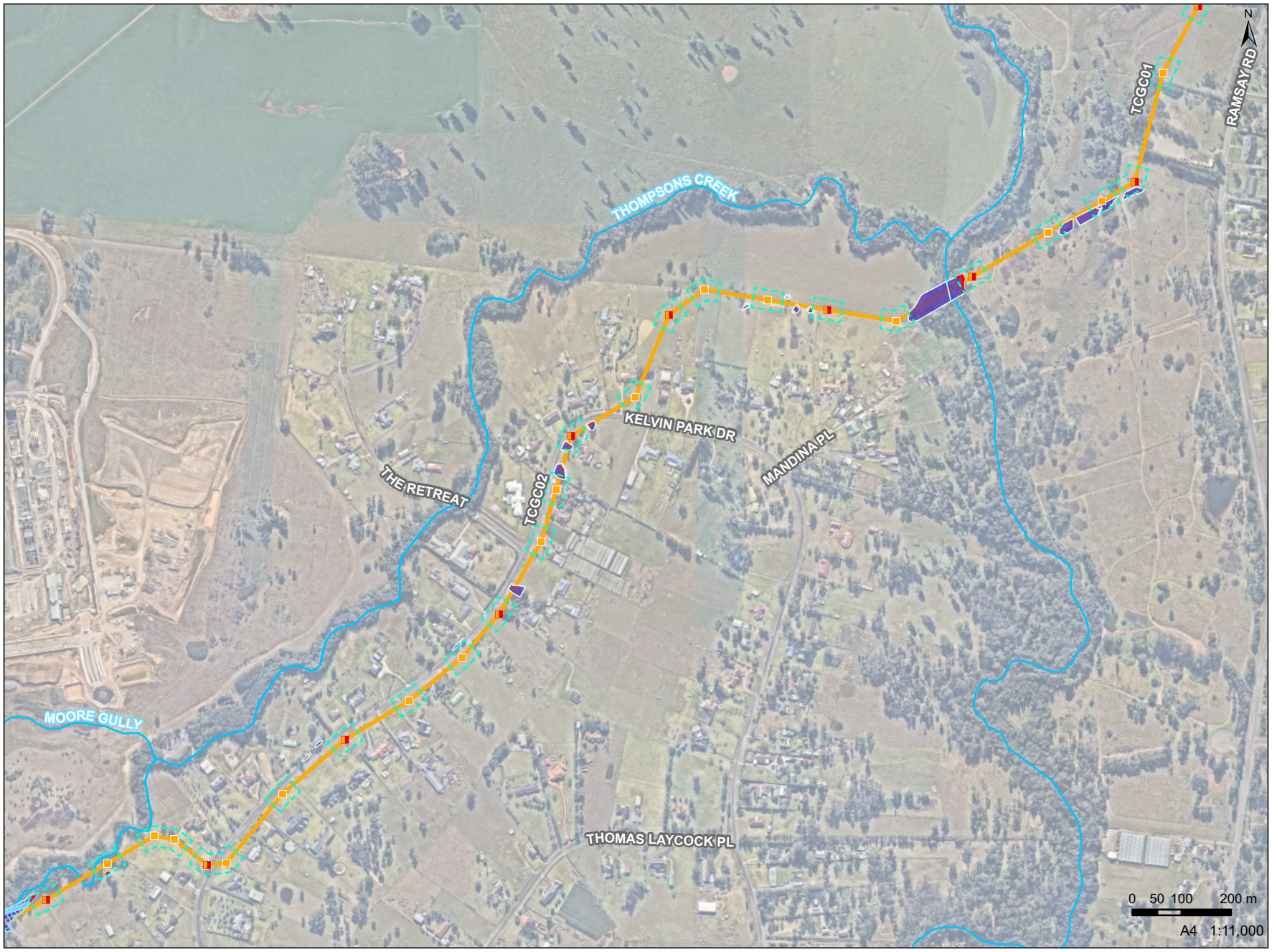

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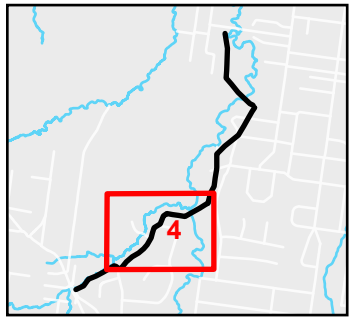

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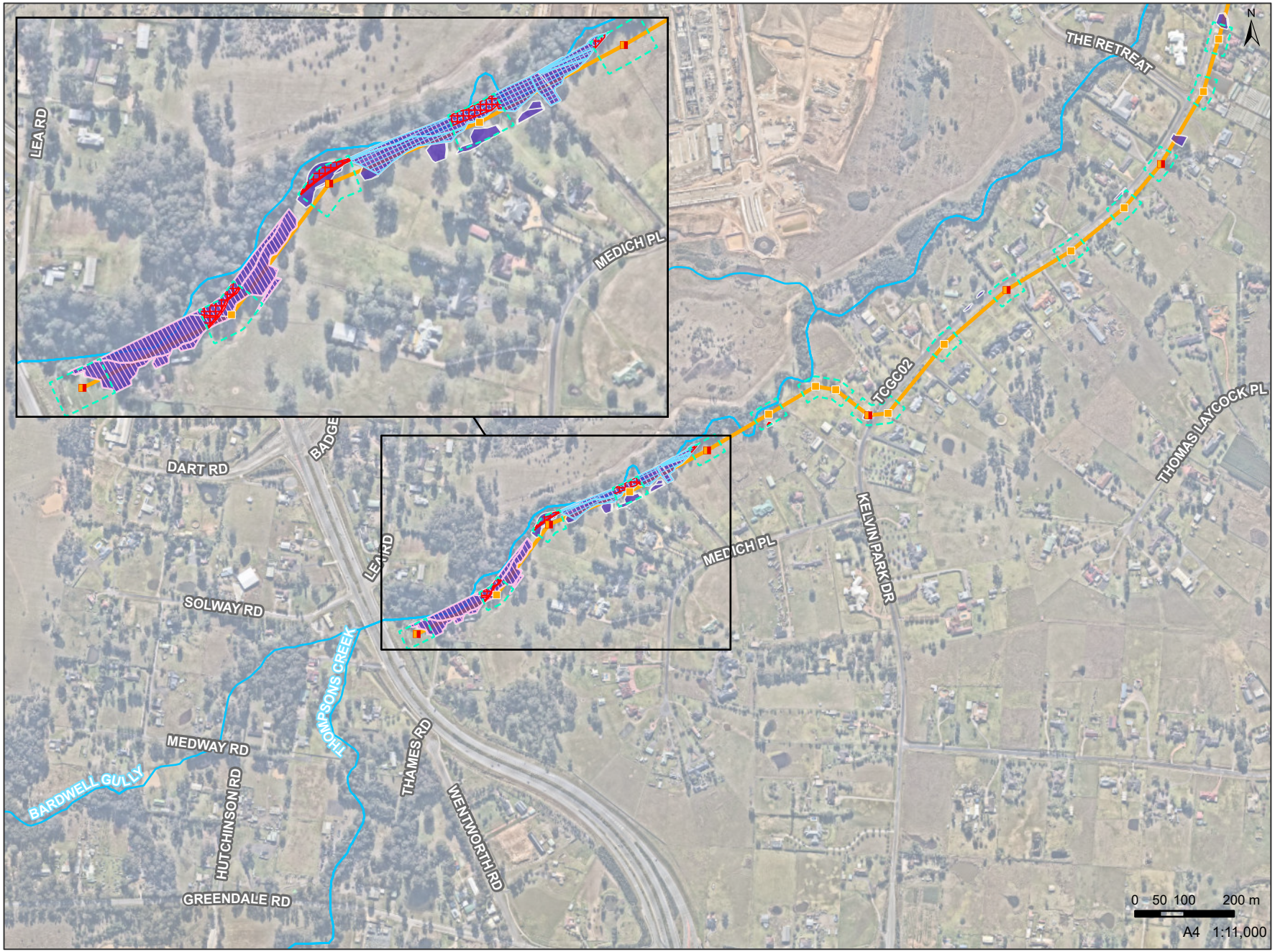

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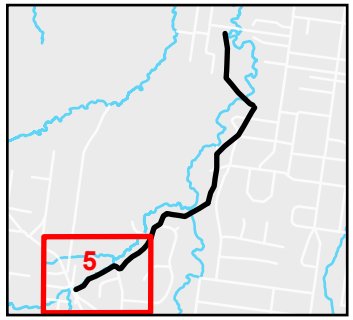

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5. Avoidance, minimisation, and offsetting

In accordance with Sydney Water's Biodiversity Offset Guide (Sydney Water 2021), the Proposal design and EIA process must apply the mitigation hierarchy, as follows:

1. **Avoid**: Site selection and the development of the design aims to avoid impacts to native vegetation
2. **Minimise/Mitigate**: Where impacts cannot be avoided then measures to minimise and mitigate the impact are developed during the EIA and implemented on site during construction
3. **Offset**: Where there are residual impacts that cannot be avoided or minimised, these impacts are offset.

5.1 Avoid

A large proportion of the Proposal area is located on areas of non-native vegetation (i.e. grazed exotic grassland) and will avoid impacts to native vegetation. Additionally, where impacts to native vegetation are proposed, they are in areas adjacent to exotic grassland, with high incursion of weeds and exotic species in the ground and mid-stories.

5.2 Minimise and Mitigate

The mitigation measures listed in Table 5-1 have been prepared in accordance with Sydney Water's standard Environmental mitigation measures (SWEMS0019.07) (Sydney Water 2023). Additional mitigation measures have been prepared, as required.

Table 5-1 Mitigation measures

ID	Mitigation measure	Timing	Responsibility
B1	Sydney Water's Project Manager (after consultation with Sydney Water's environmental and community representatives and affected landowners) can approve temporary ancillary construction facilities (such as compounds and access tracks), without additional environmental assessment or approval if the facilities meet the following principles: ▪ Limit proximity to sensitive receivers ▪ No disruption to property access ▪ No impact to known items of non-Aboriginal and Aboriginal heritage ▪ Outside high risk areas for Aboriginal heritage ▪ Use existing cleared areas and existing access tracks ▪ No impacts to remnant native vegetation or key habitat features ▪ No disturbance to waterways ▪ Potential environmental impacts can be managed using the safeguards in the EIA ▪ No disturbance of contaminated land or acid sulfate soils ▪ will be rehabilitated at the end of construction. The Delivery Contractor must demonstrate in writing how the proposed ancillary facilities meet these principles. Any facilities that do not meet these principles will require additional environmental impact assessment. The agreed location of these facilities must be shown on the Construction Environmental Management Plan (CEMP) site plan and appropriate environmental controls installed.	Construction	Construction Contractor

ID	Mitigation measure	Timing	Responsibility
B2	Preclearance surveys recommended for: ▪ Green and Golden Bell Frog and the Cumberland Plain Land Snail. Fauna spotter catcher required to be present to avoid potential direct impacts to native species including threatened Cumberland Plain Land Snail and Green and Golden Bell Frog. During construction a 10 m buffer is required around the relict oxbow adjacent to Study Area C to avoid impacts to Green and Golden Bell Frog.	Construction	Construction contractor, Project ecologist
B3	If native fauna is encountered on site, stop work, and allow the fauna to move away unharassed. Engage a licensed ecologist if assistance is required to move fauna.	Construction	Construction contractor
B4	If any threatened species (flora or fauna) are discovered during the works, stop work immediately and notify the Sydney Water Project Manager. Work will only recommence once the impact on the species has been assessed and appropriate control measures implemented.	Construction, operation	Sydney Water, all contractors
B5	Manage biosecurity in accordance with: ▪ *Biosecurity Act 2015* (see NSW Weedwise), including reporting new weed infestations or invasive pests ▪ Contemporary bush regeneration practices, including disposal of sealed bagged weeds to a licenced waste disposal facility. Record Pesticides and Herbicides use in accordance with SWEMS00017.	Construction	Construction contractor
B6	Bag all plant parts and excavated topsoil that may be infested with weed propagules and dispose at a licensed waste disposal facility.	Construction	Construction contractor
B7	Physically delineate vegetation to be cleared and/or protected on site and install appropriate signage prior to works commencing.	Construction	Construction contractor
B8	Minimise vegetation clearance and disturbance, including impacts to standing dead trees and riparian zones. Where possible, limit clearing to trimming rather than the removal of whole plants.	Construction	Construction contractor
B9	Retain dead tree trunks, bush rock or logs in-situ unless they are in the disturbance corridor and moving is unavoidable. Reposition material elsewhere on the site or approved adjacent sites. If native fauna is likely to be present, a licensed ecologist should inspect the removal and undertake fauna relocation.		
B10	Provided it is essential for delivering the Proposal, Sydney Water's Project Manager can approve the following vegetation removal and tree trimming, without additional environmental assessment (but only after consultation with Sydney Water's Environmental and Community Representatives and affected landowners). Sydney Water considers vegetation removal in these circumstances has minimal environmental impact: ▪ Any minor: - vegetation trimming or, - removal of exotic vegetation or, - removal of planted native vegetation	Construction	Construction contractor

ID	Mitigation measure	Timing	Responsibility
	Where the vegetation is not a threatened species (including a characteristic species of a threatened community or population), heritage listed, in declared critical habitat, in a declared area of outstanding biodiversity value, in areas mapped as ENV or RBM 12 under Sydney Growth Centre Biodiversity Certification Order or in land mapped as avoided land or strategic conservation area under the Cumberland Plain Conservation Plan. ▪ Any removal of remnant vegetation where there is no net change to environmental impact (e.g., a different area of vegetation is removed but the total area is the same or less than assessed in the EIA). Written explanation of the application of this clause (including justification of the need for trimming or removal and any proposed revegetation) should be provided when seeking Project Manager approval. Any impacts to native vegetation and trees in non-certified land (with the exception of ENV) must be offset in accordance with the Biodiversity Offset Guideline (SWEMS0019.13).		
B11	Inspect vegetation for potential fauna prior to clearing or trimming. If fauna is present, or ecological assessment has determined high likelihood of native fauna presence, including removal of hollow trees, engage a licensed ecologist to inspect and relocate fauna before works.	Construction	Construction contractor
B12	Map and report native vegetation clearing greater than 0.01 ha (100 m^2) in extent (and any associated rehabilitation) to the Sydney Water Environmental Representative. Track vegetation clearing as per SWEMS0015.26 Contractor Native Vegetation Clearing and Rehabilitation template.	Construction	Sydney Water and Construction Contractor
B13	Any required revegetation will be carried out in accordance with Sydney Water procedure SWEMS0025.11 Guideline for native revegetation following construction.	Post Construction	Sydney Water and Construction contractor
B14	Minimise impacts on native vegetation in non-certified areas, native vegetation retention areas and areas outside the growth centre. Options to consider where feasible include: ▪ alternative construction methodologies (under bore vegetation and waterways, compressed construction corridors) ▪ avoiding impact to hollow bearing and habitat trees.	Construction	Sydney Water and Construction contractor
B15	A hygiene protocol must be prepared prior to works starting and implemented by the Delivery Contractor during works to avoid introduction of pathogens in machinery, tools, PPE or imported soils.	Construction	Sydney Water and Construction contractor

5.3 Offset

This assessment identifies that the Proposal requires the clearing of native vegetation. Vegetation to be cleared is listed as ENV in non-certified land under the Western Sydney Growth Centre SEPP Biodiversity Certification Order (BCO) (NSW DCCEEW, 2007). Statutory offsets are required for clearing ENV within non-certified lands as per Condition 11 of the BCO.

Table 5-2 outlines the estimates for statutory offsetting under the Western Sydney Growth Centre SEPP BCO for the Proposal.

Table 5-2 Estimated statutory biodiversity offsets for the Proposal

Offset group	PCT ID	PCT name	Area impacted	Offset ratio	Offset required
ENV (non-certified land)	PCT 4025	Cumberland Red Gum Riverflat Forest	0.131 ha	3:1	0.393 ha

Non-statutory offsetting would also be undertaken in accordance with Sydney Water's Biodiversity Offset Guide (SWEMS0019.13) (Sydney Water 2024). Offsets for native vegetation within certified lands have already been applied by the State Government of NSW.

The vegetation clearing for the Proposal is considered a 'moderate impact' under the Guide in that it is "larger scale impacts (>100 m^2), that are not considered significant (e.g. removal of native vegetation associated with new infrastructure projects)." Table 5-3 outlines the estimates for biodiversity offsetting under Sydney Water's Biodiversity Offset Guide (Sydney Water 2024) based on total clearance of the three impact areas. The final offset amounts may differ if actual vegetation impacts change.

Table 5-3 Estimated Sydney Water biodiversity offsets for the Proposal

Offset group	PCT ID	PCT name	Area impacted*	Offset ratio	Offset required
Native vegetation	PCT 4023	Coastal Valleys Swamp Oak Riparian Forest	0.100 ha	2:1	0.200 ha
Threatened native vegetation	PCT 4025	Cumberland Red Gum Riverflat Forest	0.080 ha	3:1	0.240 ha

*Note that the areas for offsetting under Sydney Water's Biodiversity Offset Guide exclude areas of native vegetation already being offset under statutory requirements and do not apply to native vegetation in certified land.

5.3.1 Offsets for Revised Design

The revised Thompsons Creek design involves changes to the approved Project alignment, including modifying sections of the Thompsons Creek gravity carrier alignment, relocation of maintenance holes along the alignment, reducing the total number of maintenance holes, and extending the South Creek gravity carrier. Sections of the approved alignment will no longer be constructed and will instead be replaced by the proposed alignment. In addition, due to the proposed changes, construction of the 3.1km pressure main is no longer required. As a result, the overall impacts to native vegetation across the entire alignment will change, which will affect the total required offsets.

The approved Project requires the clearing of up to 0.574 ha of ENV on non-certified land. The revised Thompsons Creek design will require the clearing of up to 0.518 ha of ENV on non-certified land. This means that the revised design will decrease the required statutory offsets by approximately 0.056 ha.

In accordance with the mitigation measures above, ongoing design development and construction planning will continue to identify and implement opportunities to avoid and/or minimise impacts to native vegetation on non-certified land. These measures are expected to reduce the final statutory offset requirements.

Table 5-4 Comparison of statutory offsets for the approved project and revised design

Offset group	Offset Ratio	Approved Thompsons Creek Design		Revised Thompsons Creek Design		Difference between Approved and Revised Design	
		Impact area	Required offset	Impact area	Required offset	Impact area	Required offset
ENV (non-certified land)	3:1	0.574 ha	1.722 ha	0.518 ha	1.554 ha	0.056 ha (decrease)	0.168 ha (decrease)

Non-statutory offsetting would also be undertaken in accordance with Sydney Water's Biodiversity Offset Guide (SWEMS0019.13) (Sydney Water 2024). Offsets for native vegetation within certified lands have already been applied by the State Government of NSW.

The vegetation clearing for the revised Thompsons Creek alignment is considered a 'moderate impact' under the Guide in that it is "larger scale impacts (>100 m^2), that are not considered significant (e.g. removal of native vegetation associated with new infrastructure projects)."

Table 5-5 outlines the estimates for biodiversity offsetting under Sydney Water's Biodiversity Offset Guide (Sydney Water 2024) based on total clearance of the impact areas for the revised Thompsons Creek alignment.

Table 5-5 Estimated Sydney Water biodiversity offsets for revised design

Offset Group	Vegetation type	Area Impacted by Revised Thompsons Creek Design*	Offset ratio	Offset required
Native vegetation	PCT 3320 Cumberland Shale Plains Woodland	0.076 ha	2:1	**0.152 ha**
	PCT 3448 Castlereagh Ironbark Forest	-	2:1	-
	PCT 4023 Coastal Valleys Swamp Oak Riparian Forest	0.100 ha	2:1	**0.200 ha**
	PCT 4025 Cumberland Red Gum Riverflat Forest	0.189 ha	2:1	**0.378 ha**
Threatened native vegetation	EPBC Act and BC Act: River-Flat Eucalypt Forest on Coastal Floodplains	0.024 ha	3:1	**0.072 ha**
	Only BC Act: River-Flat Eucalypt Forest on Coastal Floodplains	0.167 ha	3:1	**0.501 ha**
	BC Act: Cumberland Plain Woodland in the Sydney Basin Bioregion	0.029 ha	3:1	**0.087 ha**

*Note that the areas for offsetting under Sydney Water's Biodiversity Offset Guide exclude areas of native vegetation already being offset under statutory requirements and do not apply to native vegetation in certified land.

Table 5-6 Comparison of Sydney Water biodiversity offsets for approved project and revised design

Vegetation type	Total Approved Thompsons Creek Project Offsets Required	Total Revised Thompsons Creek Design Offsets Required	Difference between Approved Project and Revised Design
PCT 3320 Cumberland Shale Plains Woodland	0.156 ha	0.152 ha	0.004 ha (decrease)
PCT 3448 Castlereagh Ironbark Forest	-	-	-
PCT 4023 Coastal Valleys Swamp Oak Riparian Forest	-	0.200 ha	0.200 ha (increase)
PCT 4025 Cumberland Red Gum Riverflat Forest	0.388 ha	0.378 ha	0.010 ha (decrease)
EPBC Act and BC Act: River-Flat Eucalypt Forest on Coastal Floodplains	0.207 ha	0.072 ha	0.135 ha (decrease)
Only BC Act: River-Flat Eucalypt Forest on Coastal Floodplains	0.204 ha	0.501 ha	0.297 ha (increase)
BC Act: Cumberland Plain Woodland in the Sydney Basin Bioregion	0.165 ha	0.087 ha	0.078 ha (decrease)
Total offsets required	**1.120 ha**	**1.390 ha**	**0.270 ha (increase)**

5.3.2 Offsetting options

As outlined in Sydney Water's Biodiversity Offset Guide (Sydney Water 2024), offsetting priorities are as follows:

1. Offsetting will occur on the site
2. Offsetting will occur on a nearby site that may be owned by Sydney Water or a local Council
3. Offsetting on a site further away can be considered, or the purchase and retirement of biodiversity credits from a registered Biodiversity Stewardship site may be considered.

6. Conclusion

This addendum biodiversity assessment report has been prepared to address the proposed changes for the combined Thompsons Creek and South Creek Catchment Wastewater Network Stage 1 Project as outlined in the approved REF, specifically for the proposed changes to the Thompsons Creek gravity carrier alignment, including the South Creek extension, and three associated maintenance holes. These changes result in a revised assessment of vegetation loss and potential ecological impacts. Potential impacts resulting from the construction of the Proposal generally relate to native vegetation clearing, including a TEC, and impacts to threatened species habitat.

The Proposal is not expected to result in a 'significant impact' on threatened entities listed under the BC Act. As the Proposal is being assessed and determined under Division 5.1 of the EP&A Act, and a significant impact is not expected, the Biodiversity Offset Scheme is not triggered and a SIS or BDAR is not required.

In summary, the Proposal would:

- Have a total direct native vegetation impact of up to 0.311 ha, comprising:
  - Up to approximately 0.100 ha of PCT 4023 Coastal Valleys Swamp Oak Riparian Forest.
  - Up to approximately 0.211 ha of PCT 4025 Cumberland Red Gum Riverflat Forest. This vegetation is also consistent with the BC Act listed endangered River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and Southeast Corner Bioregions TEC.
- Potentially require additional minor discrete trimming of native and non-native vegetation.
- Have a negligible impact and unlikely to significantly impact on threatened biodiversity.

The proposed changes will result in sections of the approved alignment being replaced by the revised design. As a result, some areas of native vegetation previously impacted under the approved REF will now be avoided and new areas of native vegetation not previously affected will be impacted which will change the required offsets.

In summary, the revised design would trigger the following offsets:

- Statutory offsets for impacts to ENV on non-certified land in accordance with the Western Sydney Growth Centre SEPP BCO:
  - 0.518 ha for ENV on non-certified land (*decrease of 0.056 ha*).
- Non-statutory offsets for impacts to native vegetation in accordance with the Sydney Water Biodiversity Offset Guide (SWEMS0019.13):
  - 0.076 ha of PCT 3320 Cumberland Shale Plains Woodland (decrease of *0.002 ha*).
  - 0.100 ha of PCT 4023 Coastal Valleys Swamp Oak Riparian Forest (*increase of 0.100 ha*).
  - 0.189 ha of PCT 4025 Cumberland Red Gum Riverflat Forest (*decrease of 0.005 ha*).
  - 0.024 ha for EPBC Act **and** BC Act Riverflat Eucalypt Forest on Coastal Floodplains TEC (*decrease of 0.045 ha*).
  - 0.167 ha for **only** BC Act Riverflat Eucalypt Forest on Coastal Floodplains TEC (*increase of 0.099 ha*).
  - 0.029 ha for BC Act Cumberland Plain Woodland in the Sydney Basin Bioregion TEC (*decrease of 0.026 ha*).

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Appendix A. Likelihood of Occurrence assessment

Table A-1 Likelihood of occurrence assessment for threatened flora and fauna

Scientific name	Common Name	BC Act Status	EPBC Status	No. records in locality*	Source	Description	Likelihood of Occurrence within the study area
TECs							
Castlereagh Scribbly Gum and Agnes Banks Woodlands of the Sydney Basin Bioregion		-	E	-	BioNet, PMST	The Castlereagh Scribbly Gum and Agnes Banks Woodlands ecological community is located in the Sydney Basin, primarily in the Castlereagh area in the north-west of the Cumberland Plain. The ecological community occurs primarily on Tertiary sands and gravels of the Hawkesbury-Nepean river system. The ecological community occurs primarily at low elevations up to 80 m ASL, including old ridges, dunes and terraces. The canopy contains, and is often dominated by, one or more of the following species: *Angophora bakeri* (narrow leaved apple), *Eucalyptus racemosa* (scribbly gum, narrowleaved scribbly gum) and *E. parramattensis* subsp. *parramattensis* (Parramatta red gum).	Low – characteristic species composition not present. Outside known IBRA sub-region.
Castlereagh Scribbly Gum Woodland in the Sydney Basin Bioregion		V	-	-	BioNet	Castlereagh Scribbly Gum Woodland in the Sydney Basin Bioregion is dominated by *Eucalyptus parramattensis* subsp. *parramattensis*, *Angophora bakeri* and *E. sclerophylla*. It has a well-developed shrub stratum consisting of sclerophyllous species such as *Banksia spinulosa* var. *spinulosa*, *Melaleuca nodosa*, *Hakea sericea* and *H. dactyloides* (multi-stemmed form). Castlereagh Scribbly Gum Woodland in the Sydney Basin Bioregion occurs almost exclusively on soils derived from Tertiary alluvium. Castlereagh Scribbly Gum Woodland in the Sydney Basin Bioregion is to occur within the LGAs of Bankstown, Blacktown, Campbelltown, Hawkesbury, Liverpool and Penrith.	Low – characteristic species composition not present
Coastal Swamp Oak (*Casuarina glauca*) Forest of New South Wales and South East Queensland ecological community		-	E	-	BioNet	Occurs from south-east Queensland to southern NSW within the South Eastern Queensland, NSW North Coast, Sydney Basin, or South East Corner bioregions. Occurs in coastal catchments at elevations up to 50 m ASL, typically less than 20 m ASL, on coastal	Low – characteristic species composition not present.

Scientific name	Common Name	BC Act Status	EPBC Status	No. records in locality*	Source	Description	Likelihood of Occurrence within the study area
						flats, floodplains, drainage lines, lake margins, wetlands and estuarine fringes where soils are at least occasionally saturated, water-logged or inundated. There are also minor occurrences on coastal dune swales or flats, particularly deflated dunes and dune soaks. Occurs on soils derived from unconsolidated sediments (including alluvium), typically hydrosols (grey-black clay-loam and/or sandy loam soils) and sometimes organosols (peaty soils). Has an open woodland, woodland, forest, or closed forest structure dominated by *Casuarina glauca* (swamp-oak, swamp she-oak).	
Coastal Swamp Sclerophyll Forest of New South Wales and South East Queensland		-	E	-	BioNet, PMST	Occurs on the mainland and islands near to the coast (within 20 km) from South East Queensland to south-eastern NSW specifically within the South Eastern Queensland, NSW North Coast, Sydney Basin and the Bateman sub-region of the South East Corner IBRA Bioregions. Occurs in coastal catchments typically below 20m ASL, but occasionally up to 220m ASL. Occurs on hydric soils with inundation patterns ranging from intermittent to episodic. The canopy is typically dominated or co-dominated by *Melaleuca quinquenervia* and/or *Eucalyptus robusta.*	Low – characteristic species composition not present.
Cooks River/Castlereagh Ironbark Forest in the Sydney Basin Bioregion		E	-	-	BioNet	Ranges from open forest to low woodland, with a canopy dominated by Broad-leaved Ironbark (*Eucalyptus fibrosa*) and Paperbark (*Melaleuca decora*). The canopy may also include other eucalypts such as Woolybutt (*E. longifolia*). The dense shrubby understorey consists of Prickly-leaved Paperbark (*Melaleuca nodosa*) and Peach Heath (*Lissanthe strigosa*), with a range of 'pea' flower shrubs, such as *Dillwynia tenuifolia*, Hairy Bush-pea (*Pultenaea villosa*) and Gorse Bitter Pea (*Daviesia ulicifolia*). Has a very restricted natural distribution and mainly occurs on clay soils derived from the deposits of ancient river systems (alluvium), or on shale soils of the Wianamatta Shales.	Low – characteristic species composition not present.
Cooks River/Castlereagh Ironbark Forest of the Sydney Basin Bioregion		-	CE	-	BioNet, PMST	The Cooks River/Castlereagh Ironbark Forest of the Sydney Basin Bioregion is a dry sclerophyll open forest to low woodland which occurs predominantly in the Cumberland Subregion between Castlereagh and Holsworthy, as well as around the headwaters of	Low – characteristic species composition not present.

Scientific name	Common Name	BC Act Status	EPBC Status	No. records in locality*	Source	Description	Likelihood of Occurrence within the study area
						the Cooks River. Cooks River/Castlereagh Ironbark Forest is usually dominated by *Eucalyptus fibrosa* (broad-leaved ironbark) and *Melaleuca decora* (paperbark). *E. longifolia* (Woollybutt) is also often present.	
Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest		-	CE	-	BioNet, PMST	The Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest represents is a coastal plain grassy eucalypt woodland, which occurs primarily in the Cumberland Sub-region. The ecological community ranges from grassy woodland to forest, with the understorey varying from predominately grassy to predominately shrubby. The tree canopy is typically dominated by *Eucalyptus moluccana* (Coastal Grey Box), *E. tereticornis* (Forest Red Gum) and/or *E. fibrosa* (Red Ironbark).	Low – characteristic species composition not present.
Cumberland Plain Woodland in the Sydney Basin Bioregion		CE	-	-	BioNet	The dominant canopy trees of Cumberland Plain Woodland are Grey Box (*Eucalyptus moluccana*) and Forest Red Gum (*E. tereticornis*), with Narrow-leaved Ironbark (*E. crebra*), Spotted Gum (*Corymbia* maculata) and Thin-leaved Stringybark (*E.* eugenioides) occurring less frequently. The shrub layer is dominated by Blackthorn (*Bursaria spinosa*), and it is common to find abundant grasses such as Kangaroo Grass (*Themeda* australis) and Weeping Meadow Grass (*Microlaena stipoides* var. *stipoides*). Typically occurs on heavy clay soils derived from Wianamatta Shale.	Low – characteristic species composition not present.
Elderslie Banksia Scrub Forest		CE	-	-	BioNet	A scrub community dominated by Coastal Banksia *Banksia integrifolia* subsp. *integrifolia*. Other canopy species include Broad-leaved Apple *Angophora subvelutina*. The shrubby understorey is diverse and includes species that usually occur in sandstone areas, such as Wedding Bush *Ricinocarpus pinifolius*, Riceflower *Pimelea linifolia* subsp. *linifolia* and Daphne Heath *Brachyloma daphnoides*. Occurs only in the Elderslie area, near Camden, in Sydney's south-west. Remaining remnants are 15 ha in total.	Low – study areas outside known distribution. Characteristic species not present.
Elderslie Banksia Scrub Forest in the Sydney Basin Bioregion		-	CE	-	PMST	The Elderslie Banksia Scrub Forest is restricted to the Cumberland subregion of the Sydney Basin IBRA bioregion. It is only known from the Camden LGA in proximity to the Nepean River. The ecological community occurs at low elevations, of around 60 to 100 m ASL.	Low – study areas outside known distribution.

Scientific name	Common Name	BC Act Status	EPBC Status	No. records in locality*	Source	Description	Likelihood of Occurrence within the study area
						The ecological community occurs on deep sandy substrates on high-level Tertiary alluvium. The canopy may be dominated by *Banksia integrifolia* subsp. *integrifolia* especially on elevated and exposed sites. *Angophora subvelutina* (Broadleaved Apple) may be prominent on less sandy sites, areas with impeded drainage/higher groundwater, and areas transitional with other forest assemblages.	Characteristic species not present.
River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria		-	CE	-	BioNet, PMST	The River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria is found in the South East Corner and Sydney Basin IBRA bioregions. The ecological community occurs on alluvial landforms related to coastal river floodplains and associated sites where transient water accumulates, including floodplains, riverbanks, riparian zones, lake foreshores, creek lines, floodplain pockets, depressions, alluvial flats, fans, terraces, and localised colluvial fans. The ecological community is typically found below 50 m ASL. The structure is generally a tall open forest to woodland, but there may be localised areas of closed forest and/or low forest. The canopy is dominated by eucalypt species, often with several species present.	High – associated PCT present.
River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions		E	-	-	BioNet	River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions is associated with silts, clay-loams and sandy loams on periodically inundated alluvial flats, drainage lines and river terraces associated with coastal floodplains. Generally, occurs below 50 m elevation. While the composition of the tree stratum varies considerably, the most widespread and abundant dominant trees include *Eucalyptus tereticornis* (forest red gum), *E. amplifolia* (cabbage gum), *Angophora floribunda* (rough-barked apple) and *A. subvelutina* (broad-leaved apple).	Known – associated PCT present, confirmed during field survey.
Shale Sandstone Transition Forest in the Sydney Basin Bioregion		CE	-	-	BioNet	Occurs at the edges of the Cumberland Plain, where clay soils from the shale rock intergrade with earthy and sandy soils from sandstone, or where shale caps overlay sandstone. The main tree species include Forest Red Gum (*Eucalyptus tereticornis*), Grey Gum (*E. punctata*), stringybarks (*E. globoidea*, *E. eugenioides*) and	Low – characteristic species composition not present.

Scientific name	Common Name	BC Act Status	EPBC Status	No. records in locality*	Source	Description	Likelihood of Occurrence within the study area
						ironbarks (*E. fibrosa* and *E. crebra*). Occurs in the Hawkesbury, Baulkham Hills, Liverpool, Parramatta, Penrith, Campbelltown and Wollondilly LGAs.	
Shale Sandstone Transition Forest of the Sydney Basin Bioregion		-	CE	-	PMST	Shale Sandstone Transition Forest occurs only in NSW, within the Sydney Basin Bioregion to the west of Sydney, on the edges of the Cumberland Plain, as well as on the sandstone-dominated Hornsby, Woronora, and Lower Blue Mountains plateaux that adjoin the plain. Shale Sandstone Transition Forest is found on soils that are primarily derived from shale substrates and thus tend to have a clay texture, but also have some influence from weathered sandstone substrates. This most commonly occurs where the Wianamatta Group shale underlying the Cumberland Plain grades into sandstone, mainly from the Hawkesbury Group.	Low – characteristic species composition not present.
Southern Sydney sheltered forest on transitional sandstone soils in the Sydney Basin Bioregion		E	-	-	BioNet	Southern Sydney sheltered forest on transitional sandstone soils is an open forest dominated by eucalypts with scattered subcanopy trees, a diverse shrub layer and a well-developed groundcover of ferns, forbs, grasses and graminoids. The dominant trees include *Angophora costata*, *Eucalyptus piperita* and occasionally *Eucalyptus pilularis*. Occurrences of *Eucalyptus pilularis*, *Acacia binervata*, *Elaeocarpus reticulatus*, *Pittosporum undulatum* and relatively dense groundcover of ferns, grasses, rushes, lilies and forbs distinguishes the community. The community has been recorded from the LGAs of Campbelltown, Hurstville, Kogarah, Sutherland, Wollondilly and Wollongong.	Low - characteristic species composition not present. Outside known LGAs.
Western Sydney Dry Rainforest and Moist Woodland on Shale		-	CE	-	BioNet, PMST	Rainforest and Moist Woodland on Shale ecological community covers two vegetation units, Western Sydney Dry Rainforest and Moist Shale Woodland. In sheltered gullies and on lower slopes the canopy layer of the ecological community is typically dominated by *Melaleuca styphelioides* (prickly-leaved paperbark). Other diagnostic tree species include *Acacia implexa* (hickory wattle), *Alectryon subcinereus* (native quince), *Brachychiton populneus* (kurrajong), *Corymbia maculata* (spotted gum), *Melicope micrococca* (white euodia) and *Streblus brunonianus* (whalebone	Low - characteristic species composition not present.

Scientific name	Common Name	BC Act Status	EPBC Status	No. records in locality*	Source	Description	Likelihood of Occurrence within the study area
						tree). The ecological community varies from a low closed rainforest, typically in lower slopes and gullies, to a more open moist woodland form on upper slopes and disturbed sites.	
Western Sydney Dry Rainforest in the Sydney Basin Bioregion		E	-	-	BioNet	Canopy trees include Prickly Paperbark (*Melaleuca styphelioides*), Hickory Wattle (*Acacia implexa*) and Native Quince (*Alectryon subcinereus*). There are many rainforest species in the shrub layer, such as Mock Olive (*Notolaea longifolia*), Hairy Clerodendrum (*Clerodendrum tomentosum*) and Yellow Pittosporum *(Pittosporum revolutum*). The shrub layer combines with vines, such as Gum Vine (*Aphanopetalum resinosum*), Wonga Vine (*Pandorea pandorana*) and Slender Grape (*Cayratia clematidea*) to form dense thickets in sheltered locations. Very restricted and occurs most commonly in the far southern section of the Cumberland Plain, in the Razorback Range near Picton. Occurs on clay soils derived from Wianamatta shale.	Low - characteristic species composition not present. Outside known distribution.
Fauna – Amphibians							
Heleioporus australiacus	Giant Burrowing Frog	V	V	0	PMST	Found in heath, woodland and open dry sclerophyll forest on a variety of soil types except those that are clay based. Spends more than 95% of its time in non-breeding habitat in areas up to 300 m from breeding sites. Whilst in non-breeding habitat it burrows below the soil surface or in the leaf litter. Individual frogs occupy a series of burrow sites, some of which are used repeatedly. The home ranges of both sexes appear to be non-overlapping suggesting exclusivity of non-breeding habitat. Home ranges are approximately 0.04ha in size Individuals move into the breeding site either immediately before or following heavy rain and occupy these sites for up to 10 days. Breeding habitat of this species is generally soaks or pools within first or second order streams	Low – clay-based soils are not suitable habitat. No records within locality.
Litoria aurea	Green and Golden Bell Frog	E	V	3	PMST	Inhabits marshes, dams, and stream-sides, particularly those containing bullrushes or spike rushes. Optimum habitat includes waterbodies that are unshaded, free of predatory fish such as Plague Minnow have a grassy area nearby and diurnal sheltering	Moderate – limited suitable habitat given lack of emergent vegetation

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						sites available Some sites, particularly in the Greater Sydney region occur in highly disturbed areas. The species is active by day and usually breeds in summer when conditions are warm and wet.	in creek. Three records in locality, most recent from 2022.
Fauna- Aves							
Anthochaera phrygia	Regent Honeyeater	CE	CE	0	PMST	The Regent Honeyeater mainly inhabits temperate woodlands and open forests of the inland slopes of south-east Australia. Birds are also found in drier coastal woodlands and forests in some years. There are three known key breeding areas, two of them in NSW - Capertee Valley and Bundarra-Barraba regions. The species breeds between July and January in Box-Ironbark and other temperate woodlands and riparian gallery forest dominated by River She-oak.	Low – limited suitable habitat, no mapped important areas or records within the locality.
Aphelocephala leucopsis	Southern Whiteface	-	V	0	PMST	The Southern Whiteface occur across most of mainland Australia south of the tropics, from the northeastern edge of the Western Australian wheatbelt, east to the Great Dividing Range. Southern whitefaces live in a wide range of open woodlands and shrublands where there is an understorey of grasses or shrubs, or both. These areas are usually in habitats dominated by acacias or eucalypts on ranges, foothills and lowlands, and plains	Low - outside known range, no records in locality.
Artamus cyanopterus cyanopterus	Dusky Woodswallow	V	-	36	BioNet	Primarily inhabit dry, open eucalypt forests and woodlands, including mallee associations, with an open or sparse understorey of eucalypt saplings, acacias and other shrubs, and groundcover of grasses or sedges and fallen woody debris. Depending on location and local climatic conditions (primarily temperature and rainfall), the Dusky Woodswallow can be resident year-round or migratory. In NSW, after breeding, birds migrate to the north of the state and to southeastern Queensland, while Tasmanian birds migrate to southeastern NSW after breeding.	Moderate – potential foraging habitat, however preferred habitat with fewer edge effects in the nearby Kemps Creek Nature Reserve.
Botaurus poiciloptilus	Australasian Bittern	E	E	1	PMST	Favours permanent freshwater wetlands with tall, dense vegetation, particularly bullrushes (*Typha* spp.) and spike rushes (*Eleocharis* spp.). Hides during the day amongst dense reeds or rushes and feed mainly at night on frogs, fish, yabbies, spiders, insects, and snails.	Low – no suitable wetland habitat present. Reed lands

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						Feeding platforms may be constructed over deeper water from reeds trampled by the bird; platforms are often littered with prey remains. Breeding occurs in summer from October to January.	limited, only records in locality.
Burhinus grallarius	Bush Stone-Curlew	E	-	2	BioNet	The Bush Stone-curlew is found throughout Australia except for the central southern coast and inland, the far south-east corner, and Tasmania. They inhabit open forests and woodlands with a sparse grassy groundlayer and fallen timber. They are largely nocturnal, being especially active on moonlit nights and feed on insects and small vertebrates, such as frogs, lizards and snakes. They will nest on the ground in a scrape or small bare patch and lay two eggs in spring and early summer.	Low – limited suitable habitat present. Only two records in the locality from 1950.
Calidris acuminata	Sharp-tailed Sandpiper	-	M (C,J,K)	2	BioNet, PMST	The Sharp-tailed Sandpiper prefers muddy edges of shallow fresh or brackish wetlands, with inundated or emergent sedges, grass, saltmarsh, or other low vegetation. This includes lagoons, swamps, lakes and pools near the coast, and dams, waterholes, soaks, bore drains and bore swamps, saltpans, and hypersaline salt lakes inland. Roosting occurs at the edges of wetlands.	Low – no suitable wading habitat. Only two records in locality from 2018 and 2022.
Calidris ferruginea	Curlew Sandpiper	-	CE, M (C,J,K)	0	PMST	Curlew Sandpipers mainly occur on intertidal mudflats in sheltered coastal areas, such as estuaries, bays, inlets and lagoons, and around non-tidal swamps, lakes and lagoons near the coast, and ponds in saltworks and sewage farms. This species is gregarious, often occurring in large flocks. They mix freely with other small waders when feeding and roosting. This species does not breed in Australia	Low – no suitable wading habitat. No records in locality.
Callocephalon fimbriatum	Gang-gang Cockatoo	V	E	2	PMST	In spring and summer, generally found in tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. In autumn and winter, the species often moves to lower altitudes in drier more open eucalypt forests and woodlands, particularly box-gum and box-ironbark assemblages, or in dry forest in coastal areas and often found in urban areas. Favours old growth forest and woodland attributes for nesting and roosting. Nests are located in hollows that are 10 cm in diameter or larger in eucalypts.	Low – opportunistic foraging, habitat unlikely to breed in locality due to seasonal movements to higher elevations. Only two records in locality from 2007 and 2015.

Scientific name	Common Name	BC Act Status	EPBC Status	No. records in locality*	Source	Description	Likelihood of Occurrence within the study area
Calyptorhynchus lathami lathami	Glossy Black-Cockatoo (south-eastern)	V	V	1	BioNet, PMST	Inhabits open forest and woodlands of the coast and the Great Dividing Range where stands of she-oak occur. Black She-oak (*Allocasuarina littoralis*) and Forest She-oak (*A. torulosa*) are important foods. Dependent on large hollow-bearing eucalypts for nest sites. A single egg is laid between March and May.	Low – no preferred she-oak habitat within the study area. Only one record in the locality from 2023.
Circus assimilis	Spotted Harrier	V	-	3	BioNet	The Spotted Harrier occurs throughout the Australian mainland, except in densely forested or wooded habitats of the coast, escarpment and ranges, and rarely in Tasmania. Individuals disperse widely in NSW and comprise a single population. Occurs in grassy open woodland including Acacia and mallee remnants, inland riparian woodland, grassland and shrub steppe. It is found most commonly in native grassland, but also occurs in agricultural land, foraging over open habitats including edges of inland wetlands.	Low – some suitable habitat present, however not preferred. Only three records in locality, the most recent from 2017.
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	V	V	2	PMST	Found in eucalypt woodlands (including Box-Gum Woodland) and dry open forest of the inland slopes and plains inland of the Great Dividing Range; mainly inhabits woodlands dominated by stringybarks or other rough-barked eucalypts, usually with an open grassy understorey, sometimes with one or more shrub species; also found in mallee and River Red Gum Forest bordering wetlands with an open understorey of acacias, saltbush, lignum, cumbungi and grasses; usually not found in woodlands with a dense shrub layer; fallen timber is an important habitat component for foraging; also recorded, though less commonly, in similar woodland habitats on the coastal ranges and plains.	Low – limited foraging habitat, two records in locality from 2019 and 2022.
Daphoenositta chrysoptera	Varied Sittella	V	-	39	BioNet	Inhabits eucalypt forests and woodlands, especially those containing rough-barked species and mature smooth-barked gums with dead branches, mallee, and Acacia woodland. Feeds on arthropods gleaned from crevices in rough or decorticating bark, dead branches, standing dead trees and small branches and twigs in the tree canopy. Builds a cup-shaped nest of plant fibres and cobwebs in an upright tree fork high in the living tree canopy, and often re-uses the same fork or tree in successive years.	Moderate – suitable foraging habitat present, however preferred habitat with fewer edge effects in the nearby Kemps Creek Nature Reserve.

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Ephippiorhynchus asiaticus	Black-necked Stork	E	-	2	BioNet	Black-necked Storks are widespread in coastal and subcoastal northern and eastern Australia, as far south as central NSW (although vagrants may occur further south or inland, well away from breeding areas). In NSW, the species becomes increasingly uncommon south of the Clarence Valley, and rarely occurs south of Sydney. Floodplain wetlands (swamps, billabongs, watercourses and dams) of the major coastal rivers are the key habitat in NSW for the Black-necked Stork. Secondary habitat includes minor floodplains, coastal sandplain wetlands and estuaries.	Low – limited suitable wetland habitat present. Only two records in the locality from 1994 and 2020.
Erythrotriorchis radiatus	Red Goshawk	CE	E	0	PMST	This unique Australian endemic raptor is distributed sparsely through northern and eastern Australia, from the western Kimberley Division of northern Western Australia to north-eastern Queensland and south to far north-eastern NSW, Red Goshawks inhabit open woodland and forest, preferring a mosaic of vegetation types, a large population of birds as a source of food, and permanent water, and are often found in riparian habitats along or near watercourses or wetlands. In NSW, preferred habitats include mixed subtropical rainforest, Melaleuca swamp forest and riparian Eucalyptus Forest of coastal rivers.	Unlikely – study areas are outside the species distribution, and it has not been recorded in the locality.
Falco hypoleucos	Grey Falcon	V	V	0	PMST	Usually restricted to shrubland, grassland and wooded watercourses of arid and semi-arid regions, although it is occasionally found in open woodlands near the coast. Also occurs near wetlands where surface water attracts prey. Preys primarily on birds, especially parrots and pigeons, using high-speed chases and stoops; reptiles and mammals are also taken. Like other falcons it utilises old nests of other birds of prey and ravens, usually high in a living eucalypt near water or a watercourse; peak laying season is in late winter and early spring; two or three eggs are laid.	Unlikely - no suitable habitat present, vagrant. No records in the locality.
Falco subniger	Black Falcon	V	M	1	BioNet	The Black Falcon is widely, but sparsely, distributed in New South Wales, mostly occurring in inland regions. The Black Falcon inhabits woodland, shrubland and grassland in the arid and semi-arid	Low – only one record in the locality from 1991.

Scientific name	Common Name	BC Act Status	EPBC Status	No. records in locality*	Source	Description	Likelihood of Occurrence within the study area
						zones, especially wooded watercourses and agricultural land with scattered remnant trees. The Black Falcon is usually associated with streams or wetlands, visiting them in search of prey and often using standing dead trees as lookout posts.	
Gallinago hardwickii	Latham's Snipe, Japanese Snipe	E	V, M (J,K)	17	BioNet, PMST	In Australia, Latham's Snipe occurs in permanent and ephemeral wetlands up to 2000 m ASL. It occurs in habitats that have saline or brackish water, such as saltmarsh, mangrove creeks, around bays and beaches, and at tidal rivers. The species breeds in the northern hemisphere.	Low – no suitable wading habitat, few records in locality.
Grantiella picta	Painted Honeyeater	V	V, M	0	PMST	The Painted Honeyeater is nomadic and occurs at low densities throughout its range. The greatest concentrations of the bird and almost all breeding occurs on the inland slopes of the Great Dividing Range. inhabits Boree/ Weeping Myall (*Acacia pendula*), Brigalow (*A. harpophylla*) and Box-Gum Woodlands and Box-Ironbark Forests. A specialist feeder on the fruits of mistletoes growing on woodland eucalypts and acacias. Prefers mistletoes of the genus *Amyema*.	Unlikely – outside the species range. No records in locality.
Haliaeetus leucogaster	White-bellied Sea-Eagle	V	-	26	BioNet	The White-bellied Sea-Eagle is the second largest raptor found in Australia, they are a common sight in coastal and near coastal areas of Australia, including inland river systems perched high in a tree or soaring over waterways and adjacent land. The breeding season extends from June to January (or sometimes February) in southern Australia but begins one or two months earlier in northern Australia. White-bellied Sea-Eagles build a large stick nest, which is used for many seasons in succession. The nest can be located in a tree up to 30 m above the ground but may also be placed on the ground or on rocks, where there are no suitable trees.	Low – limited suitable breeding habitat. As such, foraging in the study area is unlikely given disturbance and fragmentation.
Hieraaetus morphnoides	Little Eagle	V	-	33	BioNet	Occupies open eucalypt forest, woodland, or open woodland. She-oak or Acacia woodlands and riparian woodlands of interior NSW are also used. Nests in tall living trees within a remnant patch, where pairs build a large stick nest in winter. Lays two or three eggs during spring, and young fledge in early summer. Preys on birds,	Low – some suitable opportunistic foraging habitat, however, given

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						reptiles, and mammals, occasionally adding large insects and carrion.	disturbance not preferred.
Hirundapus caudacutus	White-throated Needletail	-	V, M (C,J,K)	2	PMST	Migratory and usually seen in eastern Australia from October to April. Breeds in forests in south-eastern Siberia, Mongolia, the Korean Peninsula, and northern Japan June-August. Most often seen in eastern Australia before storms, low pressure troughs and approaching cold fronts and occasionally bushfire. These conditions are often used by insects to swarm (e.g., termites and ants) or tend to lift insects away from the surface which favours sighting of White-throated Needletails as they feed. More common in coastal areas, less so inland.	Low – aerial habitat possible, however not utilising terrestrial habitat within the study areas. Only two recorded in the locality from 2010 and 2019.
Lathamus discolor	Swift Parrot	E	CE	39	BioNet, PMST	Breeds in Tasmania during spring and summer, migrating in the autumn and winter months to south-eastern Australia from Victoria and the eastern parts of South Australia to south-east Queensland. Migrates to the Australian south-east mainland between February and October. On the mainland they occur in areas where eucalypts are flowering profusely or where there are abundant lerp (from sap-sucking bugs) infestations. Favoured feed trees include winter flowering species such as Swamp Mahogany (*Eucalyptus robusta*), Spotted Gum (*Corymbia maculate*), Red Bloodwood (*C. gummifera*), Forest Red Gum (*E. tereticornis*), Mugga Ironbark (*E. sideroxylon*), and White Box (*E. albens*).	Low – limited suitable foraging habitat of preferred species within the study areas. Most recent records are from 2019.
Limosa limosa	Black-tailed Godwit	VC	E, M	1	BioNet	The Black-tailed Godwit is a migratory wading bird that breeds in Mongolia and Eastern Siberia and flies to Australia for the southern summer, arriving in August and leaving in March. In NSW, it is most frequently recorded at Kooragang Island (Hunter River estuary), with occasional records elsewhere along the coast, and inland. This is primarily a coastal species and is usually found in sheltered bays, estuaries and lagoons with large intertidal mudflats and/or sandflats. Further inland, it can also be found on mudflats and in water less than 10 cm deep, around muddy lakes and swamps.	Unlikely – no suitable habitat within the study areas and only one record from the locality.

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Lophoictinia isura	Square-tailed Kite	V	M	6	BioNet	The Square-tailed Kite ranges along coastal and subcoastal areas from south-western to northern Australia, Queensland, NSW and Victoria. In NSW, scattered records of the species throughout the state indicate that the species is a regular resident in the north, north-east and along the major west-flowing river systems. It is a summer breeding migrant to the south-east, including the NSW south coast, arriving in September and leaving by March. It is found in a variety of timbered habitats including dry woodlands and open forests. Shows a particular preference for timbered watercourses. In arid north-western NSW, has been observed in stony country with a ground cover of chenopods and grasses, open acacia scrub and patches of low open eucalypt woodland.	Low – limited suitable habitat within the study area and only six records within the locality.
Melanodryas cucullata cucullata	South-eastern Hooded Robin, Hooded Robin (south-eastern)	E	E	3	PMST	The Hooded Robin is widespread, found across Australia, except for the driest deserts and the wetter coastal areas - northern and eastern coastal Queensland and Tasmania. Prefers lightly wooded country, usually open eucalypt woodland, acacia scrub and mallee, often in or near clearings or open areas. Requires structurally diverse habitats featuring mature eucalypts, saplings, some small shrubs, and a ground layer of moderately tall native grasses. Often perches on low dead stumps and fallen timber or on low-hanging branches, using a perch-and-pounce method of hunting insect prey. Territories range from around 10 ha during the breeding season, to 30 ha in the non-breeding season.	Low - limited suitable habitat within the study areas. Vagrant to area. Only three records in the locality.
Melithreptus gularis gularis	Black-chinned Honeyeater	V	-	3	BioNet, PMST	In NSW it is widespread, with records from the tablelands and western slopes of the Great Dividing Range to the north-west and central-west plains and the Riverina. It is rarely recorded east of the Great Dividing Range, although regularly observed from the Richmond and Clarence River areas. It has also been recorded at a few scattered sites in the Hunter, Central Coast and Illawarra regions, though it is very rare in the latter. Occupies mostly upper levels of drier open forests or woodlands dominated by box and ironbark eucalypts, especially Mugga Ironbark (Eucalyptus sideroxylon), White Box (E. albens), Inland Grey Box (E. microcarpa),	Low – limited suitable habitat within he study area. Only two records within the locality from 2007 and 2013.

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						Yellow Box (E. melliodora), Blakely's Red Gum (E. blakelyi) and Forest Red Gum (E. tereticornis). Also inhabits open forests of smooth-barked gums, stringybarks, ironbarks, river sheoaks (nesting habitat) and tea-trees.	
Neophema chrysostoma	Blue-winged Parrot	V	V	0	PMST	Blue-winged parrots breed on mainland Australia south of the Great Dividing Range in southern Victoria from Port Albert in Gippsland west to Nelson, and sometimes in the far south-east of South Australia, and the north-western, central, and eastern parts of Tasmania. Blue-winged parrots inhabit a range of habitats from coastal, sub-coastal and inland areas, through to semi-arid zones. They tend to favour grasslands and grassy woodlands and are often found near wetlands both near the coast and in semi-arid zones.	Low - limited suitable habitat present. No records in the locality. Edge of known range.
Neophema pulchella	Turquoise Parrot	V	-	1	BioNet	The Turquoise Parrot's range extends from southern Queensland through to northern Victoria, from the coastal plains to the western slopes of the Great Dividing Range. It generally lives on the edges of eucalypt woodland adjoining clearings, timbered ridges and creeks in farmland. This species is usually seen in pairs or small, possibly family, groups and have also been reported in flocks of up to thirty individuals. It prefers to feed in the shade of a tree and spends most of the day on the ground searching for the seeds of grasses and herbaceous plants or browsing on vegetable matter.	Low – limited suitable habitat present and only one record in the locality from 2009.
Ninox connivens	Barking Owl	V	-	1	BioNet	The Barking Owl is found throughout continental Australia except for the central arid regions. Although still common in parts of northern Australia, the species has declined greatly in southern Australia and now occurs in a wide but sparse distribution in NSW. They inhabit woodland and open forest, including fragmented remnants and partly cleared farmland. It is flexible in its habitat use, and hunting can extend in to closed forest and more open areas. Sometimes able to successfully breed along timbered watercourses in heavily cleared habitats (e.g. western NSW) due to the higher density of prey found on these fertile riparian soils. They generally	Low – limited suitable habitat present and only one record in the locality from 2018.

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						roost in shaded portions of tree canopies, including tall midstorey trees with dense foliage such as Acacia and Casuarina species.	
Ninox strenua	Powerful Owl	V	-	8	BioNet	The Powerful Owl is endemic to eastern and south-eastern Australia, mainly on the coastal side of the Great Dividing Range from Mackay to south-western Victoria. In NSW, it is widely distributed throughout the eastern forests from the coast inland to tablelands, with scattered records on the western slopes and plains suggesting occupancy prior to land clearing. There have been recent increases in population density across the Sydney area. The Powerful Owl inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest. The Powerful Owl requires large tracts of forest or woodland habitat but can occur in fragmented landscapes as well. The species breeds and hunts in open or closed sclerophyll forest or woodlands and occasionally hunts in open habitats	Low – limited suitable habitat present. Only eights records in the locality, the most recent from 2021.
Numenius madagascariensis	Eastern Curlew, Far Eastern Curlew	CE	CE, M (C,J,K)	0	PMST	It generally occupies coastal lakes, inlets, bays, and estuarine habitats, and in New South Wales is mainly found in intertidal mudflats and sometimes saltmarsh of sheltered coasts. Occasionally, the species occurs on ocean beaches (often near estuaries), and coral reefs, rock platforms, or rocky islets. It forages in or at the edge of shallow water, occasionally on exposed algal mats or waterweed, or on banks of beach-cast seagrass or seaweed. It roosts on sandy spits and islets, especially on dry beach sand near the high-water mark, and among coastal vegetation including low saltmarsh or mangroves. May also roost on wooden oyster leases or other similar structures	Low – no suitable coastal habitat. No records in locality.
Oxyura australis	Blue-billed Duck	V	-	2	BioNet	The Blue-billed Duck is endemic to south-eastern and south-western Australia. It is widespread in NSW, but most common in the southern Murray-Darling Basin area. The Blue-billed Duck prefers deep water in large permanent wetlands and swamps with dense aquatic vegetation. The species is completely aquatic, swimming low in the water along the edge of dense cover. It will fly if disturbed but prefers to dive if approached.	Low – no suitable wetland habitat, only two records in locality from 2019.

Scientific name	Common Name	BC Act Status	EPBC Status	No. records in locality*	Source	Description	Likelihood of Occurrence within the study area
Parvipsitta pusilla	Little Lorikeet	V	-	9	BioNet	The Little Lorikeet is distributed widely across the coastal and Great Divide regions of eastern Australia from Cape York to South Australia. Forages primarily in the canopy of open Eucalyptus forest and woodland, yet also finds food in Angophora, Melaleuca and other tree species. Riparian habitats are particularly used, due to higher soil fertility and hence greater productivity. Isolated flowering trees in open country, e.g. paddocks, roadside remnants and urban trees also help sustain viable populations of the species.	Low – some preferred habitat present, but no records in the locality since 2018.
Petroica phoenicea	Flame Robin	V	-	5	BioNet	Breeds in upland tall moist eucalypt forests and woodlands, often on ridges and slopes. Prefers clearings or areas with open understoreys. The ground layer of the breeding habitat is dominated by native grasses and the shrub layer may be either sparse or dense. Occasionally occurs in temperate rainforest, and also in herb fields, heathlands, shrublands and sedgelands at high altitudes. In winter, birds migrate to drier more open habitats in the lowlands (i.e., valleys below the ranges, and to the western slopes and plains). Often occurs in recently burnt areas; however, habitat becomes unsuitable as vegetation thickens following regeneration	Low – limited suitable habitat present, however only five records in locality, the most recent from 2004.
Pycnoptilus floccosus	Pilotbird	V	V	0	PMST	Its name comes from its supposed habit of following lyrebirds, taking prey that they flush, and from its call guiding bushmen seeking for lyrebirds. This habit is well known but seldom observed. The pilotbird is highly terrestrial, feeding on or near the ground and when disturbed it runs swiftly on strong legs. Its call has been described as "piercing and sweet".	Low – no suitable habitat due to lack of wet forest/rainforest. No records in the locality.
Pyrrholaemus sagittatus	Speckled Warbler	V	-	18	BioNet	The species is most frequently reported from the hills and tablelands of the Great Dividing Range, and rarely from the coast. There has been a decline in population density throughout its range, with the decline exceeding 40% where no vegetation remnants larger than 100ha survive. The Speckled Warbler lives in a wide range of Eucalyptus dominated communities that have a grassy understorey, often on rocky ridges or in gullies. Typical habitat would include scattered native tussock grasses, a sparse shrub layer, some eucalypt regrowth and an open canopy.	Low – species prefers areas of larger woodland and no records in the locality since 2016.

Scientific name	Common Name	BC Act Status	EPBC Status	No. records in locality*	Source	Description	Likelihood of Occurrence within the study area
Rostratula australis	Australian Painted Snipe	-	E	1	PMST	The Australian Painted Snipe generally inhabits shallow terrestrial freshwater (occasionally brackish) wetlands, including temporary and permanent lakes, swamps and claypans. This species has mainly been recorded in the Murray-Darling region, but has also been recorded in south-east Queensland, eastern NSW, south-east South Australia, and the Mt Lofty Ranges.	Low – no suitable wadding habitat present. Only one record in the locality.
Stagonopleura guttata	Diamond Firetail	V	V	4	BioNet, PMST	Found in grassy eucalypt woodlands, including Box-Gum Woodlands and Snow Gum Eucalyptus pauciflora Woodlands. Also occurs in open forest, mallee, Natural Temperate Grassland, and in secondary grassland derived from other communities. Often found in riparian areas (rivers and creeks), and sometimes in lightly wooded farmland. Feeds exclusively on the ground, on ripe and partly ripe grass and herb seeds and green leaves, and on insects (especially in the breeding season). Groups separate into small colonies to breed, between August and January. Nests are globular structures built either in the shrubby understorey, or higher up, especially under hawk's or raven's nests.	Low - Some preferred habitat along creek corridor, however, only four records in the locality with the most recent being from 2012.
Stictonetta naevosa	Freckled Duck	V	-	2	BioNet	The Freckled Duck is found primarily in south-eastern and south-western Australia, occurring as a vagrant elsewhere. It breeds in large temporary swamps created by floods in the Bulloo and Lake Eyre basins and the Murray-Darling system, particularly along the Paroo and Lachlan Rivers, and other rivers within the Riverina. Prefer permanent freshwater swamps and creeks with heavy growth of Cumbungi, Lignum or Tea-tree. During drier times they move from ephemeral breeding swamps to more permanent waters such as lakes, reservoirs, farm dams and sewage ponds.	Low – limited preferred swamp habitat with associated emergent vegetation. Only two records in locality from 2013 and 2018.
Tringa nebularia	Common Greenshank	E	E, M (C,J,K)	1	BioNet, PMST	The Common Greenshank does not breed in Australia; however, the species occurs in all types of wetlands and has the widest distribution of any shorebird in Australia. The Common Greenshank is found in a wide variety of inland wetlands and sheltered coastal habitats of varying salinity. It occurs in sheltered coastal habitats, typically with large mudflats and saltmarsh, mangroves, or seagrass. Habitats include embayments, harbours, river estuaries, deltas and	Low – limited preferred suitable wading habitat present. Only one record in locality from 2006.

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						lagoons and are recorded less often in round tidal pools, rock-flats, and rock platforms. The species uses both permanent and ephemeral terrestrial wetlands, including swamps, lakes, dams, rivers, creeks, billabongs, waterholes, and inundated floodplains, claypans and salt flats. It will also use artificial wetlands, including sewage farms and saltworks dams, inundated rice crops and bores. The edges of the wetlands used are generally of mud or clay, occasionally of sand, and may be bare or with emergent or fringing vegetation, including short sedges and saltmarsh, mangroves, thickets of rushes, and dead or live trees.	
Tyto novaehollandiae	Masked Owl	V	-	2	BioNet	Extends from the coast where it is most abundant to the western plains. Overall records for this species fall within approximately 90% of NSW, excluding the most arid north-western corner. There is no seasonal variation in its distribution.	Low – some preferred habitat present, however, only two records in the locality from 2015 and 2016.
Fauna- Fish							
Macquaria australasica	Macquarie Perch	E (FM Act)	E	0	PMST	Macquarie Perch have declined considerably from their historical distribution within NSW, and they are now considered isolated to the upper reaches of the Lachlan and Murrumbidgee Rivers in southern NSW. A riverine, schooling species. It prefers clear water and deep, rocky holes with lots of cover. As well as aquatic vegetation, additional cover may comprise of large boulders, debris, and overhanging banks	Unlikely – outside known range. Closest mapped habitat is in the Nepean River about 16 km to the north-west.
Prototroctes maraena	Australian Grayling	E (FM Act)	V	0	PMST	It was once abundant throughout its range but has declined in many areas since European settlement and is now generally patchily distributed. In NSW its most northern limit is now the Clyde River. Larvae migrate out to see for the first 4 – 6 months before migrating back to freshwater. In their freshwater phase they are found in moderate to fast flowing waters, such as glides or runs, during the day and slow-flowing waters at night.	Unlikely – outside known range. Closest mapped habitat is in the Nepean River about 16 km to the north-west.
Fauna - Gastropoda							

Scientific name	Common Name	BC Act Status	EPBC Status	No. records in locality*	Source	Description	Likelihood of Occurrence within the study area
Meridolum corneovirens	Cumberland Plain Land Snail	E	-	470	BioNet	Lives in small areas on the Cumberland Plain west of Sydney, from Richmond and Windsor south to Picton and from Liverpool west to the Hawkesbury and Nepean Rivers at the base of the Blue Mountains. known from over 100 different locations, but not all are currently occupied, and they are usually isolated from each other as a result of land use patterns.	High – suitable habitat in Eucalypt woodland, many records. No habitat in parts of study area with exotic grassland.
Fauna - Mammalia							
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	10	PMST	Roosts in caves (near their entrances), crevices in cliffs, old mine workings and in the disused, bottle-shaped mud nests of the Fairy Martin frequenting low to mid-elevation dry open forest and woodland close to these features. Females have been recorded raising young in maternity roosts (c. 20-40 females) from November through to January in roof domes in sandstone caves and overhangs	Low – opportunistic foraging habitat present, however no caves or cliffs within proximity of the study area. Several records within the locality.
Dasyurus maculatus	Spotted-tailed Quoll	V	E	4	PMST	Recorded across a range of habitat types, including rainforest, open forest, woodland, coastal heath, and inland riparian forest, from the sub-alpine zone to the coastline. Quolls use hollow-bearing trees, fallen logs, other animal burrows, small caves, and rock outcrops as den sites.	Low – no suitable den sites and limited woodland. No records in locality.
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V	-	31	BioNet	Prefers moist habitats, with trees taller than 20 m. Generally, roosts in eucalypt hollows, but has also been found under loose bark on trees or in buildings. Hunts beetles, moths, weevils, and other flying insects above or just below the tree canopy. Hibernates in winter. Females are pregnant in late spring to early summer.	Low – limited suitable foraging and roosting habitat due to lack of moist forest.
Micronomus norfolkensis	Eastern Coastal Free-tailed Bat	V	-	117	BioNet	Occur in dry sclerophyll forest, woodland, swamp forests and mangrove forests east of the Great Dividing Range. Roost mainly in tree hollows but will also roost under bark or in man-made structures. Usually solitary but also recorded roosting communally, probably insectivorous	Moderate - suitable foraging habitat present. However, disturbed, and subject to edge effects. Several

Scientific name	Common Name	BC Act Status	EPBC Status	No. records in locality*	Source	Description	Likelihood of Occurrence within the study area
							recent records in locality.
Miniopterus australis	Little Bent-winged Bat	V	-	21	BioNet	East coast and ranges of Australia from Cape York in Queensland to Wollongong in NSW. Moist eucalypt forest, rainforest, vine thicket, wet and dry sclerophyll forest, Melaleuca swamps, dense coastal forests and banksia scrub. Generally found in well-timbered areas. Little Bentwing-bats roost in caves, tunnels, tree hollows, abandoned mines, stormwater drains, culverts, bridges and sometimes buildings during the day, and at night forage for small insects beneath the canopy of densely vegetated habitats.	Moderate - suitable foraging habitat present. No suitable breeding caves present. However, disturbed, and subject to edge effects.
Miniopterus orianae oceanensis	Large Bent-winged Bat	V	-	119	BioNet	Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings, and other man-made structures. Form discrete populations centred on a maternity cave that is used annually in spring and summer for the birth and rearing of young. Maternity caves have very specific temperature and humidity regimes.	Moderate - suitable foraging habitat present. No suitable breeding caves present. However, disturbed, and subject to edge effects.
Myotis macropus	Southern Myotis	V	-	91	BioNet	Generally, roost in groups of 10-15 individuals, close to water in caves, mine shafts, hollow-bearing trees, storm water channels, buildings, under bridges and in dense foliage. Forage over streams and pools catching insects and small fish by raking their feet across the water surface. In NSW females have one young each year usually in November or December.	Moderate - suitable foraging habitat present. However, disturbed, and subject to edge effects.
Notamacropus parma	Parma Wallaby	V	V	0	PMST	The species once occurred in north-eastern NSW from the Queensland boarder to the Bega area in the southeast. Preferred habitat is moist eucalypt forest with thick, shrubby understorey, often with nearby grassy areas, rainforest margins and occasionally drier eucalypt forest. Typically feed at night on grasses and herbs in more open eucalypt forest and the edges of nearby grassy areas. During the day they shelter in dense cover.	Low - no suitable moist eucalypt forest habitat is present, no records in locality.

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Petauroides volans	Greater Glider	E	E	0	PMST	Greater Gliders are forest dependent and prefer older tree age classes in moist forest types. They use hollow-bearing trees for shelter and nesting, with each family group using multiple den trees within its home range. They eat mainly young eucalypt leaves, with a preference for certain species. Breeding season begins in March, and a single young is born between April and June.	Low – suitable foraging and breeding habitat, however not recorded in the locality.
Petaurus australis	Yellow-bellied Glider (south-eastern)	V	V	0	PMST	In NSW, distribution of the Yellow-bellied Glider is essentially coastal, extending inland to adjacent ranges. The Yellow-bellied Glider occurs in a diversity of habitats and climates across its range. It typically occurs in tall, mature eucalypt forest in regions of high rainfall, but is also known to occur in drier areas. It inhabits a wide range of forest types but prefers resource rich forests where mature trees provide nesting hollows and tree species composition provides year-round continuity of food resources. They generally require a patch size of over 25ha.	Low – suitable foraging and breeding habitat, however not recorded in the locality.
Petaurus norfolcensis	Squirrel Glider	V	-	1	BioNet	The species is widely though sparsely distributed in eastern Australia, from northern Queensland to western Victoria. Squirrel Gliders inhabit mature or old growth Box, Box-Ironbark woodlands and River Red Gum forest west of the Great Dividing Range and Blackbutt-Bloodwood forest with heath understorey in coastal areas. They prefer a mixed species stands with a shrub or Acacia midstorey. They tend to live in family groups of a single adult male one or more adult females and offspring. They require abundant tree hollows for refuge and nest sites.	Low – some suitable foraging habitat, however no suitable refuge sites observed during field surveys. Only one record from the locality.
Petrogale penicillata	Brush-tailed Rock-wallaby	E	V	0	PMST	In NSW they occur from the Queensland border in the north to the Shoalhaven in the south, with the population in the Warrumbungle Ranges being the western limit. Occupy rocky escarpments, outcrops, and cliffs with a preference for complex structures with fissures, caves and ledges, often facing north. Shelter or bask during the day in rock crevices, caves and overhangs and are most active at night when foraging. Browse on vegetation in and adjacent	Unlikely – the study area is beyond the eastern extent of the range. No records in locality.

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						to rocky areas eating grasses and forbs as well as the foliage and fruits of shrubs and trees.	
Phascolarctos cinereus	Koala	E	E	51	BioNet, PMST	Inhabit eucalypt woodlands and forests. Feed on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area will select preferred browse species. Inactive for most of the day, feeding and moving mostly at night. Spend most of their time in trees, but will descend and traverse open ground to move between trees	Low – some suitable habitat present, however unlikely to be present due to fragmentation. Most recent record from 2021.
Pseudomys novaehollandiae	New Holland Mouse, Pookila	-	V	0	PMST	The New Holland Mouse has been found from coastal areas and up to 100 km inland on sandstone country. Across the species' range, the New Holland Mouse is known to inhabit the following types of habitat: open heath, open woodland with a heathland understorey, vegetated sand dunes.	Low – there is limited suitable habitat for the species due to vegetation type and soils. No records in the locality.
Pteropus poliocephalus	Grey-headed Flying-fox	V	V	280	BioNet, PMST	Occur in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths, and swamps as well as urban gardens and cultivated fruit crops. Roosting camps are generally located within 20km of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy. Individual camps may have tens of thousands of animals and are used for mating, and for giving birth and rearing young. Annual mating commences in January and conception occurs in April or May; a single young is born in October or November.	Moderate - suitable opportunistic foraging habitat, nearest camp is the Ropes Creek camp approx. 10.5 km north of the study area.
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V	-	11	BioNet	The Yellow-bellied Sheathtail-bat is a wide-ranging species found across northern and eastern Australia. Roosts singly or in groups of up to six, in tree hollows and buildings; in treeless areas they are known to utilise mammal burrows. When foraging for insects, flies high and fast over the forest canopy, but lower in more open country. Forages in most habitats across its very wide range, with and without trees; appears to defend an aerial territory.	Moderate – potential opportunistic foraging habitat present, and some records in the locality from 2024.

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Scoteanax rueppellii	Greater Broad-nosed Bat	V	-	62	BioNet	Utilises a variety of habitats from woodland through to moist and dry eucalypt forest and rainforest, though it is most commonly found in tall wet forest. Although this species usually roosts in tree hollows, it has also been found in buildings Forages after sunset, flying slowly and directly along creek and river corridors at an altitude of 3-6m. Open woodland habitat and dry open forest suits the direct flight of this species as it searches for beetles and other large, slow-flying insects; this species has been known to eat other bat species. Little is known of its reproductive cycle, however a single young is born in January; prior to birth, females congregate at maternity sites located in suitable trees, where they appear to exclude males during the birth and raising of the single young.	Moderate - suitable foraging habitat present. However, disturbed, and subject to edge effects. Few recent records in locality.
Fauna – Reptilia							
Aprasia parapulchella	Pink-tailed Worm-lizard, Pink-tailed Legless Lizard	V	V	0	PMST	The Pink-tailed Legless Lizard is primarily known from the Central and Southern Tablelands and the South Western Slopes, with a confirmed outlier record on the Hay Plains north of Hay. There is a concentration of populations in the Canberra/Queanbeyan Region. Inhabits sloping, open woodland areas with predominantly native grassy ground layers, particularly those dominated by Kangaroo Grass (*Themeda australis*). Sites are typically well-drained, with rocky outcrops or scattered, partially buried rocks.	Unlikely – outside known range. No suitable habitat. No records within the locality.
Holphocephalus bungaroides	Broad-headed Snake	E	E	0	PMST	The Broad-headed Snake is largely confined to Triassic and Permian sandstones, including the Hawkesbury, Narrabeen and Shoalhaven groups, within the coast and ranges in an area within approximately 250 km of Sydney. The Broad-headed Snake is often found in rocky outcrops and adjacent sclerophyll forest and woodland, with the most suitable sites occurring in sandstone ridgetops.	Low – limited suitable habitat present and no records within the locality.
Flora							
Acacia bynoeana	Bynoe's Wattle	E	V	0	PMST	A low growing, well-branched shrub mostly 0.1-1m high with hairy and warty branches. The phyllodes (leaves) are crowded, scattered or in irregular whorls, cylindrical and warty. Flowerheads consisting of 10-20 golden yellow flowers occur in the angle between the	Low – no suitable habitat due to lack of sandy soils. No

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						phyllode and stem. Fruit is a slightly curved pod 1-2cm long. Occurs in heath or dry sclerophyll forest on sandy soils. Seems to prefer open, sometimes slightly disturbed sites such as trail margins, edges of roadside spoil mounds and in recently burnt patches. Associated overstorey species include Red Bloodwood, Scribbly Gum, Parramatta Red Gum, Saw Banksia, and Narrow-leaved Apple.	records in the locality.
Acacia pubescens	Downy Wattle	E	V	28	BioNet, PMST	A spreading shrub, 1-5 m high with brilliant yellow flowers, bipinnate leaves (divided twice pinnately) and conspicuously hairy branchlets. Concentrated around the Bankstown-Fairfield-Rookwood area and the Pitt Town area, with outliers occurring at Barden Ridge, Oakdale, and Mountain Lagoon. Usually grows in dry sclerophyll forest and woodland in clay soils. Often in roadside and rail side bushland remnants.	Low – suitable soils, however associated PCT not present. Easily identifiable species all year round and was not detected during the field survey.
Allocasuarina glareicola	-	E	E	0	PMST	Primarily restricted to the Richmond (NW Cumberland Plain) district, but with an outlier population found at Voyager Point, Liverpool. Grows in Castlereagh woodland on lateritic soil. Found in open woodland with *Eucalyptus parramattensis*, *Eucalyptus fibrosa, Angophora bakeri, Eucalyptus sclerophylla* and *Melaleuca decora.*	Low – no suitable habitat due to soil profile. Not recorded in locality.
Cryptostylis hunteriana	Leafless Tongue-orchid	V	V	0	PMST	The Leafless Tongue Orchid has been recorded from as far north as Gibraltar Range National Park south into Victoria around the coast as far as Orbost. It is known historically from a number of localities on the NSW south coast and has been observed in recent years at many sites between Batemans Bay and Nowra. The larger populations typically occur in woodland dominated by Scribbly Gum (*Eucalyptus sclerophylla*), Silvertop Ash (*E.* sieberi), Red Bloodwood (Corymbia *gummifera*) and Black Sheoak (*Allocasuarina littoralis*); appears to prefer open areas in the understorey of this community and is often found in association with the Large Tongue Orchid (*C. subulata*) and the Tartan Tongue Orchid (*C. erecta*).	Low – associated vegetation types and PCT not present within study areas. No records in locality.

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Cynanchum elegans	White-flowered Wax Plant	E	E	8	PMST	The White-flowered Wax Plant usually occurs on the edge of dry rainforest vegetation. Other associated vegetation types include littoral rainforest; Banksia integrifolia coastal scrub; Forest Red Gum (*Eucalyptus tereticornis*) aligned open forest and woodland; *Corymbia maculata* aligned open forest and woodland; and *Melaleuca armillaris* scrub to open scrub. Flowering occurs between August and May, with a peak in November. Flower abundance on individual plants varies from sparse to prolific. The fruit can take up to six months to mature. Seed production is variable and unreliable. Seeds are wind dispersed.	Low – No suitable habitat due to lack of wet forest.
Dillwynia tenuifolia	-	V	-	1332	BioNet	In western Sydney, may be locally abundant particularly within scrubby/dry heath areas within Castlereagh Ironbark Forest and Shale Gravel Transition Forest on tertiary alluvium or laterite clays. May also be common in transitional areas where these communities adjoin Castlereagh Scribbly Gum Woodland. At Yengo, is reported to occur in disturbed escarpment woodland on Narrabeen sandstone. *Eucalyptus fibrosa* is usually the dominant canopy species. *Eucalyptus globoidea, E. longifolia, E. parramattensis, E. sclerophylla* and *E.* sideroxylon may also be present or codominant, with *Melaleuca* decora frequently forming a secondary canopy layer.	Low – suitable soils and many records in locality, however not associated with PCT or vegetation within study areas.
Dillwynia tenuifolia (Kemps Creek population)	-	E	-	1346	BioNet	The endangered population occurs in the area bounded by Western Road, Elizabeth Drive, Devonshire Road and Cross Street, Kemps Creek in the Liverpool LGA. The population occurs on a small outlier of the Berkshire Park Soil Landscape. The site supports a transition from Castlereagh Ironbark Forest to Castlereagh Scribbly Gum Woodland. Portions of the site contain a form of Shale Gravel Transition Forest.	Low – study areas located outside distribution of endangered population.
Eucalyptus aggregata	Black Gum	V	V	0	PMST	In NSW, the species occurs predominantly in the South Eastern Highlands IBRA bioregion with the most eastern part of the distribution being located just within the Sydney Basin IBRA bioregion. Locally frequent, in grassy woodland on alluvial soils	Low - outside of known range. No records in locality.

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						along creeks on broad, cold flats; south from Bathurst. Flowering has been recorded in January, February, April, and October.	
Eucalyptus benthamii	Camden White Gum, Nepean River Gum	CE	CE	195	PMST	Occurs on the alluvial flats of the Nepean River and its tributaries. There are two major subpopulations: in the Kedumba Valley of the Blue Mountains National Park and at Bents Basin State Recreation Area. Several trees are scattered along the Nepean River around Camden and Cobbitty, with a further stand at Werriberri (Monkey) Creek in The Oaks. Requires a combination of deep alluvial sands and a flooding regime that permits seedling establishment.	Low – outside of known range, associated vegetation types not present in study areas.
Genoplesium baueri	Bauer's Midge Orchid	E	E	0	PMST	The species has been recorded from locations between Ulladulla and Port Stephens. About half the records were made before 1960 with most of the older records being from Sydney suburbs including Asquith, Cowan, Gladesville, Longueville, and Wahroonga. Grows in dry sclerophyll forest and moss gardens over sandstone. Flowers February to March.	Low – no suitable habitat due to lack of sandy soils. No records in the locality.
Grevillea juniperina subsp. *Juniperina*	Juniper-leaved Grevillea	V	-	1275	BioNet	Occurs in the NSW Central Coast botanical district, in the far western suburbs of Sydney, from Marsden Park, Riverstone, Blacktown and Penrith and N to the Pitt Town area. Grows in open dry sclerophyll (eucalypt dominated) forest or woodland, at altitudes of less than about 50 m, in sandy to clay-loam soils and red pseudo-lateritic gravels. Flowers mostly August–September, sporadically in other months.	High – suitable soils and PCT associates present. Many records in the locality.
Grevillea parviflora subsp. *Parviflora*	Small-flower Grevillea	V	V	17	BioNet, PMST	It occurs in the Prospect–Camden and Appin areas, with other disjunct populations occurring in the Lower Hunter Valley, on the Central Coast and in the Port Stephens area. Small-flower Grevillea grows on sandy to gravelly clay over shale on crests, upper slopes, or flat plains in both low-lying areas (30–65 m ASL) and on higher topography (200–300 m ASL). It flowers from August to November.	Low – study areas not on transitional soils, associated PCT not present.
Gyrostemon thesioides	-	E	-	30	BioNet	Within NSW, the species has most recently been recorded near Lake Burragorang in the Blue Mountains National Park, and near Long Point in Western Sydney. It has also been recorded in 2004 in	Low – some suitable habitat present but all records are

Scientific name	Common Name	BC Act Status	EPBC Status	No. records in locality*	Source	Description	Likelihood of Occurrence within the study area
						Wollemi National Park, near the Colo River (one male plant), and historically at sites near the Georges and Nepean Rivers (more than 55 and 110 years ago respectively). Also occurs in Western Australia, South Australia, Victoria and Tasmania.	isolated within a site 10km to the south-east of the study area.
Hakea dohertyi	Kowmung Hakea	CE	CE	0	PMST	Kowmung Hakea is confined to a small area (18 sq. km) in the Kowmung Valley in Kanangra Boyd National Park. Population varies, but up to 7000 plants have been counted. Additional small populations occur in Bindook area and at Tonalli Cove on Lake Burragorang.	Low – populations isolated to a single site outside of the study area. No records within the locality.
Haloragis exalata subsp. *exalata*	Wingless Raspwort, Square Raspwort	V	V	0	PMST	Square Raspwort occurs in four widely scattered localities in eastern NSW. It is sparsely distributed in the Central Coast, South Coast and North Western Slopes botanical subdivisions of NSW. Square Raspwort appears to require protected and shaded damp situations in riparian habitats. Flowering specimens in NSW are recorded from November to January.	Low – no suitable habitat due to lack of damp areas. No records in the locality.
Isotoma fluviatilis subsp. *fluviatilis*	-	-	Extinct	7	BioNet	Currently known from only two adjacent sites on a single private property at Erskine Park in the Penrith LGA. Previous sightings are all from western Sydney, at Homebush and at Agnes Banks. Known to grow in damp places, on the Cumberland Plain, including freshwater wetland, grassland/alluvial woodland and an alluvial woodland/shale plains woodland (Cumberland Plain Woodland) ecotone. May be an early successional species that benefits from some disturbance.	Low – study areas outside of known remaining population.
Leucopogon exolasius	Woronora Beard-heath	V	V	1	BioNet	Woronora Beard-heath is found along the upper Georges River area and in Heathcote National Park.	Low – the study area is outside of the species know distribution and only one record within the locality.

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Macadamia integrifolia	Macadamia Nut	-	V	2	BioNet	Not known to occur naturally in the wild in NSW. The Macadamia Nut is a medium-sized tree which can grow to approximately 20 m in height with a similar crown width, giving the tree a rounded shape.	Unlikely – does not occur naturally in NSW, records planted garden specimens.
Marsdenia viridiflora subsp. *viridiflora*	*Marsdenia viridiflora* R. Br. subsp. *viridiflora* population in the Bankstown, Blacktown, Camden, Campbelltown, Fairfield, Holroyd, Liverpool, and Penrith LGAs	E	-	337	BioNet	The *Marsdenia viridiflora* R. Br subsp. *viridiflora* population in the Bankstown, Blacktown, Camden, Campbelltown, Fairfield, Holroyd, Liverpool, and Penrith LGAs is disjunct and at or near the southern limit of its range. It occurs as very scattered plants in areas of remnant woodland and shrubland vegetation.	Low – suitable LGA, however not associated with PCT within the study areas.
Melaleuca deanei	Deane's Paperbark	V	V	0	PMST	Grows in wet heath on sandstone; uncommon, in coastal districts from Berowra to Nowra. The species occurs mostly in ridgetop woodland, with only 5% of sites in heath on sandstone. Flowers appear in summer, but seed production appears to be small and consequently the species exhibits a limited capacity to regenerate.	Low - no suitable habitat due to soil type. No records in the locality.
Persicaria elatior	Knotweed, Tall Knotweed	V	V	0	PMST	Knotweed has been recorded in south-eastern NSW (Mt Dromedary (an old record)), Moruya State Forest near Turlinjah, the Upper Avon River catchment north of Robertson, Bermagui, and Picton Lakes. In northern NSW it is known from Raymond Terrace (near Newcastle) and the Grafton area (Cherry Tree and Gibberagee State Forests). The species also occurs in Queensland. This species normally grows in damp places, especially beside streams and lakes. Occasionally in swamp forest or associated with disturbance.	Low – no suitable habitat present. No records in the locality.

Scientific name	Common Name	BC Act Status	EPBC Status	No. records in locality*	Source	Description	Likelihood of Occurrence within the study area
Persoonia hirsuta	Hairy Persoonia	E	E	0	PMST	Persoonia hirsuta has a scattered distribution around Sydney. The species is distributed from Singleton in the north, along the east coast to Hilltop in the south west, Dombarton in the south east and the Blue Mountains to the west. Persoonia hirsuta has a large area of occurrence, but occurs in small populations or isolated individuals, increasing the species' fragmentation in the landscape.	Low – limited suitable habitat present and no records within the locality.
Persoonia nutans	Nodding Geebung	E	E	13	BioNet, PMST	Restricted to the Cumberland Plain in western Sydney, between Richmond in the north and Macquarie Fields in the south. Northern populations are confined to aeolian and alluvial sediments and occur in a range of sclerophyll forest and woodland vegetation communities, with the majority of individuals occurring within Agnes Banks Woodland or Castlereagh Scribbly Gum Woodland and some in Cooks River/Castlereagh Ironbark Forests. Southern populations also occupy tertiary alluvium but extend onto shale sandstone transition communities and into Cooks River/Castlereagh Ironbark Forest.	Low – suitable soils, however associated PCT not present in study area.
Pimelea curviflora var. *curviflora*	-	V	V	0	PMST	Occurs on shaley/lateritic soils over sandstone and shale/sandstone transition soils on ridgetops and upper slopes amongst woodlands. Also recorded in Illawarra Lowland Grassy Woodland habitat at Albion Park on the Illawarra coastal plain. Flowers October to May. Has an inconspicuous cryptic habit as it is fine and scraggly and often grows amongst dense grasses and sedges. It may not always be visible at a site as it appears to survive for some time without any foliage after fire or grazing, relying on energy reserves in its tuberous roots. Likely to be fire tolerant species capable of resprouting following fire due to the presence of a tap root. Seedlings have been observed following fire.	Low – no suitable habitat due to soil type. No records in the locality.
Pimelea spicata	Spiked Rice-flower	E	E	159	BioNet, PMST	In both the Cumberland Plain and Illawarra environments this species is found on well-structured clay soils. On the Cumberland Plain sites, it is associated with Grey Box communities (particularly Cumberland Plain Woodland variants and Moist Shale Woodland) and in areas of ironbark. Mature plants spread over short distances through underground rhizomes, and this can assist them to recover	Low – associated PCT present, however not preferred habitat. Many records in the locality but they are

Scientific name	Common Name	BC Act Status	EPBC Status	No. records in locality*	Source	Description	Likelihood of Occurrence within the study area
						from disturbances like fire and irregular grazing. Flowers may be self-pollinating, although fruit production is variable. A soil seedbank develops and is maintained in the presence of a suitable disturbance regime.	isolated to a site roughly 10km west.
Pomaderris brunnea	Brown Pomaderria	E	V	0	PMST	Brown Pomaderris grows in moist woodland or forest on clay and alluvial soils of flood plains and creek lines. Flowers appear in September and October. The species is expected to live for 10-20 years, while the minimum time to produce seed is estimated to be 4-6 years. The species has been found in association with *Eucalyptus amplifolia, Angophora floribunda, Acacia parramattensis, Bursaria spinosa* and *Kunzea ambigua*.	Low – no suitable habitat due to lack of moist forest. No records in the locality.
Pterostylis gibbosa	Illawarra Greenhood, Pouched Greenhood	E	E	0	PMST	Known from a small number of populations in the Hunter region (Milbrodale), the Illawarra region (Albion Park and Yallah) and the Shoalhaven region (near Nowra). All known populations grow in open forest or woodland, on flat or gently sloping land with poor drainage.	Unlikely – outside of known distribution. No records in locality.
Pterostylis saxicola	Sydney Plains Greenhood	E	E	0	PMST	Restricted to western Sydney between Freemans Reach in the north and Picton in the south. There are very few known populations, and they are all very small and isolated. Two populations occur within a conservation reserve (Georges River National Park; Scheyville National Park). Most commonly found growing in small pockets of shallow soil in depressions on sandstone rock shelves above cliff lines.	Low – no suitable habitat due to lack of sandstone derived soils. No records in the locality.
Pultenaea parviflora	-	E	V	666	BioNet, PMST	It is endemic to the Cumberland Plain of Western Sydney. It occurs from Windsor to Penrith and east to Erskine Park-area and Dean Park. It extends to Wilberforce and Freemans Reach as well as Pitt Town and Marayla-area. It grows on shale and alluvial soils, in dry sclerophyll woodland. It is usually found in the Cooks River Castlereagh Ironbark and Shale Gravel Transition Forest communities.	Low – suitable habitat and soils, however not associated with PCT within study areas.
Pultenaea pedunculata	Matted Bush-pea	E	-	8	BioNet	Matted Bush-pea is widespread in Victoria, Tasmania, and south-eastern South Australia. In NSW however, it is represented by just	Low – no suitable habitat due to soil

Scientific name	Common Name	BC Act Status	EPBC Status	No. records in locality*	Source	Description	Likelihood of Occurrence within the study area
						three disjunct populations, in the Cumberland Plains in Sydney, the coast between Tathra and Bermagui and the Windellama area south of Goulburn (where it is locally abundant). The Matted Bush-pea occurs in a range of habitats. NSW populations are generally among woodland vegetation but plants have also been found on road batters and coastal cliffs. It is largely confined to loamy soils in dry gullies in populations in the Windellama area.	type. Wight records within the locality but all are isolated within a site 10 km south-west of the study area.
Rhizanthella slateri	Eastern Underground Orchid	V	E	0	PMST	Habitat requirements are poorly understood, and no particular vegetation type has been associated with the species, although it is known to occur in sclerophyll forest. Highly cryptic given that it grows almost completely below the soil surface, with flowers being the only part of the plant that can occur above ground. Therefore, usually located only when the soil is disturbed. Flowers September to November.	Low – no suitable habitat due to soil type and vegetation associations. No records in locality.
Rhodamnia rubescens	Scrub Turpentine	CE	CE	0	PMST	Occurs in coastal districts north from Batemans Bay in New South Wales, approximately 280 km south of Sydney, to areas inland of Bundaberg in Queensland. Populations of *R. rubescens* typically occur in coastal regions and occasionally extend inland onto escarpments up to 600 m ASL in areas with rainfall of 1000-1600 mm. Found in littoral, warm temperate and subtropical rainforest, and wet sclerophyll forest usually on volcanic and sedimentary soils.	Low – no suitable habitat due to lack of wet forest. No records in locality.
Syzygium paniculatum	Magenta Lilly Pilly	E	V	2	PMST	On the south coast the Magenta Lilly Pilly occurs on grey soils over sandstone, restricted mainly to remnant stands of littoral (coastal) rainforest. On the central coast Magenta Lilly Pilly occurs on gravels, sands, silts and clays in riverside gallery rainforests and remnant littoral rainforest communities.	Low – no suitable habitat due to lack of wet forest. Only two records within the locality.
Thelymitra kangaloonica	Kangaloon Sun Orchid	CE	CE	0	PMST	The Kangaloon Sun-orchid occurs in NSW and is known from three locations near Robertson in the Southern Highlands. Flowers in October-Nov. Generally, occurs within 200m of swamps. Orchid seeds are very small and can occasionally disperse widely (if on favourable winds) but generally disperse locally within their population.	Low - outside of known range. No suitable habitat due to lack of swamps. No records in the locality.

Scientific name	Common Name	BC Act Status	EPBC Status	No. records in locality*	Source	Description	Likelihood of Occurrence within the study area
Thesium australe	Austral Toadflax, Toadflax	V	V	0	PMST	Although originally described from material collected in the SW Sydney area, populations have not been seen in a long time. Occurs in grassland on coastal headlands or grassland and grassy woodland away from the coast. Often found in association with Kangaroo Grass (*Themeda australis*).	Low – no suitable habitat due to vegetation types. Likely locally extinct. No records in locality.

*Based on BioNet Atlas records

V: Vulnerable, E: Endangered, EP: Endangered Population, CE: Critically Endangered, M:Marine, C: China–Australia Migratory Bird Agreement (CAMBA), J: Japan–Australia Migratory Bird Agreement (JAMBA), K: Republic of Korea–Australia Migratory Bird Agreement (ROKAMBA), SVTM: NSW State Vegetation Type Map (NSW DCCEEW 2024a), BioNet: NSW BioNet Atlas database (NSW DCCEEW 2025b), PMST: EPBC Protected Matters Search Tool (DCCEEW 2025a).

Appendix B. Flora and fauna recorded during field survey

Table C-1 Flora recorded during field survey

Scientific Name	Common Name	BC Status	EPBC Status	Exotic	4023	4025	Disturbed exotic grass
Acacia parramattensis	Parramatta Wattle					*	
Alternanthera philoxeroides	Alligator Weed			*		*	
Angophora subvelutina	Broad-leaved Apple					*	
Araujia sericifera	Moth Vine			*		*	
Bidens pilosa	Cobbler's Pegs			*	*		
Bursaria spinosa	Native Blackthorn					*	
Carex inversa	Knob Sedge				*		
Casuarina glauca	Swamp Oak				*	*	
Cenchrus clandestinus	Kikuyu Grass			*	*	*	*
Centella asiatica	Indian Pennywort					*	*
Cestrum parqui	Green Cestrum			*	*		
Chenopodium nutans	Climbing Saltbush					*	
Chloris gayana	Rhodes Grass			*		*	
Cirsium vulgare	Spear Thistle			*			*
Conyza sumatrensis	Tall fleabane			*	*		*
Crepis spp.				*		*	
Cucurbita maxima	Ironbark Pumpkin			*	*		
Cynodon dactylon	Common Couch				*	*	

Cyperus eragrostis	Umbrella Sedge			*	*		
Dichondra repens	Kidney Weed					*	
Eleocharis spp.	Spike-rush, Spike-sedge					*	
Eucalyptus amplifolia	Cabbage Gum				*	*	
Galium aparine	Goosegrass			*	*	*	
Hypochaeris radicata	Catsear			*			*
Juncus usitatus					*	*	*
Ligustrum lucidum	Large-leaved Privet			*	*		
Ligustrum sinense	Small-leaved Privet			*	*		
Lobelia purpurascens	whiteroot				*		
Melaleuca linariifolia	Flax-leaved Paperbark				*	*	
Melia azedarach	White Cedar					*	
Microlaena stipoides	Weeping Grass					*	
Modiola caroliniana	Red-flowered Mallow			*	*		
Morus alba	White Mulberry			*	*		
Nasturtium officinale	Watercress			*	*		
Oplismenus aemulus						*	
Paspalum urvillei	Vasey Grass			*		*	*
Persicaria decipiens	Slender Knotweed				*		
Plantago lanceolata	Lamb's Tongues			*	*	*	*
Rubus fruticosus sp. agg.	Blackberry complex			*		*	
Rumex brownii	Swamp Dock				*		
Senecio madagascariensis	Fireweed			*	*	*	*

Setaria parviflora				*		*	
Sida rhombifolia	Paddy's Lucerne			*	*	*	
Solanum prinophyllum	Forest Nightshade					*	
Solanum pseudocapsicum	Madeira Winter Cherry			*	*		
Taraxacum officinale	Dandelion			*			*
Tradescantia fluminensis	Wandering Jew			*	*	*	
Trifolium repens	White Clover			*	*		*
Typha orientalis	Broad-leaved Cumbungi					*	
Verbena bonariensis	Purpletop			*	*		*

Table C-2 Incidentally observed fauna during field survey

Scientific Name	Common Name	BC Status	Exotic	Observation Type
Acridotheres tristis	Common Myna		*	Observed
Ardenna pacifica	Wedge-tailed Shearwater	P		Observed
Corvus coronoides	Australian Raven	P		Observed
Crinia signifera	Common Eastern Froglet	P		Observed
Dacelo novaeguineae	Laughing Kookaburra	P		Heard
Eulamprus quoyii	Eastern Water-skink	P		Observed
Grallina cyanoleuca	Magpie-lark	P		Observed
Gymnorhina tibicen	Australian Magpie	P		Observed
Manorina melanocephala	Noisy Miner	P		Observed
Ocyphaps lophotes	Crested Pigeon	P		Observed
Rhipidura leucophrys	Willie Wagtail	P		Heard
Threskiornis moluccus	Australian White Ibis	P		Observed

P: Protected.

Appendix C. Assessments of Significance

C.1 BC Act Test of Significance

Under Part 7, Division 1 of the BC Act, the test of significance is to be taken into account for the purposes of determining whether a proposed activity or activity is likely to significantly affect threatened species, populations or communities, or their habitats. This test should be applied to species, populations and communities listed under the BC Act that are likely or known to occur on site and where potential or known habitat has not been avoided and/or indirect impacts are likely regardless of the minimisation or mitigation measures proposed. The tests of significance have been completed as according to the Threatened Species Test of Significance Guidelines (OEH 2018).

As the following entities are likely to occur within the sites and may be impacted by the works, as such tests of significance have been prepared.

Threatened Ecological Communities

- River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (Endangered)

Threatened Species

- Group: Woodland birds
  - Dusky Woodswallow (*Artamus cyanopterus cyanopterus*) (Vulnerable)
  - Varied Sittella (*Daphoenositta chrysoptera*) (Vulnerable).
- Group: Microchiropteran bats (micro-bats)
  - Eastern Coastal Free-tailed Bat (*Micronomus norfolkensis)* (Vulnerable)
  - Little Bent-winged Bat (*Miniopterus australis*) (Vulnerable)
  - Large Bent-winged Bat (*Miniopterus orianae oceanensis*) (Vulnerable)
  - Southern Myotis (*Myotis macropus*) (Vulnerable)
  - Grey-headed Flying-fox (*Pteropus Poliocephalus*) (Vulnerable)
  - Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventri*) (Vulnerable)
  - Greater Broad-nosed Bat (*Scoteanax rueppellii*) (Vulnerable)
- Cumberland Plain Land Snail (*Meridolum corneovirens*) (Endangered)
- Green and Golden Bell Frog (*Litoria aurea*) (Endangered)

Table E-1.1 River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions

Name of TEC	River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (Endangered – BC Act)

River-flat eucalypt forest on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions TEC is listed as Endangered under the BC Act and would be directly impacted by the Proposal. As such, a 5-part test has been prepared. The following is to be taken into account to determine whether the Proposal is likely to significantly impact the TEC.

Ecology

The community is associated with silts, clay-loams and sandy loams, on periodically inundated alluvial flats, drainage lines and river terraces associated with coastal floodplains (NSW TSSC 2011a).

River-Flat Eucalypt Forest on Coastal Floodplains generally occurs below 50 m elevation, but may occur on localised river flats up to 250 m above sea level in the NSW North Coast, Sydney Basin and South East Corner bioregions. The structure of the community may vary from tall open forests to woodlands, although partial clearing may have reduced the canopy to scattered trees. Typically, these forests and woodlands form mosaics with other floodplain forest communities and treeless wetlands, and often they fringe treeless floodplain lagoons or wetlands with semi-permanent standing water (NSW TSSC 2011a).

The composition of River-Flat Eucalypt Forest on Coastal Floodplains is primarily determined by the frequency and duration of waterlogging and the texture, nutrient and moisture content of the soil. The TEC has a tall open tree layer of eucalypts, which may exceed 40 m in height, but can be considerably shorter in regrowth stands or under conditions of lower site quality. While the composition of the tree stratum varies considerably, the most widespread and abundant dominant trees include *Eucalyptus tereticornis* (forest red gum), *E. amplifolia* (cabbage gum), *Angophora floribunda* (rough-barked apple) and *A. subvelutina* (broad-leaved apple) (NSW TSSC 2011a).

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.

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

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 works would remove up to approximately 0.211 ha of the TEC. This generally comprises all stratum including groundcover, mid-storey and canopy trees. Clearing of moderate condition vegetation would impact both native and exotic species. In addition, the TEC extends further along the South Creek riparian corridor, which is likely to comprise portions of the TEC in improved condition, without the degree of weed and disturbance experienced by the community within the study areas.

As such, the Proposal would not substantially and adversely affect the extent or composition of the community to the extent that would place it at risk of local 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

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

Name of TEC	River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (Endangered – BC Act)
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 works would remove up to 0.211 ha of the TEC, comprising all stratum layers (i.e., ground, mid-storey, and canopy vegetation). The proposed clearance of native vegetation is largely restricted to the edge of the TEC where it grades into disturbed exotic grassland. Majority of works for the Proposal have been confined to previously disturbed or areas of exotic vegetation. At its widest point, clearance involves the removal of up to 30 m strips of vegetation from the edge of the TEC, however, will not result in the fragmentation of the community or establishment of isolated patches, and ecological processes across the impact area would not be impacted. The habitat being removed is in moderate condition and connects to further River-Flat Eucalypt Forest along the South Creek riparian corridor. As such, the works would not fragment or remove habitat important for the community's long-term survival 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 Proposal is not located in any declared AOBV.	
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
The BC Act defines a 'key threatening process' (KTP) as a process that 'adversely affects threatened species or ecological communities' or 'could cause species or ecological communities that are not threatened to become threatened' (s 4.32). Schedule 4 of the BC Act provides a list of KTPs. In relation to this ecological community, the Proposal is likely to include or exacerbate the following KTPs: ▪ Land clearing ▪ Flood mitigation and drainage works ▪ Landfilling and earthworks associated with urban and industrial development ▪ Pollution from urban and agricultural runoff ▪ Weed invasion ▪ Overgrazing, trampling and other soil disturbance by domestic livestock and feral animals including pigs ▪ Activation of 'acid sulfate soils' ▪ Removal of dead wood and rubbish dumping The Proposal would require the clearing of up to about 0.211 ha of the TEC. The clearing of native vegetation is considered a key impact for the community, particularly in urban areas. However, clearance has been restricted to patches with high weed incursion, grading into exotic grasslands and previous disturbance. Due to the minor extent of the clearance required, with additional patches of the TEC extending along the South Creek corridor, the Proposal is not considered to significantly contribute to key threatening processes.	
Conclusion	
The Proposal would require the removal of up to approximately 0.211 ha of the River-flat Eucalypt Forest TEC. Works would involve impacts to all strata layers in moderate condition vegetation, however, is predominantly located at the fringes of existing patches across the study areas. Vegetation located within the study areas connects to the wider landscape, as the TEC continues beyond the site along the South Creek corridor. As such, no long-term impacts to the TEC are likely. Considering the above assessment, the Proposal is not likely to have a 'significant impact' on the River-flat eucalypt forest on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions TEC. Consequently, a SIS or a BDAR is not required.	

Table E-1.2 Woodland birds

Name of threatened species	Woodland birds: ▪ Dusky Woodswallow (*Artamus cyanopterus cyanopterus*) (Vulnerable) ▪ Varied Sittella (*Daphoenositta chrysoptera*) (Vulnerable)
Two woodland birds have been identified as moderately likely to occur on site and potentially impacted by the Proposal. These species are listed as Vulnerable under the BC Act. As such, a 5-part test has been prepared to determine whether the Proposal is likely to significantly impact the species. **Ecology** **Dusky Woodswallow** The Dusky Woodswallow primarily inhabit dry, open eucalypt forests and woodlands, including mallee associations, with an open or sparse understorey of eucalypt saplings, acacias and other shrubs, and groundcover of grasses or sedges and fallen woody debris. Depending on location and local climatic conditions (primarily temperature and rainfall), the dusky woodswallow can be resident year round or migratory. In NSW, after breeding, birds migrate to the north of the state and to southeastern Queensland, while Tasmanian birds migrate to southeastern NSW after breeding (DPE 2017a) **Varied Sittella** The Varied Sittella inhabits eucalypt forests and woodlands, especially those containing rough-barked species and mature smooth-barked gums with dead branches, mallee, and Acacia woodland. Feeds on arthropods gleaned from crevices in rough or decorticating bark, dead branches, standing dead trees and small branches and twigs in the tree canopy. Builds a cup-shaped nest of plant fibres and cobwebs in an upright tree fork high in the living tree canopy, and often re-uses the same fork or tree in successive years (DPE 2017b).	
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	
There are possibly viable populations of these species in the locality as there are recent records and there is suitable habitat within the surrounding locality, with connected patches of bushland along South Creek corridor. The works would clear up to 0.311 ha of suitable foraging, nesting, perching, and sheltering habitat for the two species. The species are known to use several PCTs. No suitable nests were recorded during the survey, however nesting could occur in mid-story and canopy vegetation prior to construction. If nests are impacted, the pairs breeding could be lost for the season, however this is unlikely due to the rarity in the locality and the small extent of clearing works on the edge of a disturbed . Additionally, the works would be completed in a short timeframe (about 8 weeks per maintenance hole), and as such would limit the disturbance to local birds. Overall, due to the minor and temporary nature of works, it is unlikely the Proposal would affect the life cycle of woodland birds such that the local viable population is likely to be placed at risk of extinction.	
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 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.	
C) in relation to the habitat of a threatened species or ecological community	

Name of threatened species	**Woodland birds:** ▪ Dusky Woodswallow (*Artamus cyanopterus cyanopterus*) (Vulnerable) ▪ Varied Sittella (*Daphoenositta chrysoptera*) (Vulnerable)
i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity 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 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	
Woodland birds are generally more susceptible to fragmentation than other bird species. The works include the clearing of up to 0.311 ha of native vegetation. However, the impact area comprises only a small component of the vegetation within the South Creek corridor and is located on the edge of a relatively disturbed patch of vegetation. The clearing would occur on the edge of existing vegetation patch and is not expected to increase fragmentation for the woodland birds. Moreover, there is considerable contiguous habitat immediately adjacent to the impact areas and portions of the impacted vegetation would be remediated following the work. As the species have not been recorded in the study areas and have few recent records in the locality, the habitat being impacted is not considered of high importance, or preferred, especially given additional suitable habitat in nearby Kemps Creek Nature Reserve. Considering the above explanation, the removal of habitat is expected to have a negligible impact on the woodland birds. The indirect impacts to habitat would not impact the long-term survival of the species.	
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 Proposal is not located in any declared AOBV.	
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	
The BC Act defines a KTP as a process that 'adversely affects threatened species or ecological communities' or 'could cause species or ecological communities that are not threatened to become threatened' (s 4.32). Schedule 4 of the BC Act provides a list of KTPs. KTPs relevant to the woodland birds include removal of native vegetation, infestation of habitat by invasive weeds, aggressive exclusion from forest and woodland habitat by over abundant Noisy Miners and removal of fallen timber. The Proposal would require the clearing of about 0.311 ha of native vegetation which comprise potential habitat for woodland birds. The works are not expected in increase any other relevant KTP. Although native vegetation would be impacted, due to the small scale of the Proposal and disturbance of areas immediately adjacent to the study areas, including high cover of weeds and established presence of Noisy Miners, it is not considered significant.	
Conclusion	
The Proposal would have minor impact on woodland birds, including the Dusky Woodswallow and Varied Sitella, as the works would include the removal of approximately 0.311 ha of suitable foraging habitat for the species. The works are not expected to have a notable impact on the species regarding breeding, fragmentation, or dispersal. Considering the above assessment, the Proposal is not likely to have a 'significant impact' on the Dusky Woodswallow or Varied Sitella. Consequently, a SIS or a BDAR is not required.	

Table E-1.3 Microchopteran bats (micro-bats)

Name of threatened species	Microchopteran bats (micro-bats)
	▪ Eastern Coastal Free-tailed Bat (*Micronomus norfolkensis*) (Vulnerable) ▪ Little Bent-winged Bat (Miniopterus australis) (Vulnerable) ▪ Large Bent-winged Bat (Miniopterus orianae oceanensis) (Vulnerable) ▪ Southern Myotis (*Myotis macropus*) (Vulnerable) ▪ Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventri*) (Vulnerable) ▪ Greater Broad-nosed Bat (*Scoteanax rueppellii*) (Vulnerable)

Five threatened microbat species have been identified as moderately or highly likely to occur on site. All the species are listed as Vulnerable under the BC Act, they are:

- Eastern Coastal Free-tailed Bat (*Micronomus norfolkensis*) (Vulnerable)
- Little Bent-winged Bat (Miniopterus australis) (Vulnerable)
- Large Bent-winged Bat (Miniopterus orianae oceanensis) (Vulnerable)
- Southern Myotis (*Myotis macropus*) (Vulnerable)
- Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventri*) (Vulnerable)
- Greater Broad-nosed Bat (*Scoteanax rueppellii*) (Vulnerable)

As such, a 5-part test has been prepared. The following is to be taken into account to determine whether the Proposal is likely to significantly impact these species.

Ecology

Eastern Coastal Free-tailed Bat

Eastern Coastal Free-tailed Bat occurs in dry sclerophyll forest, woodland, swamp forests and mangrove forests east of the Great Dividing Range. The species roost mainly in tree hollows but will also roost under bark or in man-made structures. It is usually solitary but also recorded roosting communally and is probably insectivorous (OEH 2024a).

Little Bent-winged Bat

The Little Bent-winged Bat prefers moist eucalypt forest, rainforest, vine thickets, wet and dry sclerophyll forest, Melaleuca swamps, dense coastal forests, and banksia scrub. They are generally found in well-timbered areas. They roost by day in caves, tunnels, tree hollows, abandoned mines, stormwater drains, culverts, bridges and sometimes buildings. The Little Bent-winged Bat forages at night for small insects beneath the canopy of densely vegetated habitats. Only five nursery sites/maternity colonies are known in Australia (OEH 2020a).

Large Bent-winged Bat

The Large Bent-winged Bat roosts in caves but also uses man-made structures. They breed in spring and summer and form discrete populations centred in large maternity caves. Maternity caves have very specific temperature and humidity regimes. At other times of the year, populations disperse within about 300 km range of maternity caves. They forage in forested areas, catching flying insects above the canopy (OEH 2019b).

Southern Myotis

The Southern Myotis is found in wide band across southern NSW. It generally roosts in groups of 10-15 individuals, close to water in caves, mine shafts, hollow-bearing trees, storm water channels, buildings, under bridges and in dense foliage. Forage over streams and pools catching insects and small fish by raking their feet across the water surface. In NSW, females have one young each year usually in November or December (OEH 2020b).

Yellow-bellied Sheathtail-bat

The Yellow-bellied Sheathtail-bat is a wide-ranging species found across northern and eastern Australia. These bats will roost singly or in groups of up to six, in tree hollows and buildings; in treeless areas they are known to utilise mammal burrows. When foraging for insects, they fly high and fast over the forest canopy, but lower in more open

Name of threatened species	Microchopteran bats (micro-bats) ▪ Eastern Coastal Free-tailed Bat (*Micronomus norfolkensis*) (Vulnerable) ▪ Little Bent-winged Bat (Miniopterus australis) (Vulnerable) ▪ Large Bent-winged Bat (Miniopterus orianae oceanensis) (Vulnerable) ▪ Southern Myotis (*Myotis macropus*) (Vulnerable) ▪ Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventri*) (Vulnerable) ▪ Greater Broad-nosed Bat (*Scoteanax rueppellii*) (Vulnerable)

country. They forage in most habitats across its very wide range, with and without trees; and appear to defend an aerial territory. Breeding has been recorded from December to mid-March, when a single young is born. (OEH, 2022).

Greater Broad-nosed Bat

The Greater Broad-nosed Bat is found mainly in the gullies and river systems that drain the Great Dividing Range, from north-eastern Victoria to the Atherton Tablelands. It utilises a variety of habitats from woodland through to moist and dry eucalypt forest and rainforest, though it is most commonly found in tall wet forest. The species usually roosts in tree hollows but has also been found in buildings. It forages after sunset, flying slowly and directly along creek and river corridors at an altitude of 3-6 m. It inhabits open woodland habitat and dry open forest suits the direct flight of this species as it searches for beetles and other large, slow-flying insects; this species has been known to eat other bat species (OEH 2024b). Little is known of its reproductive cycle, however a single young is born in January; prior to birth, females congregate at maternity sites located in suitable trees, where they appear to exclude males during the birth and raising of the single young (OEH 2024b).

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

There are likely viable populations of these five micro-bat species in the locality as there are recent records and there is suitable habitat nearby within the South Creek riparian corridor that is connected to the study area, and nearby Kemps Creek Nature Reserve.

The study areas provide suitable foraging habitat for the species and a flyway across the area, particularly along riparian corridors. Limited suitable roosting habitat is present in tree hollows, and no suitable breeding habitat is present for cave breeding species.

Works would require the removal of up to 0.311 ha of potentially suitable foraging habitat. Nevertheless, these impacts are minor and there is considerable habitat in adjacent areas. As such, the works are unlikely to impact the life cycle of micro-bats such that the local viable population is likely to be placed at risk of extinction.

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

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.

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

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

Name of threatened species	**Microchopteran bats (micro-bats)** ▪ Eastern Coastal Free-tailed Bat (*Micronomus norfolkensis*) (Vulnerable) ▪ Little Bent-winged Bat (Miniopterus australis) (Vulnerable) ▪ Large Bent-winged Bat (Miniopterus orianae oceanensis) (Vulnerable) ▪ Southern Myotis (*Myotis macropus*) (Vulnerable) ▪ Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventri*) (Vulnerable) ▪ Greater Broad-nosed Bat (*Scoteanax rueppellii*) (Vulnerable)
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 works would require the temporary removal of about 0.311 ha of foraging habitat for the species, however would not result in an impact to HBTs. Due to the mobility of the species, the works would not increase fragmentation. No night works or operational impacts are expected, as such indirect impacts of noise and light spill are considered negligible. Considering the extent of suitable habitat along the connected South Creek corridor and considerable suitable habitat in nearby Kemps Creek Nature Reserve, the impacted vegetation is not considered highly important habitat. Considering the above explanation, the Proposal is unlikely to impact the long-term survival of the species.	
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 Proposal is not located in any declared AOBV.	
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	
The BC Act defines a KTP as a process that 'adversely affects threatened species or ecological communities' or 'could cause species or ecological communities that are not threatened to become threatened' (s 4.32). Schedule 4 of the BC Act provides a list of KTPs. The Proposal would result in the removal of potential foraging habitat, which is listed as a KTP for these micro-bat species. However, given existing disturbance of the study area and edge effects already experienced across habitats at the site, these habitats are likely not preferred, with high quality habitat nearby. As such, the Proposal would not contribute to the KTPs for the species.	
Conclusion	
The Proposal would have negligible impact on microbat species in the locality. Whilst the Proposal would result in the removal of up to 0.311 ha of suitable foraging habitat, the study areas are bordered by disturbed, exotic vegetation and subject to edge effects with additional suitable habitat across the locality. Considering the above assessment, the Proposal is not likely to have a 'significant impact' on micro-bats. Consequently, a SIS or a BDAR is not required.	

Table E-1.4 Cumberland Plain Land Snail (*Meridolum corneovirens*)

Name of threatened species	Cumberland Plain Land Snail (*Meridolum corneovirens*) (Endangered)
The Cumberland Plain Land Snail has been identified as highly likely to occur on site and is listed as Endangered under the BC Act. As such, a 5-part test has been prepared. The following is to be taken into account to determine whether the Proposal is likely to significantly impact the species. **Ecology** Cumberland Plain Land Snail Lives in small areas on the Cumberland Plain west of Sydney, from Richmond and Windsor south to Picton and from Liverpool west to the Hawkesbury and Nepean Rivers at the base of the Blue Mountains. Primarily inhabits Cumberland Plain Woodland (a critically endangered ecological community). This community is a grassy, open woodland with occasional dense patches of shrubs. It is also known from Shale Gravel Transition Forests, Castlereagh Swamp Woodlands and the margins of River-flat Eucalypt Forest, which are also listed communities (OEH 2019a). Lives under litter of bark, leaves and logs, or shelters in loose soil around grass clumps. Occasionally shelters under rubbish. Can dig several centimetres into soil to escape drought (OEH 2019a).	
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	
There is possibly a viable population of the species in the locality as there are recent nearby records and there is considerable suitable habitat within the surrounding area, particularly within areas of eucalypt forest. However, native vegetation within the study areas is located on the boundary of disturbed exotic grasslands, with high degree of weed incursion to native vegetation patches. Nevertheless, the portions of native vegetation across the study area are considered suitable habitat. The Proposal would remove up to 0.311 ha of suitable habitat for the species (PCT 4025). However, due to the localised habitat disturbance, the low density of individuals, and considerable surrounding habitat, it is unlikely that the works would impact any individuals, even less likely during breeding activities. As identification of the species is difficulted for all personnel, all snails observed on site must be assumed to be the Cumberland Plain Land Snail and relocated from the impact area. Due to the proposed short timeframe and isolated nature of the works, the Proposal is unlikely to affect the life cycle of the species such that the local viable population is likely to be placed at risk of extinction.	
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 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.	
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 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	

Name of threatened species	Cumberland Plain Land Snail (*Meridolum corneovirens*) (Endangered)
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 Proposal includes the clearing of up to 0.311 ha of native vegetation comprising suitable foraging, sheltering, breeding habitat for the species. However, vegetation within the study areas is subject to edge effects, with high abundance of exotic species in the mid- and ground stories. Additional suitable habitat extends along the South Creek corridor and likely comprises preferred habitat in improved condition. The clearing is restricted to the edge of existing native vegetation corridor, and is not expected to fragment vegetation or restrict movement of the species during construction. Considering the small extent of impacts and the of low importance of vegetation within the study area, with preferred habitat is present nearby, the Proposal is unlikely to impact the long-term survival of the species 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 Proposal is not located in any declared AOBV.	
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	
The BC Act defines a KTP as a process that 'adversely affects threatened species or ecological communities' or 'could cause species or ecological communities that are not threatened to become threatened' (s 4.32). Schedule 4 of the BC Act provides a list of KTPs. KTPs relevant to the Cumberland Plain Land Snail includes the removal of native vegetation and bush rock or fallen timber, incursion of weeds and inappropriate fire regimes. The Proposal would require the clearing of up to 0.311 ha of native vegetation which comprises habitat for the species. The Proposal would not result in the removal of bush rock, or likely lead to increased weed prevalence in the patch, given previous establishment of weeds within the study areas. Although it would contribute to a KTP for the species, due to the small scale of the Proposal, edge effects and surrounding disturbance it is not considered significant.	
Conclusion	
The Proposal would have negligible impact on the Cumberland Plain Land Snail. The Proposal is not likely to impact the life cycle or dispersal of the species. The species was not observed during the targeted surveys completed during the field surveys, and implementation of management measures would be observed to minimise potential impacts to individuals if found. Considering the above assessment, the Proposal is not likely to have a 'significant impact' on the Cumberland Plain Land Snail. Consequently, a SIS or a BDAR is not required.	

Table E-1.5 Green and Golden Bell Frog

Name of threatened species	Green and Golden Bell Frog (***Litoria aurea***) (Endangered)
While the Green and Golden Bell Frog has been identified as unlikely to occur on site, it is listed as Endangered under the BC Act. As such, a 5-part test has been prepared. The following is to be taken into account to determine whether the Proposal is likely to significantly impact the species. **Ecology** Green and Golden Bell Frog	

Name of threatened species	Green and Golden Bell Frog (***Litoria aurea***) **(Endangered)**

Since 1990 there have been approximately 50 recorded locations in NSW, most of which are small, coastal, or near coastal populations. These locations occur over the species' former range, however they are widely separated and isolated. Large populations in NSW are located around the metropolitan areas of Sydney, Shoalhaven and mid north coast (one an island population).

The species inhabits marshes, dams and stream-sides, particularly those containing bullrushes (*Typha* spp.) or spikerushes (*Eleocharis* spp.). The species is active by day and usually breeds in summer when conditions are warm and wet.

Some sites, particularly in the Greater Sydney region occur in highly disturbed areas.

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

There is possibly a viable population of the species in the locality as there are recent nearby records and there is considerable suitable habitat within the surrounding area, particularly within areas of eucalypt forest.

All current populations of green and golden bell frog are regarded as important populations. A current population is defined as a site where one or more green and golden bell frogs have been detected on at least one occasion since 1995, even if they have not recently been discovered at the site (due to the species tendency towards local extinction and recolonisation cycles).

The Proposal would remove up to 0.060 ha of suitable habitat for the species (PCT 4025). However, due to the localised habitat disturbance and considerable surrounding habitat, it is unlikely that the works would impact any individuals, even less likely during breeding activities, which are seasonally dependent.

Due to the proposed short timeframe and isolated nature of the works, the Proposal is unlikely to affect the life cycle of the species such that the local viable population is likely to be placed at risk of extinction.

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

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.

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

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

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 exotic areas of the site are apparently suitable for the Green and Golden Bell Frog with bullrushes identified surrounding the dam. Up to 0.060 ha of habitat adjacent to that dam would be removed. Most of the dam habitat would not be directly affected, and any Green and Golden Bell Frogs that may be present can be expected to use the remaining area of the dam or the swamp forest during construction. It is not considered likely for isolation to occur and

Name of threatened species	Green and Golden Bell Frog **(*Litoria aurea*) (Endangered)**
the small portion of habitat that would be cleared would not alter the overall composition of the habitat with proper mitigation measures (i.e., 10 m buffer around dam, weed controls, erosion controls).	
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)	
No.	
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	
There is a chance that activities associated with the project may introduce Chytrid fungus into the habitat. Pathogen control measures will be implemented to ensure that Chytrid fungus is not introduced or spread.	
Conclusion	
The Proposal would have negligible impact on the Green and Golden Bell Frog. The Proposal is not likely to impact the life cycle or dispersal of the species. No targeted surveys have been undertaken for the species but potential habitat was assessed during field surveys. With the implementation of management measures to minimise potential impacts to individuals if present, the Proposal is not likely to have a 'significant impact' on the Green and Golden Bell Frog. Consequently, a BDAR is not required.	

Appendix E – Aboriginal Cultural Heritage Assessment Report

Aboriginal heritage information must not be made publicly available or be published in any form or by any means by Sydney Water or our contractors / joint ventures, unless written approval has been provided to Sydney Water from DPE's AHIMS Registrar .

For publicly displayed REFs, all Aboriginal heritage information that identifies individual sites must be removed.

THOMPSONS CREEK WASTEWATER NETWORK STAGE 1

Aboriginal Cultural Heritage Assessment

Prepared for Sydney Water

Liverpool Local Government Area

August 2025

Ref. 2324

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Executive Summary

Sydney Water proposes to construct and operate the Thompsons Creek and South Creek Project in order to cater for predicted growth in demand for wastewater servicing associated with the Western Sydney Aerotropolis Growth Area and the South West Growth Centre. The project is located within the Liverpool and Penrith local government areas. Sydney Water engaged Kelleher Nightingale Consulting Pty Ltd (KNC) to prepare an Aboriginal cultural heritage assessment report (CHAR) for the Thompsons Creek Wastewater Network Project Stage 1 study area. This CHAR was prepared to support an Aboriginal Heritage Impact Permit (AHIP) application. It has been prepared in accordance with the Heritage NSW *Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW* (OEH 2011).

Aboriginal archaeological assessment identified six Aboriginal archaeological sites within the study area. Archaeological and cultural significance of the identified Aboriginal sites is defined by the information they exhibit. The archaeological sites located within the study area were assessed as displaying low and moderate archaeological significance. A total of three Aboriginal archaeological sites within the study area display low archaeological value and significance. Deposits associated with these sites are located within disturbed environmental contexts, having been subject to ongoing land use disturbance and natural erosional processes. These sites are unlikely to retain intact and substantial subsurface archaeological deposit.

A total of two Aboriginal sites within the study area display moderate archaeological significance based on their scientific value and potential to inform on the Aboriginal landscape use of the South Creek catchment. The significance of harm to the sites is moderate, given the sites' overall moderate archaeological significance/potential. Their archaeological value is linked to the information that they contain. Recovery of this information through archaeological salvage excavation of these sites would mitigate the impact of the project and offer an opportunity to better understand the distribution of Aboriginal archaeological materials in these locations.

Impact assessment confirmed that six Aboriginal archaeological sites are located within the impact area for the project. Salvage excavation will be undertaken at sites of moderate archaeological significance within the study area. No Archaeological salvage mitigation is warranted for low significance sites located within the study area.

A land based AHIP should be obtained under section 90 of the *National Parks and Wildlife Act 1974* for the study area. The AHIP should include Aboriginal objects associated with sites:

Martin Road South Creek AFT 1	45-5-6015	Direct / Partial	Low
Western Road AFT 1	45-5-5930	Direct / Total	Moderate
Rossmore Grange	45-5-5842	Direct / Partial	Low
Rossmore Grange AFT 1	45-5-5933	Direct / Partial	Moderate
Medich Place AFT 1	45-5-5931	Direct / Total	Low
Medich Place AFT 2	45-5-5932	Direct / Total	Low

The non-impacted portion of sites Martin Road South Creek AFT 1, Rossmore Grange and Rossmore Grange AFT 1 should be demarcated with protective fencing during construction works and listed in the CEMP. These areas should be identified as "no-go zones" on the CEMP maps and workers inducted as to appropriate protection measures.

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1 Introduction

1.1 Project background

Sydney Water plans to build a section of the Thompsons Creek and South Creek Catchments Wastewater Network (the 'project') to meet growing demand for servicing in the South West Growth Area (SWGA) and Western Sydney Aerotropolis Growth Area (WSAGA). The project is located within the Liverpool and Penrith local government areas (LGAs).

The wider project area is located approximately 55 kilometres to the west of the Sydney CBD, spanning the suburbs of Kemps Creek, Badgerys Creek, Bradfield and Rossmore (Figure 1). Project works would include the following main components:

- new wastewater pumping stations (SP1228 (interim), SP1241 & SP1243), including new access roads and DN500 overflow pipes
- Approximately 5.5 kilometres of pressure mains (including temporary and permanent pressure mains)
- Approximately nine kilometres of gravity pipeline (comprising three gravity carriers)
- vent shafts, maintenance holes, scour pits and air valves at various locations along the alignment

Construction will include a combination of trenched and trenchless methods, including horizontal directional drilling (HDD), microtunneling, and horizontal auger boring (HAB) across the alignment and at pump station locations.

The northern half of the broader Thompsons Creek and South Creek Catchment Wastewater Network Project comprised the South Creek Wastewater Network Project Stage 1 corridor which has previously been subject to Aboriginal cultural heritage assessment. AHIP #5409 was granted for South Creek Wastewater Network Project Stage 1 corridor on 14 May 2025 for a duration of five years (see Figure 1).

The 'study area' for this assessment comprises the Thompsons Creek Wastewater Network Project Stage 1 corridor (which consists of the southern half of the broader Thompsons Creek and South Creek Catchments Wastewater Network Project) (Figure 2). The location of the study area in relation to the broader project area is shown on Figure 1.

Sydney Water engaged Kelleher Nightingale Consulting Pty Ltd (KNC) to prepare an Aboriginal cultural heritage assessment report (CHAR) for the Thompsons Creek Wastewater Network Project Stage 1 study area. This CHAR was prepared to support an Aboriginal Heritage Impact Permit (AHIP) application. It has been prepared in accordance with the Heritage NSW *Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW* (OEH 2011).

1.2 Statutory controls and development context

The project is for water infrastructure to be carried out by Sydney Water and will be assessed under Part 5 of the *Environmental Planning and Assessment Act 1979*.

1.3 National Parks and Wildlife Act 1974

The *National Parks and Wildlife Act 1974* (NPW Act) is the primary statutory control dealing with Aboriginal heritage in New South Wales. Items of Aboriginal heritage (Aboriginal objects) or Aboriginal places (declared under section 84) are protected and regulated under the NPW Act.

Under the Act, an "Aboriginal object" is defined as "any deposit, object or material evidence (not being a handicraft made for sale) relating to the Aboriginal habitation of the area that comprises New South Wales, being habitation before or concurrent with (or both) the occupation of that area by persons of non-Aboriginal extraction and includes Aboriginal remains". As such, Aboriginal objects are confined to physical evidence and are commonly referred to as Aboriginal sites. Aboriginal objects are protected under section 86 of the Act. It is an offence to harm or desecrate an Aboriginal object, either knowingly [section 86 (1)] or unknowingly [section 86 (2)].

There are offences and penalties relating to harm to, or desecration of, an Aboriginal object or declared Aboriginal place. Harm includes to destroy, deface, damage or move. Penalties are tiered according to offences, which include:

- a person must not harm or desecrate an Aboriginal object that the person knows is an Aboriginal object
- a person must not harm an Aboriginal object (strict liability offence)
- a person must not harm or desecrate an Aboriginal place (strict liability offence)
- failure to notify Office of Environment and Heritage of the location of an Aboriginal object (existing offence and penalty)

- contravention of any condition of an AHIP.

Under section 87 (1) it is a defence against prosecution if "(a) the harm or desecration concerned was authorised by an Aboriginal heritage impact permit and (b) the conditions to which that Aboriginal heritage impact permit was subject were not contravened".

Section 87 (2) of the Act provides a defence if "the defendant exercised due diligence to determine whether the act or omission constituting the alleged offence would harm an Aboriginal object and reasonably determined that no Aboriginal object would be harmed".

Section 89A of the Act relates to the notification of sites of Aboriginal objects, under which it is an offence if the location of an Aboriginal object is not notified to the Director-General in the prescribed manner within a reasonable time.

Under section 90 (1) of the Act "the Director-General may issue an Aboriginal heritage impact permit". The regulation of Aboriginal heritage impact permits is provided in Part 6 Division 2 of the Act, including regulations relating to consultation (section 90N).

An AHIP is required for an activity which will harm an Aboriginal object.

1.4 Objectives of the CHAR

The proposed works will impact on some Aboriginal objects (archaeological sites). Approval obtained under the *National Parks and Wildlife Act 1974* is required for these Aboriginal objects prior to any impact or harm. The proponent is applying for an AHIP under section 90A of the Act.

Clause 61 of the *National Parks and Wildlife Regulation 2019* requires that an application for an AHIP is accompanied by a CHAR. The CHAR is to provide information on:

- the significance of the Aboriginal places that are the subject of the application
- the actual or likely harm to those Aboriginal objects or Aboriginal places from the proposed activity that is the subject of the application
- any practical measures that may be taken to protect and conserve those Aboriginal objects or Aboriginal places
- any practical measures that may be taken to avoid or mitigate any actual or likely harm to those Aboriginal objects or Aboriginal places.

The *Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW* (Heritage NSW 2011) provides further guidance on the preparation of a CHAR. This report has been prepared in accordance with the requirements of the Regulation and the guide.

This CHAR has been prepared to accompany an application for an AHIP for Aboriginal objects impacted by the project located outside of existing approval/AHIP areas, including those associated with the following Aboriginal sites: Martin Road South Creek AFT 1, Western Road AFT 1, Rossmore Grange, Rossmore Grange AFT 1, Medich Place AFT 1 and Medich Place AFT 2.

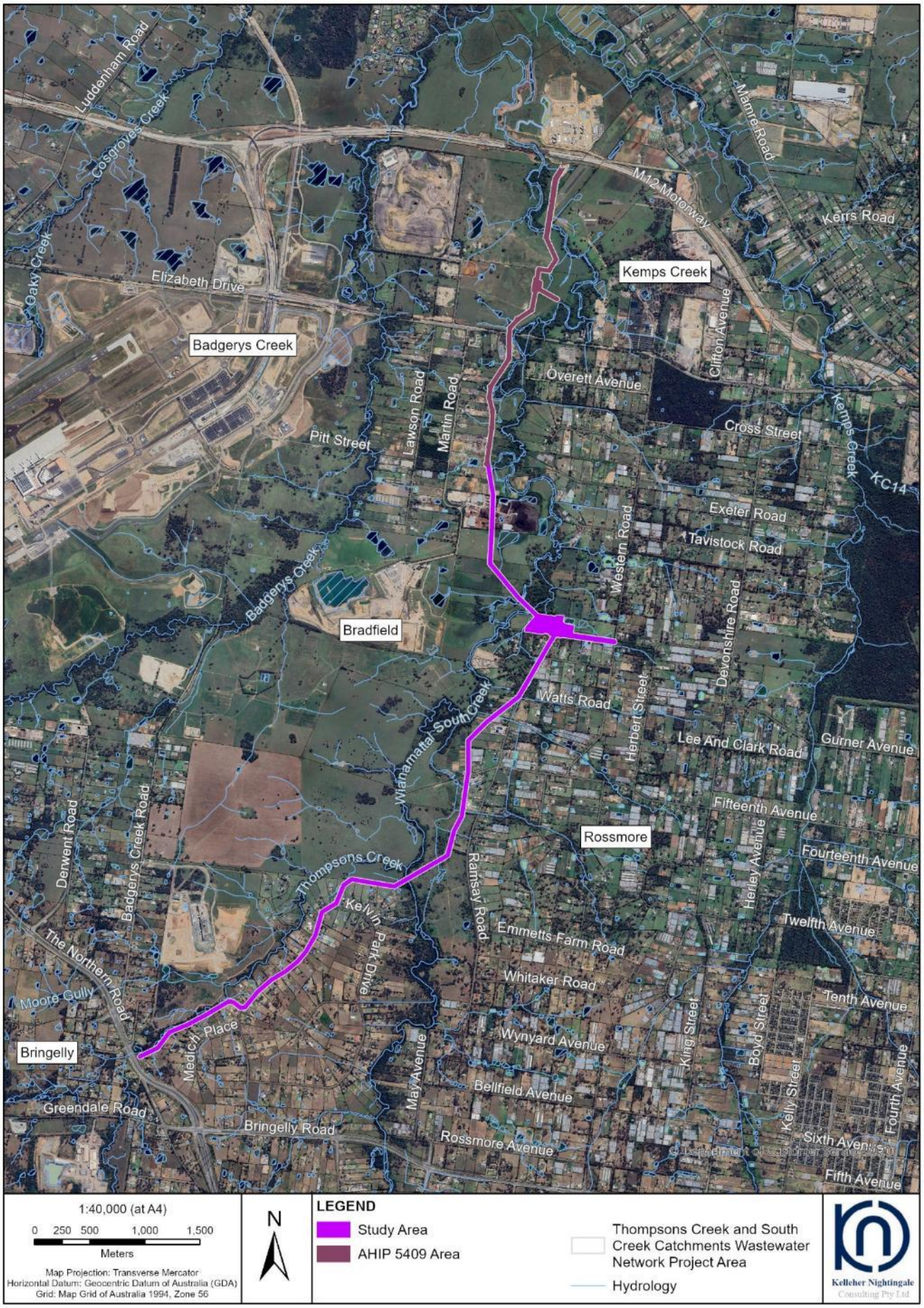

Figure 1. Overview of study area and broader project area



Figure 2. Location of the study area

2 Landscape Context

The study area is located on the Cumberland Plain, a gently undulating and generally low-lying physiographic region of the Sydney Basin. The Sydney Basin is a large geological feature that stretches from Batemans Bay to Newcastle and west to Lithgow. The formation of the basin began between 300 to 250 million years ago when river deltas gradually replaced the ocean that had extended as far west as Lithgow. The oldest, Permian layers of the Sydney Basin consist of marine, alluvial and deltaic deposits that include shales and mudstone overlain by coal measures. The near surface geology of the Cumberland Plain consists of sedimentary rocks of the Wianamatta Group and Hawkesbury Sandstone, both deposited during the Triassic.

Topography of the study area is generally defined by the terrace, flat and open depression landforms of the South Creek valley and floodplain (Figure 3). South Creek and Thompsons Creek are prominent hydrological features in the local landscape and are likely to have provided reliable sources of fresh water. Hydrology of the region has been highly altered since British colonisation with the construction of online dams and various drainage works. Concrete culverts are common around road crossings and the natural flow and flood regime has been altered.

The underlying geology of the study area consists of Bringelly Shale on the elevated landforms and Quaternary Alluvium within the low lying areas adjacent to South Creek and Thompsons Creek (Figure 4). Bringelly Shale is composed of shale, carbonaceous claystone, claystone, laminate, fine to medium-grained lithic sandstone, rare coal and tuff (Clark and Jones 1991) and is the dominant geology of much of the Cumberland Plain. Quaternary Alluvium was deposited in association with fluvial activity during the Pleistocene and Holocene epochs. The alluvial deposits consist of medium-grained sand, silt and clay.

The formation of soil landscapes within the study area has been influenced by topography and underlying geology (Bannerman, Hazleton and Tille 1990). The majority of the study area comprises the South Creek soil landscape which is characterised by deep to very deep alluvial sediments, loams and clays present across low lying areas adjacent to the watercourses within the study area (Figure 4). South Creek soils are located within a dynamic landscape of active floodplains and are subject to repeated episodes of erosion and deposition. Aboriginal land use and the associated discarding of stone artefacts are likely to have occurred in areas of South Creek soils due to their proximity to water sources; however, the dynamic nature of these areas is likely to have had a variable impact on the preservation of Aboriginal sites. Integrity of archaeological deposit in these areas is strongly dependent on topography and flooding. Sites within low lying areas adjacent to the creek lines are likely to be highly disturbed low-density scatters exposed by erosion and/or redeposited by flooding events, while Aboriginal sites within (micro topographic) landforms elevated above the extent of flooding events are more likely to retain intact archaeological deposits.

A portion of the study area comprises the residual Blacktown soil landscape which is developed in situ on the gentle crests and slopes from underlying Bringelly Shale geology, (Figure 4). The Blacktown soil landscape consists of shallow to moderately deep hard-setting red, brown and yellow podzolic soils. It is subject to minor erosion where surface vegetation is not maintained. The soil landscape is often close to water sources and associated resources, without being within flooding areas. Areas within proximity to permanent water sources are more likely to contain high-density Aboriginal sites because these areas would have provided a relatively stable environment throughout the year for resource gathering.

The study area and its surroundings have been largely cleared of native vegetation. A study by the NSW National Parks and Wildlife Service (NPWS) in 2002 identified scattered scatted remnant Cumberland Plain Woodland (Shale Plains Woodland) on the gentle crest and slope and River-Flat Eucalypt Forest (Alluvial Woodland) adjacent to major drainage lines. Remnant native vegetation demonstrates that the area contained a diverse range of native flora which was likely to have provided past Aboriginal people with a range of raw materials and food sources.

Land use in the study area has predominantly been rural/semi-rural and includes market gardens, small farm allotments and rural residential. Expected disturbances from these land uses include those from clearing, tillage of soils, cultivation, grazing and sheet erosion. Other key uses include road and power infrastructure, residential and industrial development including quarrying. Large infrastructure developments including the WSA and M12 Motorway are also currently under construction. The more severe ground disturbances within roads, tracks, infrastructure and dam construction have modified the land and limited archaeological potential/sensitivity within these areas. Natural disturbance factors include erosion and soil movement, particularly in higher gradient areas where clearance of original vegetation accelerates erosion, gully and stream bank erosion (incision) along the waterways, and the effects of flooding and alluvial processes along the creeks.

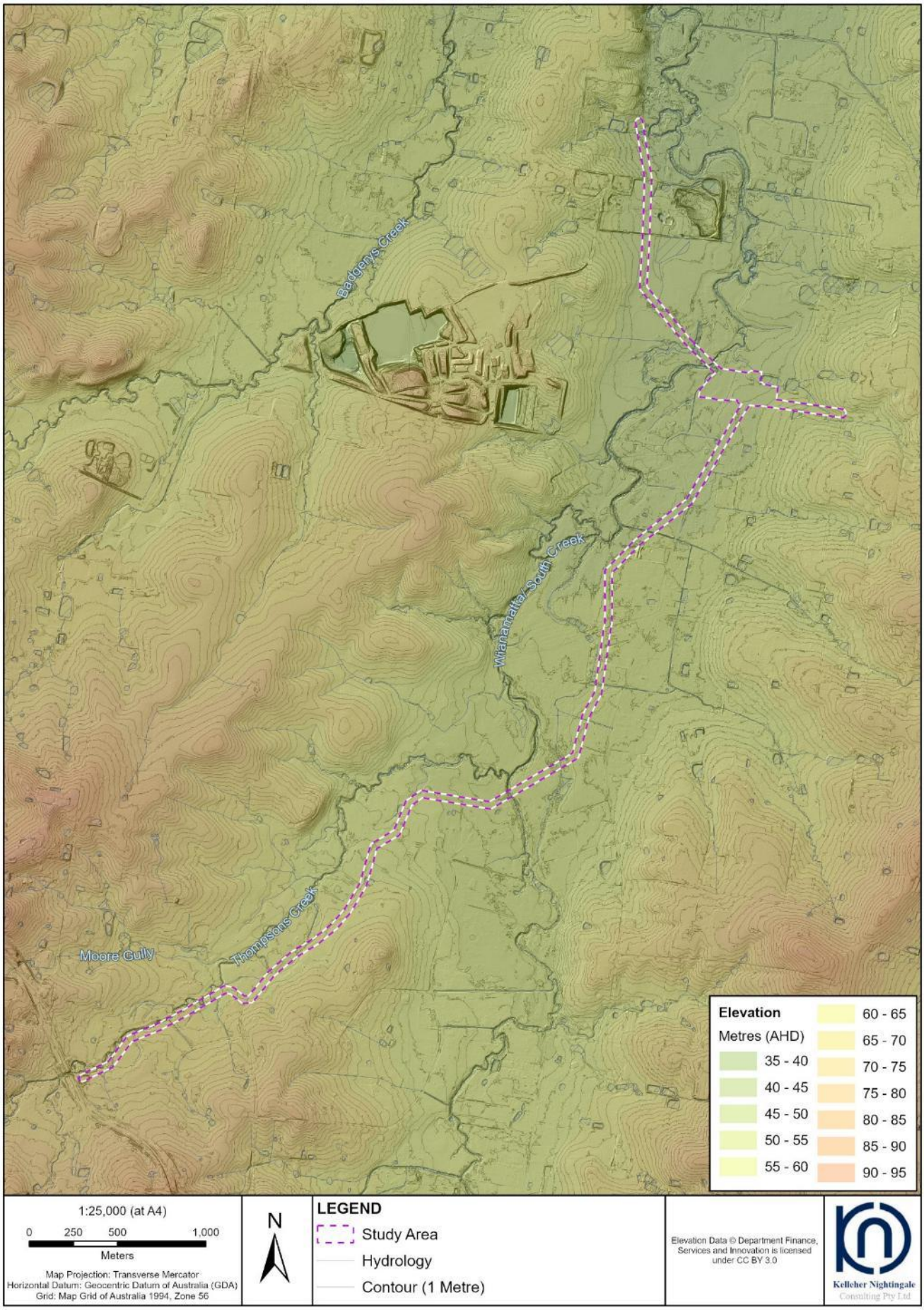

Figure 3. Topography of the study area

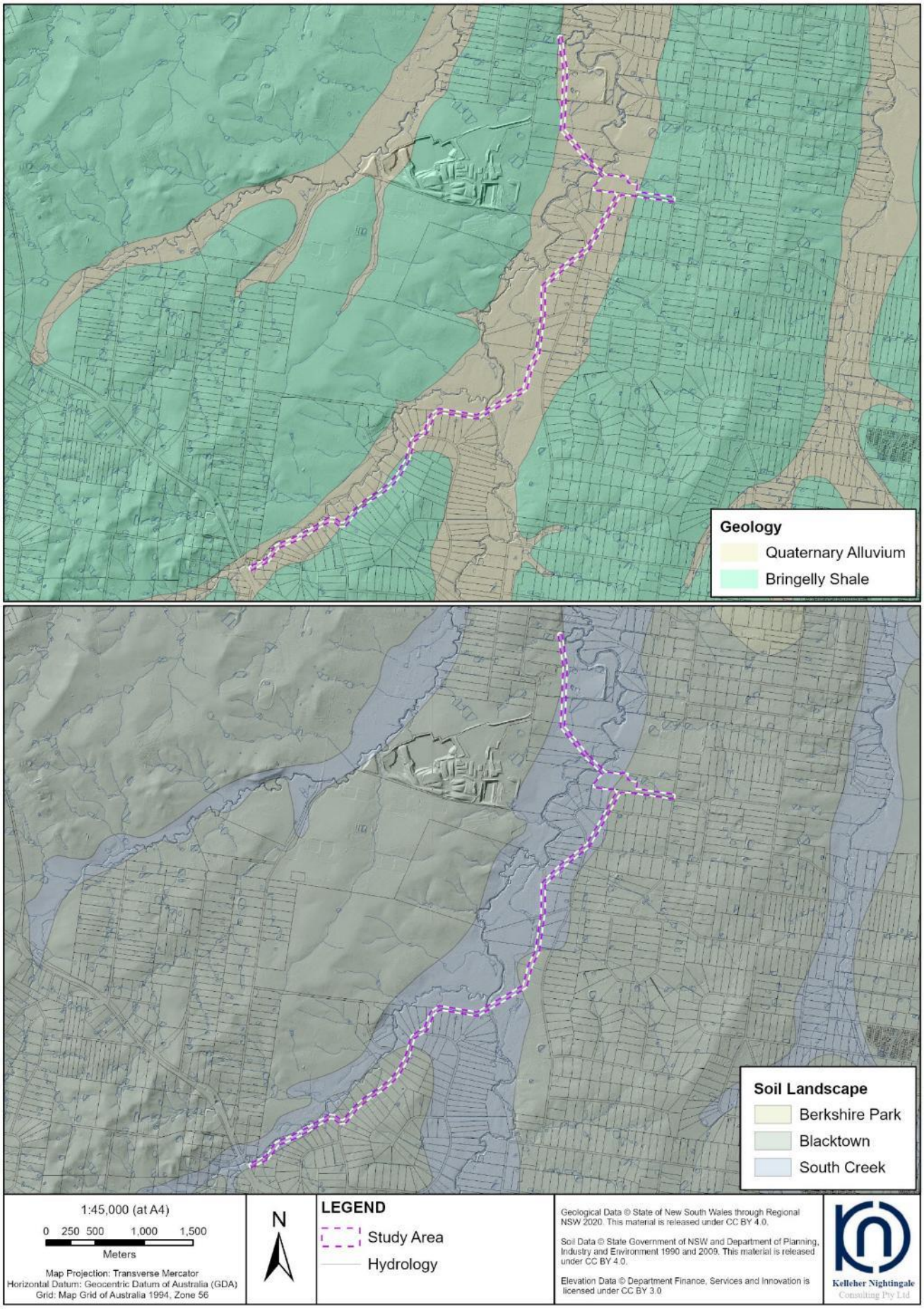

Figure 4. Geology of the study area

3 Ethnohistoric Context

Historical descriptions of the social organisation, culture and practices of Aboriginal people living in the Sydney region at the time of European invasion is fragmentary due to the generalised nature of early British accounts which provide vague and at times contradictory information. It should be noted that the early British accounts are observations of Aboriginal people living in the Sydney region during the late 18th and 19th centuries and should not be used to infer the cultural practices of Aboriginal people living in the preceding millennia which are highly unlikely to have been static.

Although the specific study area is not recorded directly in any ethnographical accounts, it lies in a landscape which was important to and intensively used by Aboriginal people in the past (cf. Attenbrow 2002). The arrival of the British caused major social and economic upheaval for the Aboriginal people living on the Cumberland Plain. Contact with Europeans introduced diseases, such as smallpox, that drastically altered the size and structure of the Aboriginal population, whilst the expansion of settlements and establishment of farmland subsumed the traditional areas used to meet subsistence needs (Attenbrow 2002).

After their arrival in Sydney Cove in 1788, the British set about exploring the surrounding area. In the first three years of settlement many areas of the region were explored including Broken Bay, Botany Bay, Rose Hill (Parramatta), Prospect Hill and overland to the Nepean, Hawkesbury and Georges Rivers. During these explorations some of the British Officers, including Governor Phillip and Captain Watkin Tench, made a number of written observations regarding the local Aboriginal people that they met and travelled with (Attenbrow 2002:13).

Early historical observations described the Cumberland Plain as a mosaic of Aboriginal groups associated with particular areas of land. These groups were described as 'tribes' in many historical observations, when in fact they were more likely small territorial clans or local clans consisting of extended family groups, forming larger land-using bands linked through marriage and communal participation in subsistence gathering activities (Attenbrow 2002:22, Brook and Kohen 1991:2). The British noted a difference between the dialects of the Aboriginal people along the coast compared with those further inland on the Cumberland Plain. Captain Tench observed when two Aboriginal men from the coast conversed with an Aboriginal man further inland "they conversed on a par and understood each other perfectly, yet they spoke different dialects of the same language; many of the most common and necessary words used in life bearing no similitude, and others being slightly different" (Tench 1793:122).

The Georges River/Appin/Camden area has been used an arbitrary boundary between the Darug, Dharawal and Gundungurra language groups (Attenbrow 2002:34). The Darug language was divided between coastal and hinterland dialects and spread from Port Jackson west to the Cumberland Plain, the Gundungurra language was predominantly associated with the hinterland and spread from the southern Cumberland Plain across the southern Blue Mountains and the Dharawal language was largely associated with coastal groups and spread from Botany Bay south to the Shoalhaven River and west to the Georges River area (Attenbrow 2002:34). In the early 20th Century, anthropologist/linguist R H Matthews noted that 'The Dharuk speaking people adjoined the Thurrawal on the north, extending along the coast to the Hawkesbury River, and inland to what are now Windsor, Penrith, Campbelltown, and intervening towns' (Matthews 1901:155 in Attenbrow 2002:32), suggesting that Aboriginal people using the study area would primarily have been from Darug-speaking groups however it is likely that people from all three language groups were familiar with the area and travelled through it on their rounds of Country.

As well as differences in dialect, the British also observed differences in subsistence activities between different groups. Kohen (1986:77) explains that the Aboriginal people who lived in the hinterland of the Cumberland Plain were not as dependant on fish and shellfish as groups closer to the coast, instead relying on small animals and plant foods in addition to seasonally available freshwater mullet and eels. Berries, Banksia flowers and wild honey were also recorded as foods of the local inhabitants (Collins 1798). The major protein component of the diet on the Cumberland Plain was achieved through the hunting of small animals. Along the rivers and larger creeks, bandicoots and wallabies were caught in traps and snares, while birds were snared using decoys (Tench 1793). The open woodland of the Cumberland Plain would have played host to possums and gliders and these likely formed a major component of the diet. These were hunted in a number of ways, including smoking out the animal by lighting a fire in the base of a hollow tree, burning large tracts of land and gathering the stranded animals, as well as cutting toe-holds in trees and climbing up to reach them (Kohen 1993:10; Tench 1793:82).

European settlement in the region began with several land grants in the early nineteenth century. The increasing settlement of the area by the British colonists led to conflict during the drought of 1814 – 1816, by which time many traditional Aboriginal resource-gathering areas had been engulfed by farmland and pasture. A spate of retaliatory killings between Aboriginal groups and settlers across Sydney eventuated in the dispatch of a punitive expedition to capture or kill those Aboriginal people involved in the skirmishes (Brook and Kohen 1991:23). Many officials, including Governor Macquarie, often recognised that these conflicts were initiated by the settlers, but with the colony on a tentative footing, especially during periods of drought, he was more inclined to protect the interests of the farmers.

Not all interactions with settlers were hostile, however; friendly contact was maintained between the Dharawal and a number of land owners, most notably the Macarthurs, who documented corroborees taking place on their property and marked out a portion of land for Aboriginal people who wished to settle there under the family's protection (Liston 1988:24). Corroborees and other sizable gatherings were also documented at other large properties and holdings in the area.

No direct ethnographic recordings relate to the specific study area; however, it is clear that the variety of resources available in and around the South Creek and Thompsons Creek catchment areas would have made it attractive and it is known that past Aboriginal people and families occupied the area. The value of the study area and its surrounds to both the past and the present Aboriginal community is underscored by the ongoing cultural connection expressed by the contemporary Aboriginal community.

4 Archaeological Context

A multitude of archaeological studies have been undertaken within and around the study area. Previous archaeological investigations have generally been carried out as part of proposed infrastructure and precinct development projects related to the ongoing urbanisation and development of western Sydney. A comprehensive background review of previous archaeological investigations was undertaken as part of the *Thompsons Creek and South Creek Project- Aboriginal Archaeological Assessment* (KNC 2024a, see Section 4).

4.1 Thompsons Creek and South Creek Project- Aboriginal Archaeological Assessment (KNC 2024a)

Aboriginal archaeological assessment of the study area was undertaken during the preliminary design stage for the broader Thompsons Creek and South Creek Catchments Wastewater Network project (KNC 2024). This assessment included archaeological field survey and an archaeological test excavation program as well as a desktop review of previous archaeological investigations and the environmental context of the project area. The results of the Aboriginal archaeological assessment were consistent with the known archaeological record for the locality and the wider region.

Background research identified several previously recorded extant Aboriginal archaeological sites within the project area, including South Creek West T1 (SCW T1) (AHIMS 45-5-5307), South Creek West T2 (SCW T2) (AHIMS 45-5-5308), South Creek (AHIMS 45-5-0215), South Creek Exeter House TRE 1 (AHIMS 45-5-5878), Elizabeth Precinct Isolated Find 06 (EP IF 06) (AHIMS 45-5-5659), Elizabeth Drive AFT 1 (includes Elizabeth Precinct PAD 03) (AHIMS 45-5-5259 (includes AHIMS 45-5-5234), 30-40 Martin Road Artefact Scatter 01 (AHIMS 45-5-5663), 50 Martin Rd PAD (AHIMS 45-5-5623), BCBW18 AS 02 (AHIMS 45-5-5164) and Rossmore Grange (AHIMS 45-5-5842).

Several previous archaeological investigations had been undertaken in the region, with the majority of previously recorded sites within the vicinity of the project area consisting of areas of archaeological potential, isolated finds and low and moderate density surface and subsurface artefact scatters. Higher density artefact scatters were located within close proximity to watercourses including Kemps Creek, Badgerys Creek and South Creek. The results of previous assessments demonstrated the focused use of South Creek, its tributaries and its resources for Aboriginal occupation. However, due to landscape modification and disturbance within the project area, it was determined that there was a low likelihood of intact archaeological deposit remaining within the majority of the project area.

4.1.1 Archaeological Survey

Archaeological survey of the project area was undertaken in May/July 2023 and February 2024 by Aboriginal stakeholders and KNC archaeologists. The investigation included two alternative alignment options for the current project, one following the road corridor of Ramsay Road, and one further to the west, between Ramsay Road and South Creek (the current alignment). The aim of the survey was to conduct a full coverage, pedestrian survey of the project area and to establish a detailed appreciation of archaeologically sensitive landforms to assist in identifying the full spatial extent of identified archaeological sites. Assessment of archaeological potential was based on topographic location and visible disturbance. Areas of exposed ground (such as eroded surfaces) were closely inspected for artefacts, or evidence of intact soils, while any mature or old growth trees were inspected for evidence of Aboriginal cultural modification.

Ground surface visibility was generally poor across the surveyed area, however areas of greater visibility were identified where erosion resulting from market gardening, animal grazing and drainage or ground surface modification had removed vegetation or restricted its growth. The survey found that the majority of the project area displayed little to no potential for intact subsurface archaeology due to high levels of ground surface disturbance and modification and through impacts from natural processes such as erosion and flooding.

The assessment confirmed the locations of the nine Aboriginal sites (comprising 10 AHIMS registrations) previously recorded within the project area corridor. Survey assessment found that site 50 Martin Rd PAD (AHIMS 45-5-5623) did not extend into the project area corridor. Archaeological survey identified five newly recorded Aboriginal archaeological features (artefacts scatter and PAD areas) within the project area corridor. These included: Elizabeth Drive South Creek PAD 1, Western Road PAD 1, Rossmore Grange AFT 1, Medich Place PAD 1 and Medich Place PAD 2. Newly identified sites comprised one low density surface artefact scatter with potential for subsurface deposit and four areas of PAD. PAD areas displayed moderate archaeological potential and were identified in areas displaying low levels of visible disturbance, in proximity to watercourses and in areas elevated above the active floodplain.

The low density surface artefact scatter (Rossmore Grange AFT 1) was recorded within close proximity to previously recorded surface artefact scatter, RSG2 identified by Extent Heritage in May 2024 (within the wider extent of Rossmore Grange PAD, AHIMS 45-5-5842). The survey confirmed that portions of the Rossmore Grange PAD area within the project area alignment exhibited low archaeological potential. A small portion of the PAD exhibited moderate archaeological potential, these areas were consistent with the identified location of Rossmore Grange AFT 1.

4.1.2 Aboriginal archaeological test excavation

Following the findings of the survey, it was determined that further investigation of the identified sites and areas of archaeological potential identified within the proposed works corridor would be required to supplement information regarding past Aboriginal land use within the project area. An archaeological test excavation program was undertaken within the project corridor in June 2024. Aboriginal stakeholders for the project participated in the test excavation program.

Test areas were chosen to collect information about the nature and extent of subsurface archaeological deposit, based on a sample derived from subsurface investigations and to build on information already obtained through previous assessment. Test excavation was undertaken at seven identified test areas (Test Area 1, Test Area 2, Test Area 3, Test Area 4, Test Area 5, Test Area 6 and Test Area 7) with a total of 112 test squares excavated during the program (Figures 5-11). Excavation took place across a range of landforms throughout the project area corridor, including microtopographic rises on the floodplain, low, medium-high and high terraces, spurs and a spur slope.

Results established the presence of subsurface archaeological deposits associated with Aboriginal archaeological sites South Creek West T1 (SCW T1), Elizabeth Drive AFT 1 (includes Elizabeth Precinct PAD 03), 30-40 Martin Road Artefact Scatter 01, Western Road AFT 1, Rossmore Grange AFT 1, Medich Place AFT 1 and Medich Place AFT 2. Several of these sites contained previously recorded surface artefacts, with test excavation undertaken to confirm the nature and extent of subsurface components of these sites. A results summary is provided in Table 1 below.

Table 1 Summary of Test Excavation Results (sites included in AHIP #5409 highlighted in purple)

Test Area	Landform	TS number	Total sample	Artefact Count	Mean artefact density/m^2	Site Name
1	Low, medium-high and high terraces, spur	TS 1 - TS 47	47 (11.75m^2)	307	26.1	South Creek West T1 (SCW T1) *and* Elizabeth Drive AFT 1 (includes Elizabeth Precinct PAD 03)
2	Slope	TS 48 - TS 52	5 (1.25m^2)	0	N/A	N/A
3	Spur	TS 53 – TS 59	7 (1.75m^2)	1	0.8	30-40 Martin Road Artefact Scatter 01
4	Low rise	TS 75 - TS 92	18 (4.5m^2)	58	12.9	Western Road AFT 1 (formerly Western Road PAD 1)
5	Low rise, terrace	TS 93 - TS 112	20 (5m^2)	161	32.2	Rossmore Grange AFT 1
6	Low rise	TS 60 - TS 63 TS 68 - TS 74	11 (2.75m^2)	5	1.8	Medich Place AFT 1 (formerly Medich Place PAD 1)
7	Low rise, terrace	TS 64 - TS 67	4 (1m^2)	3	0.8	Medich Place AFT 2 (formerly Medich Place PAD 2)
Total			**112 (28m^2)**	**535**	**19.1**	

In general, results supported the existing understanding of the archaeological landscape within this part of the Cumberland Plain, namely that more intensive, focused and/or repeated Aboriginal occupation took place on landforms associated with the larger creek corridors. The majority of the project area traverses the terraces and flats associated with the South Creek and Thompson Creek watercourses. Moderate frequencies of cores and cortical artefacts recovered from terraces adjacent to South Creek indicated that primary reduction processes were taking place, whilst a significant number of modified artefacts and tools suggested production and utilisation. Results of the archaeological testing program supported a site prediction model where complex sites would be located on higher elevated areas adjacent to South Creek, while areas adjacent to lower order creeklines and landforms on lower elevations would tend to be low density scatters which do not exhibit the complexity of sites within closer proximity to major creek lines or had been negatively affected by ongoing erosional and fluvial processes.

A variety of raw materials were present across the assemblage, with the greatest varieties corresponding to higher density deposits (Test Area 1 and Test Area 5). Silcrete dominated the assemblage, accounting for 69% of artefact raw materials (n=369). This was followed by a relatively high proportion of indurated mudstone/tuff (22.6%, n=121) and quartz (4.9%, n=26). At Test Area 4, indurated mudstone (n=29) was present in greater numbers than silcrete (n=24).

Several raw materials occurred at individual test areas. Igneous (n=2) and medium grained siliceous (MGS) (n=1) raw materials (n=2) were restricted to Test Area 5, whilst petrified wood (n=4) was restricted to Test Area 1 and quartzite (n=1) was restricted to Test Area 6. The remaining raw materials, chert (n=4) and fine grained siliceous (FGS) (n=4), were split between Test Area 1 and Test Area 5.

The presence of cores, flakes, and broken flaked debitage within the test excavation assemblage indicated that activities across the project area included lithic reduction, predominantly secondary/tertiary. Cores (n=24) were mostly unifacial or multidirectional in form, with examples of unidirectional and bifacial cores present.

Six cores had been exhausted and were of equal quantities of indurated mudstone/tuff and silcrete. Half of the core assemblage retained between 1-30% of cortex. Modified artefacts included retouched artefacts (several with usewear), blades and blade fragments, and several point forms including one with retouch. Modified artefacts were recovered from four of the seven tested areas. Formal tool types comprised backed artefacts, including four bondi points and a geometric microlith. Two ground tool fragments were recovered from Test Area 5 and comprised one igneous ground tool/axe fragment and one MGS ground tool fragment. Overall, the recovered assemblages are typical of generalised Aboriginal land use during the Holocene.

The sites identified within the project area are a representative sample of the South Creek catchment's Aboriginal archaeological record and its current state of preservation: they range from relatively intact high density deposits to isolated objects in disturbed contexts representing lost or discarded cultural material from the general area, dispersed as 'background scatter' across the landscape.

The South Creek catchment would have contained numerous resources used by Aboriginal people, including varied flora and fauna across the differing vegetation communities, permanent fresh water and a variety of landform types suitable for different activities. The gently undulating country, abundant water sources and soils suitable for agriculture also made the area an early focus of European land use in the region. This has resulted in a long and cumulative history of land use disturbance from vegetation clearance, agricultural and pastoral practices, residential, commercial and industrial uses including quarrying, dam construction and drainage modifications, and road and services infrastructure.

Several tested areas displayed evidence of this anthropomorphic disturbance. Testing at Test Area 2 revealed a highly disturbed deposit comprising historic fill related to construction of the neighbouring residence, with no subsurface archaeological deposit identified. Excavation at Test Area 3 revealed evidence of cultivation disturbance and testing at this location recovered one isolated Aboriginal object. Anthropomorphic disturbance also tended to exacerbate natural processes of erosion and had altered the hydrological regime through drainage works or landscape modifications. This was particularly evident at Test Area 1 where neighbouring landuse activities (large scale levelling and filling operations across the horse stud property) had led to changes in run-off and surface water movement. The ground surface and underlying deposit within the northern portion of Test Area 1 showed signs of disturbance related to machinery movements, and areas of swampy inundated ground had developed due to an increase in water runoff from the neighbouring property.

Background research, review of previous investigations, archaeological survey and the test excavation program identified a confirmed total of 13 Aboriginal archaeological sites (comprising 14 AHIMS registrations) within the Thompsons Creek and South Creek Catchments Wastewater Network Project. The archaeological value and significance of these deposits varied depending on the extent of disturbance and the nature/complexity of the site and its contents. Scientific significance assessment was undertaken based on site integrity/intactness, rarity, representativeness and archaeological research potential. It was determined that two sites displayed high significance, two sites displayed moderate-high significance, four sites displayed moderate significance and five sites displayed low significance.

Impact assessment considered that 11 Aboriginal archaeological sites (comprising 12 AHIMS registrations) within the project area were likely to be impacted by construction of the project, resulting in a partial impact to seven sites (comprising eight AHIMS registrations) and a total impact to four sites. Impact assessment determined that two high significance sites would not be impacted by the project. It was recommended that future detailed design for the project should take the location of the identified sites into consideration and avoid impact where possible. If impact to the sites could not be avoided, it was recommended that additional assessment and an AHIP would be required prior to impacting the identified sites. The assessment would include a process of Aboriginal community consultation and the preparation of a CHAR, in accordance with the relevant Heritage NSW guidelines.

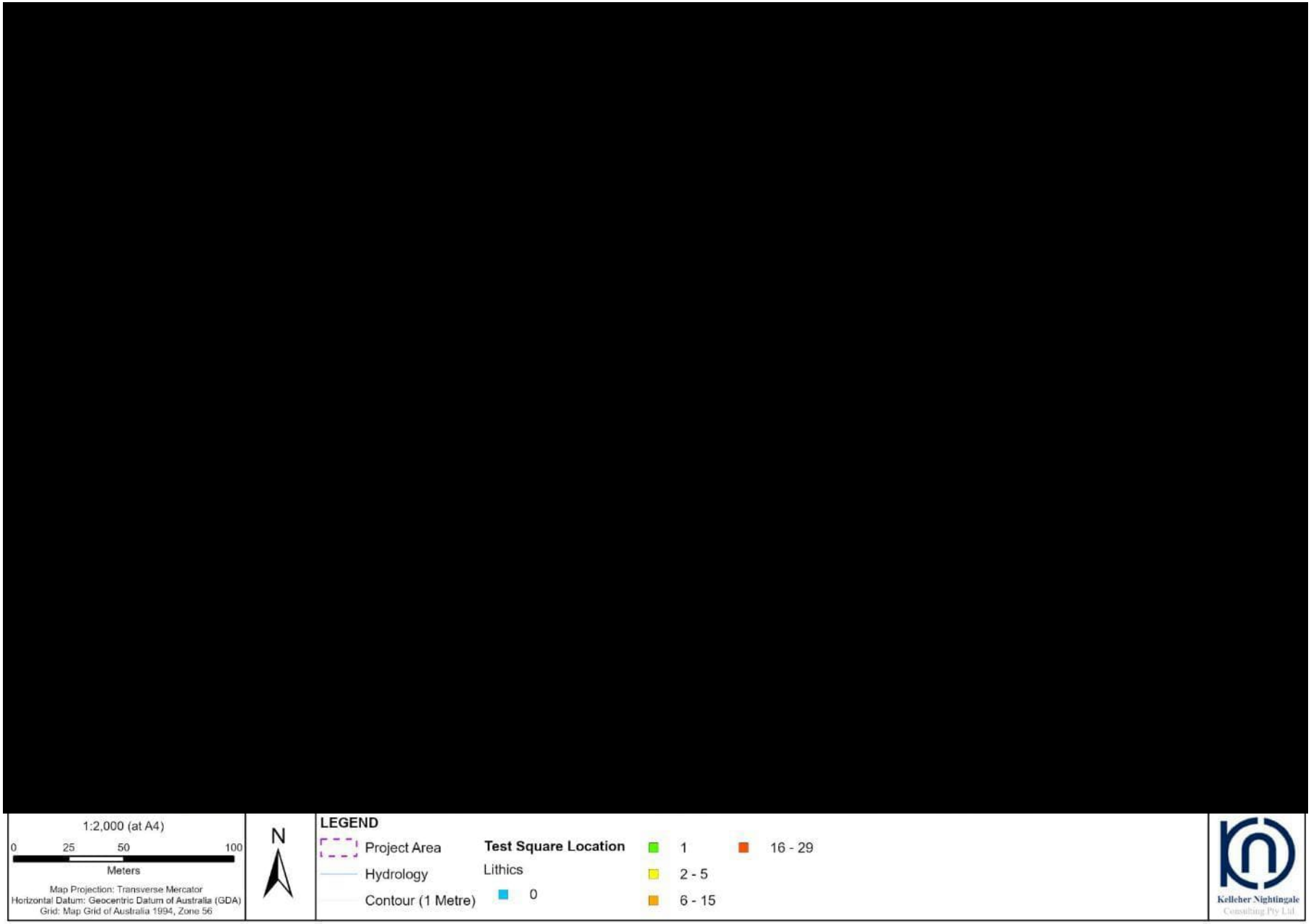

Figure 5. Test Area 1 – 2024 Test square locations and results. NB: Figure shows previous alignment.

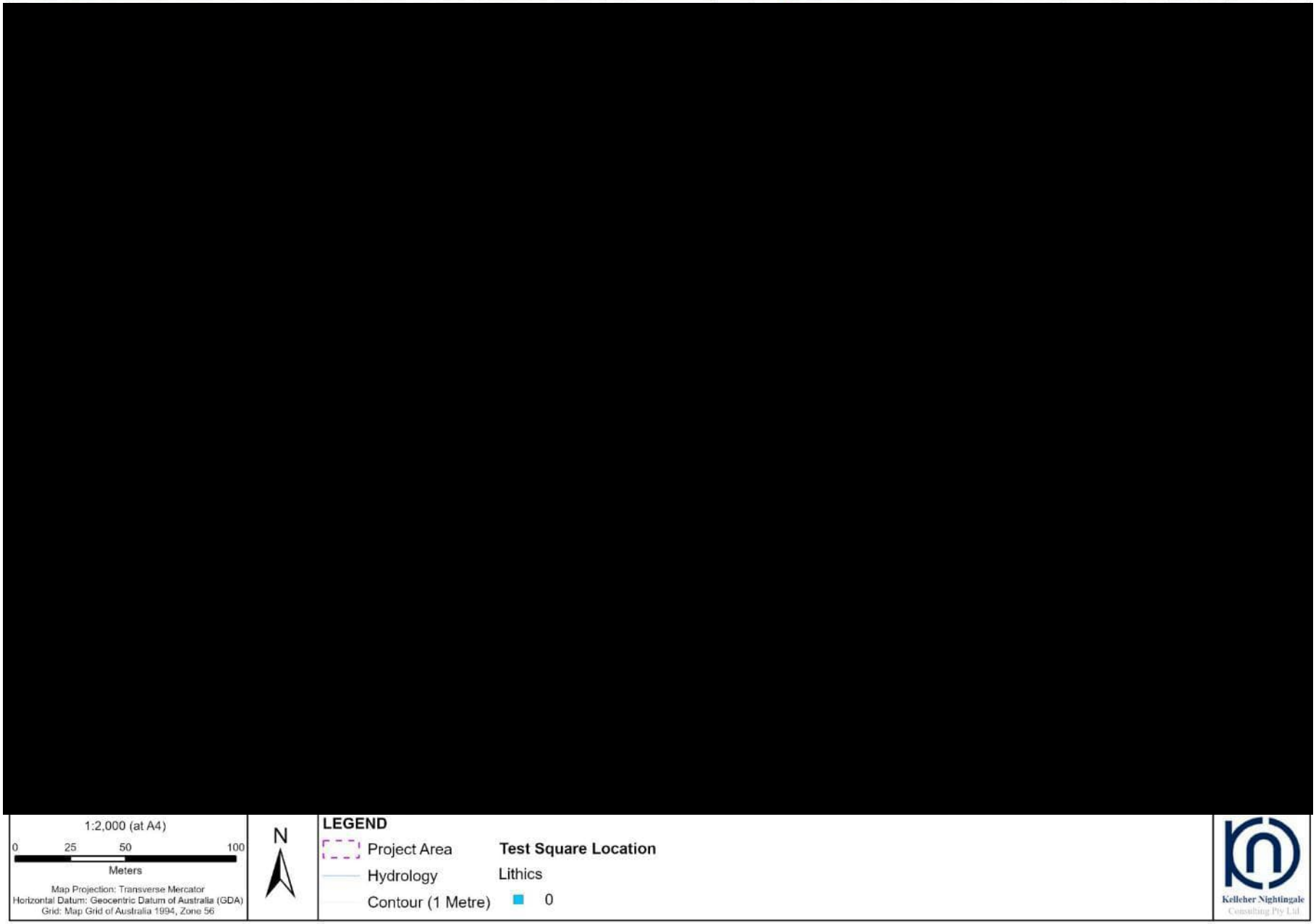

Figure 6. Test Area 2 – 2024 Test square locations and results. NB: Figure shows previous alignment.

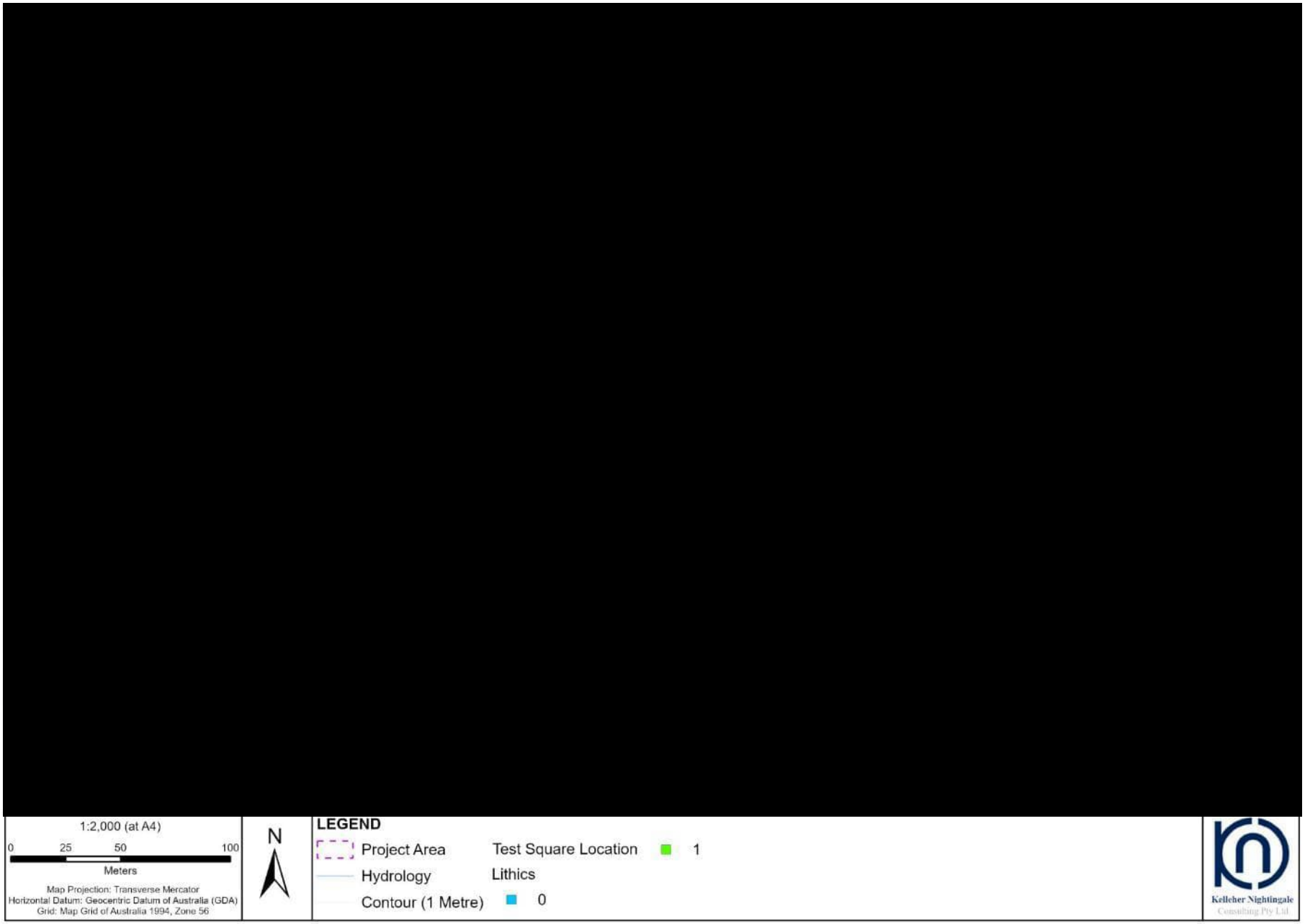

Figure 7. Test Area 3 – 2024 Test square locations and results. NB: Figure shows previous alignment.

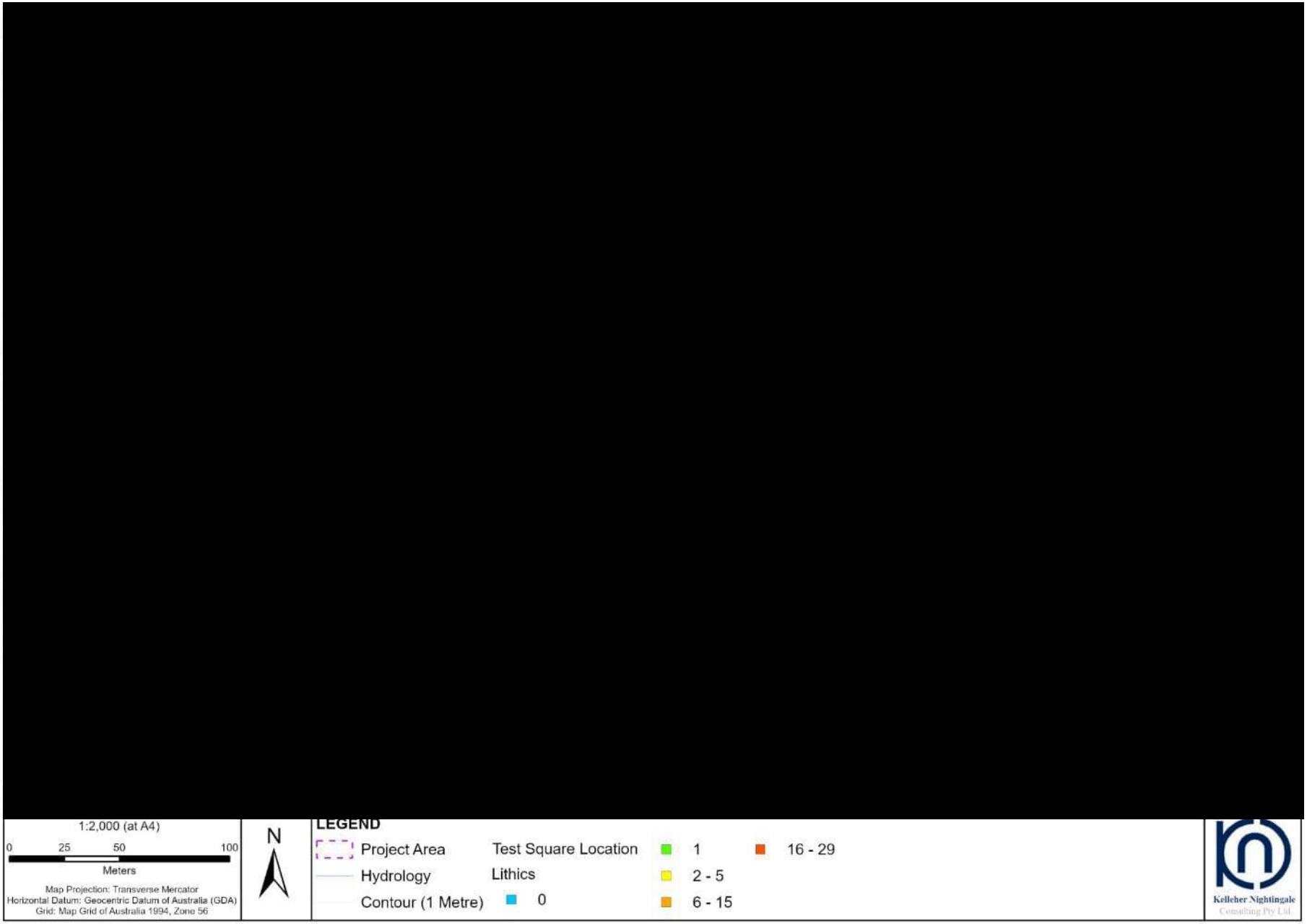

Figure 8. Test Area 4 – 2024 Test square locations and results. NB: Figure shows previous alignment.

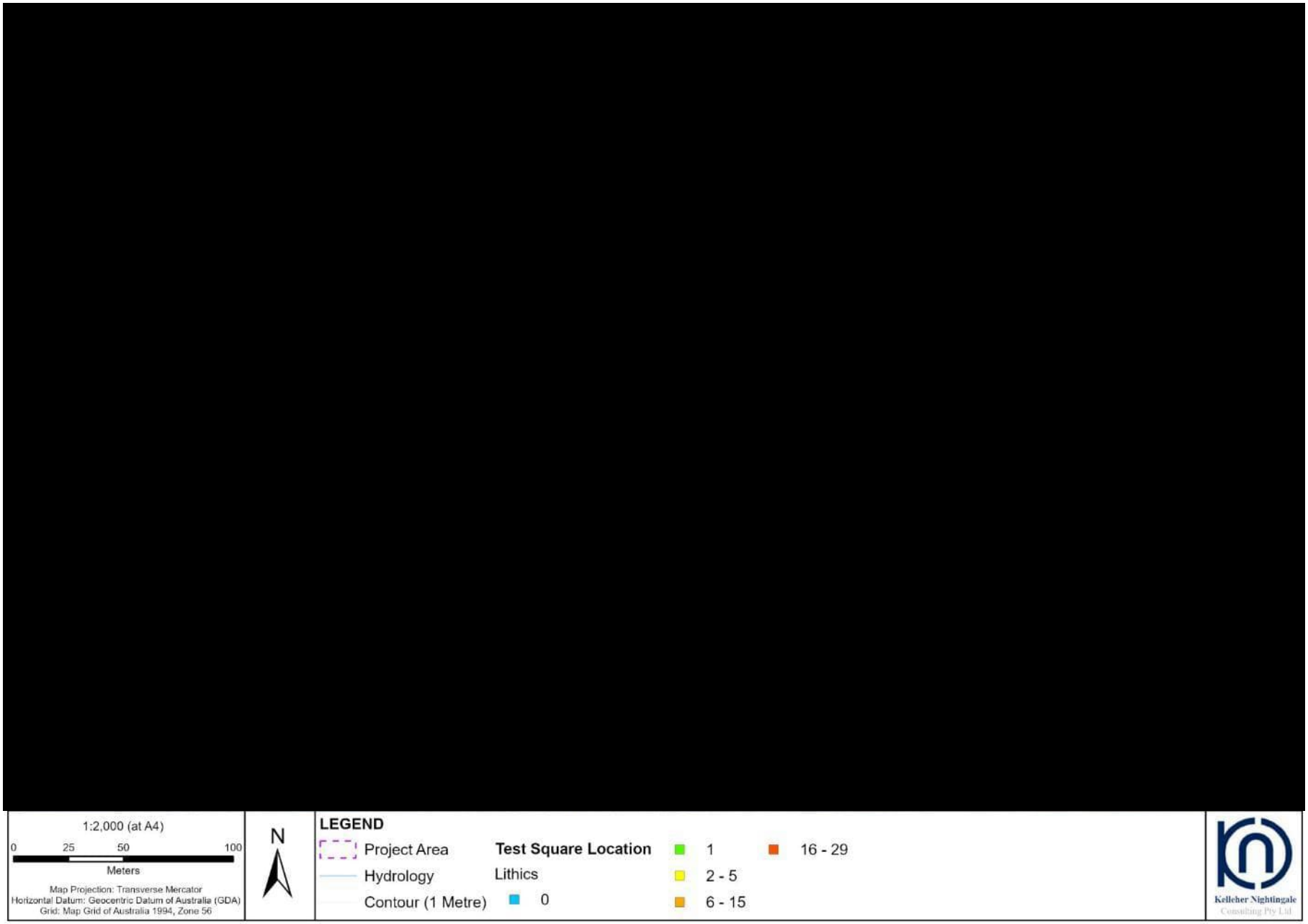

Figure 9. Test Area 5 – 2024 Test square locations and results. NB: Figure shows previous alignment.

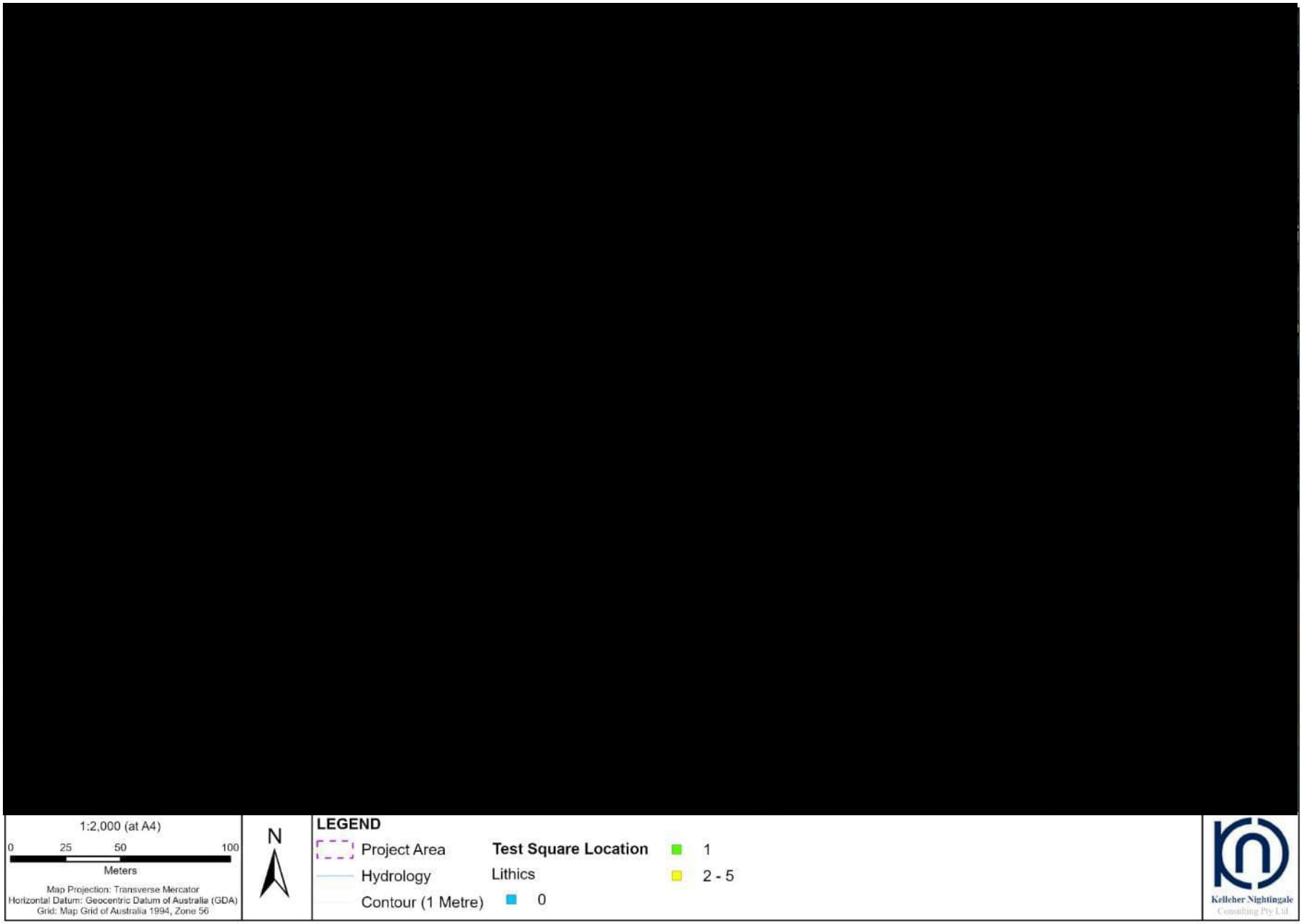

Figure 10. Test Area 6 – 2024 Test square locations and results. NB: Figure shows previous alignment.

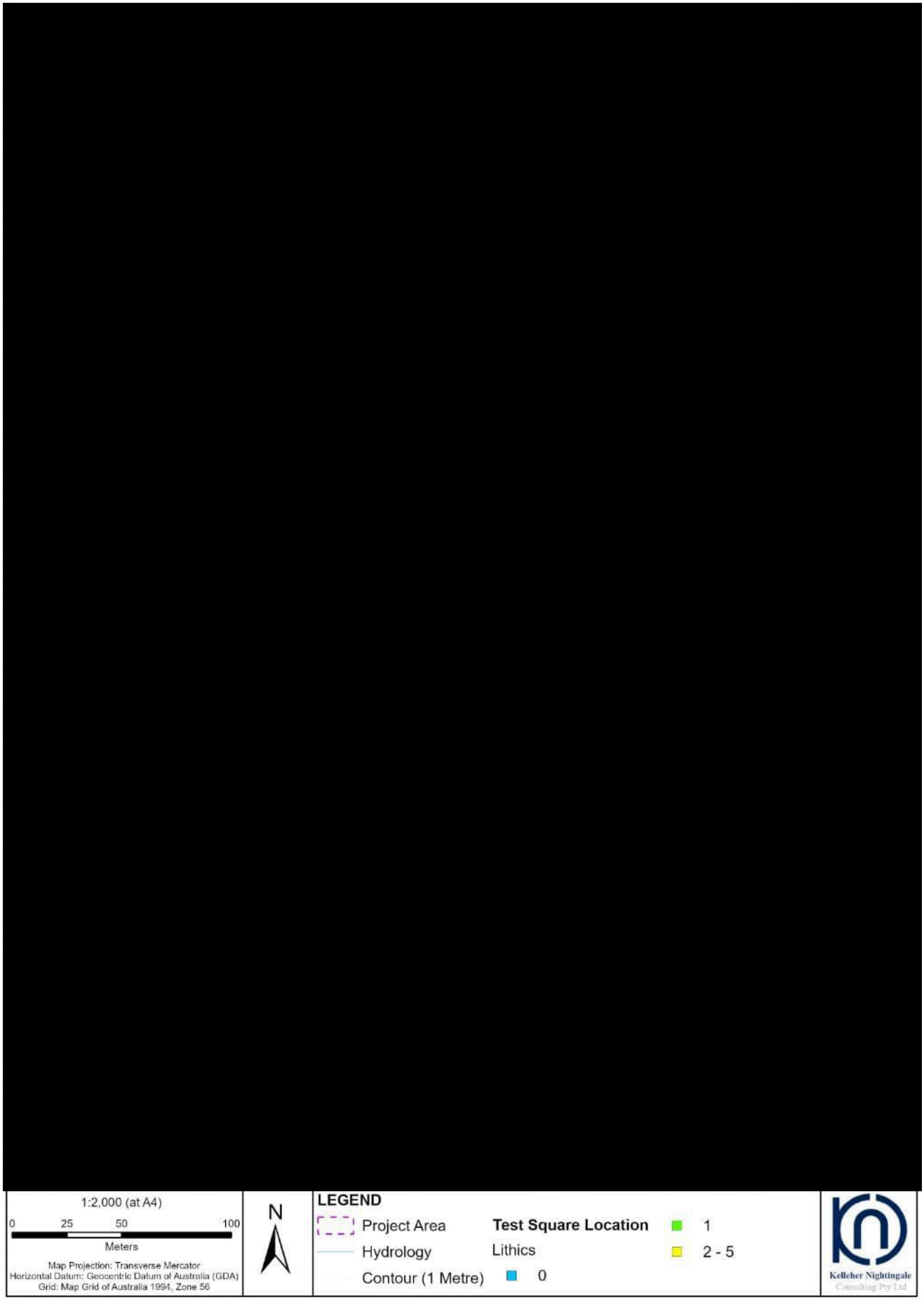

Figure 11. Test Area 7 – 2024 Test square locations and results. NB: Figure shows previous alignment.

4.2 Thompsons Creek and South Creek Project- Aboriginal Heritage Due Diligence (KNC 2024b)

Subsequent to completion of the Thompsons Creek and South Creek Catchments Wastewater Network: Aboriginal Archaeological Assessment Report, changes to the project resulted in an altered alignment within the northern portion of the project area to reduce impacts (within the current study area, located on eastern side of South Creek). An Aboriginal heritage due diligence was completed by KNC in November 2024 to inform the addendum Review of Environmental Factors (REF) and assess the potential impacts on Aboriginal heritage within the updated project alignment area (KNC 2024b). Desktop assessment and visual inspection confirmed that one previously registered site, South Creek West T1 (SCW T1) (AHIMS 45-5-5307) was located within the updated project alignment.

The inspection established that previously recorded Aboriginal archaeological site Fleurs 1, Fleurs Radio Telescope (includes South Creek East (SCE)) (AHIMS 45-5-0496, includes AHIMS 45-5-5306) did not extend into the updated project alignment. The majority of the assessment area was found to have been heavily modified as a result of historic agricultural land use practices and recent construction works associated with the AWRC project.

The assessment concluded that any project works undertaken within the site extent of South Creek West T1 (SCW T1) must be undertaken in accordance with any future AHIP conditions. Provided that this condition was met, the report recommended that there were no further archaeological constraints to the proposed works in the updated project alignment.

4.3 Thompsons Creek Wastewater Network Stage 1: Aboriginal Archaeological Assessment (KNC 2025)

Three locations were subject to additional Aboriginal archaeological assessment in May/June 2025 to assess changes in the alignment. The additional assessment included archaeological field survey and an archaeological test program at one newly identified PAD area (Martin Road South Creek PAD 1) identified as a result of the additional field survey. The results of the archaeological field survey and archaeological test program are outlined below.

4.3.1 Archaeological survey

Regional character, and site predictions, survey coverage analysis are present below.

Regional Character and Site Predictions
Previous archaeological investigations have provided data on site distribution, site typology and lithic raw material use that aid in assessing the archaeological character of the region. Site frequency and density can be related to key landscape factors including distance to water, landform, degree of slope, soil landscape and proximity to environmental resources.

Archaeological sites in the region generally occur as surface and subsurface artefact scatters and isolated artefacts. Relatively elevated landforms along the margins of creeks, especially those offering permanent water and associated environmental resources such as South Creek would have been favourable for occupation by Aboriginal people. This is reflected in the archaeological record by higher artefact densities recorded along the major creeklines, potentially reflecting repeated or more intensive use of these locations. Lower density artefact scatters and isolated artefacts have been recorded across the local area. Elevated locations on hilltops and ridge crests tend to display a different archaeological signature, chiefly a sparser artefact distribution and less evidence for ‘everyday’ or utilitarian activities, suggesting that these areas were often used differently.

The study area is located within a landscape with varying levels of natural and human disturbance. Activities associated with agricultural land use practices as well as fluvial process associated with the landscape context have led to the disturbance of surface and subsurface deposits. Within these contexts, Aboriginal objects are unlikely to survive in situ and the archaeological potential of such sites is generally low. Conversely, ground surface visibility is often increased by these processes, leading to increased identification of surface artefacts in these areas.

Based on information from previous archaeological investigations, landscape context and regional character, site predictions for the study area include the following:

- Archaeological sites are likely to consist of low density artefact scatters and/or isolated artefacts.
- It can be expected that silcrete and indurated mudstone / tuff will be the most commonly encountered artefact raw materials, with occasional occurrences of quartz, chert and petrified wood.
- Clearance of the majority of original vegetation lessens the likelihood of identifying culturally modified trees, but old growth trees may be present in the study area and have the potential to display scars of Aboriginal origin.
- The identification of archaeological sites is likely to be affected by differential visibility of the ground surface, but successful assessment of areas of potential archaeological deposit can be made based on landform and other environmental factors such as disturbance, degree of slope, distance to the South Creek and on land located above flood affected areas.

Survey Coverage

The study area was inspected in three survey units by pedestrian survey in May 2025 by Mark Rawson (KNC) (Figure 12). Survey Unit 1 comprised the northern realignment area located on the western side and across the channel of South Creek, within Lots 56 & 55 DP3050 (between 245 & 255 Martin Road, Badgerys Creek). Landforms comprised the broad flat adjacent to the creek channel and the open depression associated with South Creek. The northern realignment area was located just north of a dammed former channel of South Creek. Due to recent heavy rains, this area had to be accessed on foot from a CSR compound upslope to the west. Ground surfaces between Martin Road and South Creek were extremely boggy due to seepage on the slope, and visibility at the time of survey was zero due to tall grasses. Portions of the northern realignment area had been previously cultivated and was utilised for cattle grazing. No Aboriginal objects or archaeological sites were identified within Survey Unit 1.

A small area of dry ground, located just north of the former South Creek channel was identified as an area of archaeological potential, based on its elevated position in the landscape and proximity to South Creek. The PAD area displayed moderate potential for subsurface archaeological deposit and was designated as Martin Road South Creek PAD 1.



Plate 1. View to southeast at Lot 55 DP3050. Location of maintenance hole. Looking along proposed alignment. This paddock had been previously ploughed and waterlogged from upslope seepage. Ground was cattle trodden and covered with exotic grass and sedges.



Plate 2. View to southeast at Lot 56 DP3050. Proposed maintenance hole location. Western side of South Creek, north of dammed former channel. This is slightly elevated dry ground, surrounded by an electric fence.

Survey Unit 2 comprised the central realignment area between Victor Road, Kemps Creek in the north and Wishart Road, Kemps Creek in the south. The entirety of Survey unit 2 comprised flat landform. Inspection of Survey Unit 2 commenced at Victor Road, via a driveway into a building formwork business, at the western edge of Lot 35 DP28050. Young native regrowth trees including Paperbarks, Cabbage Gums and Sheoaks were located along the central realignment area.

Ground surface visibility within Survey Unit 2 was very low and impeded by aquatic weeds and thick grasses. Most of the ground surface at the time of survey was waterlogged A proposed maintenance hole location was inspected in the south-west corner of Lot 35 DP28050. The proposed maintenance hole location was in a disturbed context which included clay fills and cut drainage channels. The inspection team then continued to Lot 36 DP28050. This lot comprised large areas of pooled water with access via a few patches of slightly raised dry ground. Within this block were Paperbarks and Cabbage and ground cover of Tradescantia, thick grasses, and aquatic weeds.



Plate 3. View to northeast at Lot 35 DP28050. This location was overgrown and lined with young native trees.



Plate 4. View to southwest. Proposed maintenance hole location at rear of Lot 35 DP28050. Waterfilled drainage ditch in foreground. This location was disturbed and boggy.

South of Watts Road, the central realignment area ran into Lot 10 DP28050, following a drainage line or modified tributary which was lined with young to medium growth native trees. A maintenance hole location was inspected in open ground south of the trees; this location had been disturbed by existing landuse practices. Several lots between Ramsay Road and Wishart Road were assessed; these areas were found to have been disturbed by ongoing agricultural landuse, including market gardening and residential landuse. No Aboriginal objects, archaeological sites or areas of archaeological potential were identified within Survey Unit 2.

Survey Unit 3 comprised the remaining southern realignment area located across Lot 2901 DP1282962 and Lots 708-710 DP788485. The survey unit comprised the flat landform located on the eastern side of the Thompsons Creek corridor. The survey unit was found to have been largely disturbed by ongoing landuse practices. Ground surface visibility was limited due to maintained lawns and some pasture grasses. No Aboriginal objects, archaeological sites or areas of archaeological potential were identified within Survey Unit 3.



Plate 5. View to southwest. Looking across rear yards of 54 and 52 Kelvin Park Drive. Ground in foreground is waterlogged from septic overflow.



Plate 6. View to northeast. New alignment route in the front yard of 50 Kelvin Park Drive.

Survey coverage analysis

Surface exposure across the overall study area was very low, with visibility on surface exposures generally low. Surface exposure was limited within the survey area and was dependant on vegetation density, and erosion resulting from natural degradation and disturbance. Areas of exposure were mostly present surrounding road verges and on small erosion scours. Details of survey and landform coverage are outlined in Table 2 and 3 below.

Table 2. Survey and landform coverage

Survey Unit	Landform	Area (m^2)	Exposure (%)	Visibility (%)	Effective Coverage (m^2)	Effective Coverage (%)
1	Open Depression (Major)	3,725	20	30	223.5	6
	Flat	20,285	10	30	608.5	3
2	Flat	32,935	10	10	329.35	1
3	Flat	15,615	10	30	468.45	3

Table 3. Landform coverage

Landform	Area (m^2)	Area Effectively Surveyed (m^2)	% of Landform Effectively Surveyed
Open Depression (Major)	3,725	223.5	6
Flat	68,835	1406.3	2

Results

One newly recorded PAD area (Martin Road South Creek PAD 1), was identified within the study area as a result of the additional archaeological survey (Figure 13). The PAD area was assessed as exhibiting moderate archaeological research potential. Outside of the identified PAD area, the remainder of the study area was found to display low archaeological potential due to combinations of archaeologically unfavourable topography, natural fluvial processes and disturbance from land use practices. The results of the additional archaeological survey are shown in Table 4 below.

Table 4. Identified Aboriginal archaeological sites and significance assessment

Site Name	AHIMS ID	Assessed significance/potential
Martin Road South Creek PAD 1	45-5-6015	Moderate



Figure 12. Survey units and landforms for additional archaeological survey area

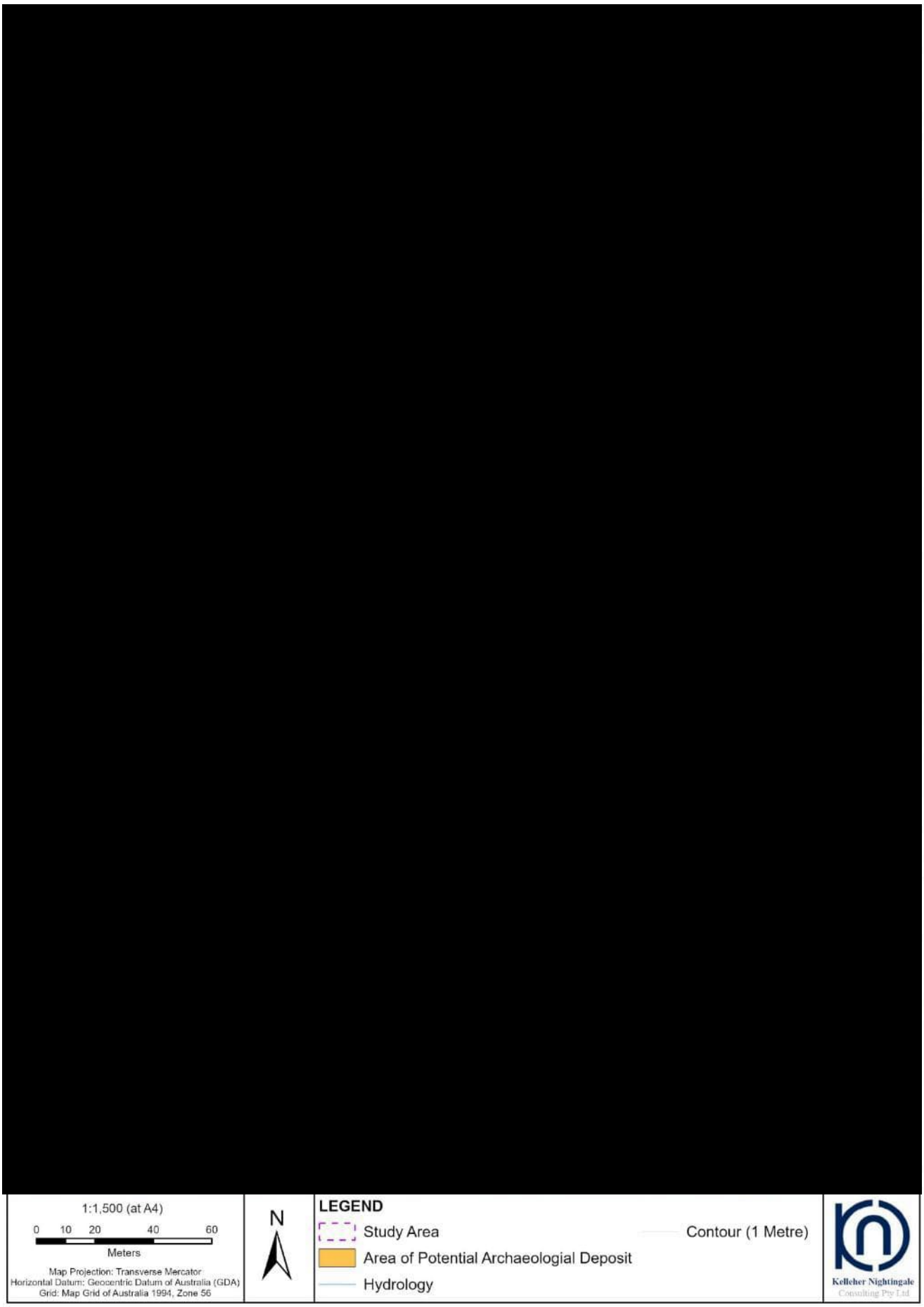

Figure 13. Results of additional archaeological survey

4.3.2 Archaeological Test Excavation (KNC 2025)

Additional field survey identified one newly record PAD area (Martin Road South Creek PAD 1) within the study area. The additional test excavation program was undertaken at Martin Road South Creek PAD 1 where it was identified that further archaeological information was required, based on the extent of potential impact from the proposed works and assessed archaeological potential. The purpose of the additional test excavation program was to collect information about the nature and extent of subsurface Aboriginal objects through excavation of a sample of the identified area.

Test excavation was carried out by KNC and field representatives of registered Aboriginal stakeholder groups in June 2025, in accordance with the *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales*. Aims, methodology and results of the test excavation program are presented below.

Aims

The purpose of the test excavation program was to collect information about the presence/absence, nature, extent and condition of subsurface Aboriginal objects through excavation of a sample of the test area. Test excavation aimed to build on the information already obtained through existing archaeological assessment for the area carried out in accordance with the requirements of the *Code of Practice*. Test excavation results were then used to further inform the archaeological assessment. The first priority during the archaeological program was to minimise, as far as practicable, the risk of harm to objects under investigation.

Additional goals of the test excavation were: to assess the boundary of any archaeological deposits in relation to the project works, to investigate the relationship between specific topographic features and archaeological deposits and to observe the effects of disturbance on archaeological deposits. This information was sought to assist in interpreting the archaeological landscape that remains in the study area and aid management of the archaeological resource. The sampling area was restricted to ensure an adequate sample without having significant impact on the archaeological value of any identified sites.

Sampling strategy and methodology

Field methodology was developed and carried out in accordance with requirement 16a of the *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales*. The test excavation program was specifically designed to target questions of artefact survivability through assessing the intactness of the deposit.

In accordance with the *Code of Practice*, test excavation units measured 50cm x 50cm (0.25m^2). Site datums were recorded at the test area, with test units then aligned along transects. The spacing of units along transects was 10 metres. Easting/northing GPS coordinates (GDA 94, Zone 56) were taken at the north-west corner of each excavation unit. The test units were then given an arbitrary identifying number (e.g. TS1, TS2, TS3). A total of 10, 50cm x 50cm units were excavated during the program at Martin Road South Creek PAD 1. Excavated totals for the test area are shown in Table 5.

It was considered that sufficient information was recovered from the excavated sample at the test area to adequately characterise the presence/absence and nature of the archaeology. Following Heritage NSW guidelines, the first excavation unit at the test area was excavated in 5cm spits onto a culturally sterile deposit (basal clay) to determine the nature of the subsurface deposit and the presence or absence of artefactual material. Based on the results of the first excavation square, subsequent squares were excavated in 10cm spits until culturally sterile soils (B horizon clays) were reached.

Data including a detailed deposit description, excavated features and unit depths, was recorded by the excavators on standardised excavation unit recording sheets. At the end of the excavation program, all squares were photographed and soil section profiles were drawn. A site plan was prepared for the excavated area showing the location of test squares and their relationship to the surrounding environment including landform/topography, creeklines, infrastructure, and areas of disturbance. All excavation was undertaken using hand tools. All excavated material was placed in buckets and transported to the adjacent sieving area and sieved using a combination of nested 5mm and 2.5mm wire mesh screens. Sieved spoil was retained for backfilling the test excavation squares.

A field catalogue of recovered artefacts was maintained to track artefact counts and recovery locations as the test excavation progressed. Following the completion of the excavation program, artefacts were retained for more detailed analysis including a precise recording of size, raw material and technical attributes. This information was compiled into a lithics database (Appendix C).

Table 5. Test excavation sample

Test Area	No. of test squares	TS numbers	Total sample
Martin Road South Creek PAD 1	10	TS1-TS10	2.5m^2

Results

Martin Road South Creek PAD 1 was located on an area of slightly elevated dry ground on the alluvial flat located north of the former South Creek channel within Lot 56 DP3050. Martin Road South Creek PAD 1 comprised the area identified during the survey to contain moderate potential for subsurface archaeological deposit. The test area was bounded by a fenceline and increasing levels of landuse disturbance to the south and west, and was covered in tall grasses.

A total of 10 test squares (50cm x 50cm) were excavated across the test area, giving a total excavated sample of 2.5m^2. Three transects were placed within the test area. Transect 1 was located at the south eastern end of the test area running northwest to southeast (TS1-TS3). Two additional test squares were placed at 10 metre intervals to the north-northwest of TS3 (TS4 and TS5). Transect 2 was oriented northeast to southwest from TS3 and contained test squares TS6 and TS9. Transect 3 (TS4, TS7, TS8 and TS10) was placed parallel to Transect 2 oriented from TS4. All test squares were spaced at 10 metre intervals.

Test square distribution and results at Martin Road South Creek PAD 1 are shown on Figure 18.



Plate 7. View south. Excavated TS3 in foreground, excavation in progress at TS2 in background. Dammed former South Creek channel in background at right.



Plate 8. View north. Excavated TS4 in foreground. Alluvial flat landform.

Soils and disturbance

Soil profiles at Martin Road South Creek PAD 1 were generally consistent across all ten test squares. Bioturbation from insect activity and grass roots was evident throughout the test area, with tree roots through basal clay at TS3 and TS8 and a tree root depression within basal clay at TS1.

In general, soils were of shallow to moderate depths. Soil depths ranged from 12cm at TS1 at the south eastern end of the test area to 50cm at TS8 at the north eastern end of the test area. All remaining test squares ranged between 19-40cm depth. The shallowest soils were encountered at the south eastern end of the test area towards the dammed former South Creek channel at TS1, TS2 and TS6 and at the western side of the test area adjacent to the fenceline at TS9. The shallow, highly mottled profiles of these soils suggest impacts from agricultural land use disturbance and land clearing activities.

The deepest deposits were encountered at the north eastern and northern sides of the test area, with an intact deposit encountered at TS8. All other test squares showed mixed soil horizons, most likely from extensive past land use practices. Soils consisted of a greyish brown silty loam overlying a yellowish brown silty clay loam. Basal clays consisted of dark reddish brown heavy clay. The upper humic O horizon was generally shallow, consisting of a greyish brown silty loam with abundant grass roots. Ferromanganese nodules and flecking was present in all test squares, indicating intermittent waterlogging of sediment. Scattered flecks of charcoal with occasional larger fragments was also common throughout all excavated squares, likely resulting from past land clearing and/or bushfire events.

Figures 14-17 illustrate representative soil profiles from Martin Road South Creek PAD 1.



I. 0-3cm: Humic layer, greyish brown silty loam, abundant grass roots. Diffuse boundary to:
II. 3-19cm: Greyish brown silty clay loam mottled with yellowish brown. Moderate compaction. Fe/Mn flecks and nodules ~3% inclusions. Scattered charcoal flecks. Few fine grass roots continuing. Diffuse boundary to:
III. Base: Dark reddish brown clay. Plastic. High compaction.

Figure 14. TS2 east section and soil profile description



I. 0-6cm: Humic layer, greyish brown silty loam, abundant grass roots. Diffuse boundary to:
II. 6-20cm: Greyish brown silty loam mottled with yellowish brown. Moderate compaction. Fe/Mn flecks and nodules ~5%. Scattered charcoal flecks. Few fine grass roots continuing. Diffuse boundary to:
III. 20-26cm: Yellowish brown silty clay loam mottled with greyish brown. High clay content, increasing with depth. Moderate-high compaction. Fe/Mn inclusions continuing. Charcoal continuing, large patch in northeast corner. Diffuse boundary to:
IV. Base: Dark reddish brown clay. Plastic. High compaction.

Figure 15. TS4 east section and soil profile description



I. 0-5cm: Humic layer, greyish brown silty loam, abundant grass roots. Diffuse boundary to:
II. 5-20cm: Greyish brown silty loam mottled with yellowish brown. Moderate compaction. Fe/Mn flecks and nodules ~5% inclusions. Scattered charcoal flecks. Few fine grass roots continuing. Diffuse boundary to:
III. 20-40cm: Yellowish brown silty clay loam mottled with greyish brown. High clay content, increasing with depth. Moderate-high compaction. Fe/Mn and charcoal inclusions continuing. Diffuse boundary to:
IV. Base: Dark reddish brown clay. Plastic. High compaction.

Figure 16. TS5 south section and soil profile description



I. 0-3cm: Humic layer, greyish brown silty loam, abundant grass roots. Diffuse boundary to:
II. 3-28cm: Greyish brown silty loam. Moderate compaction. Fe/Mn flecks and nodules ~5% inclusions. Scattered charcoal flecks. Few fine grass roots continuing. Clear boundary to:
III. 28-50cm: Yellowish brown silty clay loam. High clay content, increasing with depth. Moderate-high compaction. Fe/Mn inclusions increasing ~20%. Diffuse boundary to:
IV. Base: Dark reddish brown clay. Plastic. High compaction.

Figure 17. TS8 east section and soil profile description

Artefact distribution

A total of 13 artefacts were recovered from the test excavation program at Martin Road South Creek PAD 1. Artefacts were recovered from six of the 10 excavated test squares. Four test squares contained zero artefacts. The extrapolated mean artefact density was generally low across the test area at 5.2 artefacts/m^2 with the majority of artefacts recovered from the north eastern portion of the test area.

Artefacts were generally recovered from test squares with moderate deposit depths and less intensive impacts from land use disturbance. TS8 contained the most intact deposit and retained the highest number of artefacts (n=4), with an extrapolated mean artefact density of 16 artefacts/m^2. The majority of artefacts were recovered from depths between 0-10cm (n=6) and 10-20cm (n=5), with only one artefact recovered from 20-30cm depth and 30-40cm depth (each, n=1). Table 6 shows the artefact distribution across the test area.

Table 6. Martin Road South Creek PAD 1 - test squares and artefact count

Test Square	n	Test Square	n
TS 1	0	TS 6	1
TS 2	0	TS 7	3
TS 3	2	TS 8	4
TS 4	0	TS 9	1
TS 5	0	TS 10	2

Lithic characteristics

Silcrete was the primary raw material excavated during testing of Martin Road South Creek PAD 1 (n=8, 61.5%) with IMT also present (n=5, 38.5%). The majority of artefacts were small in size with 38.5% of artefacts measuring between 10-15mm in maximum dimension, followed by artefacts between 5-10mm, 15-20mm, 25-30mm and 35-40mm (each n=2, 15.4%). The largest size range of 35-40mm comprised a silcrete multidirectional core and an IMT proximal fragment.

The assemblage consisted predominantly of angular fragments, proximal flake fragments and medial flake fragments (each n=3, 23.1%) (Table 7). This was followed by distal flake fragments (n=2, 15.4%); one complete flake and one complete core were also present. The complete core was a silcrete multidirectional core with seven negative flake scars (Plate 9: ID# 9). It was the largest artefact in the assemblage with a maximum dimension of 39.79mm. No formal tools or modified artefacts were identified at Martin Road South Creek PAD 1.

Two artefacts retained cortex. The silcrete core from TS8 retained between 1-30% of rough granular cortex and the large IMT proximal flake fragment from TS9 retained 1-30% of cobble cortex. Heat exposure was present on both silcrete and IMT artefacts with variation in colour, lustre and the presence of crenate fracture surfaces on some select artefacts indicating that the material was affected by heating, whether deliberately or due to exposure to bushfires.

Table 7. Martin Road South Creek PAD 1 - reduction types and raw material

	Core	Flake	Proximal Fragment	Medial Fragment	Distal Fragment	Angular Fragment	Total	*(%)*
Silcrete	1	0	1	2	2	2	**8**	**61.5**
IMT	0	1	2	1	0	1	**5**	**38.5**
Total	1	1	3	3	2	3	**13**	**100**
%	***7.7***	***7.7***	***23.1***	***23.1***	***15.4***	***23.1***	***100***	



Plate 9. Silcrete multidirectional core from TS8, Spit 3 (20-30cm), ID# 9.



Plate 10. IMT artefacts from TS7. Left: proximal flake fragment from Spit 1 (0-10cm) ID# 4. Right: complete flake from Spit 2 (10-20cm), ID# 6.

Summary and Conclusions

Test excavation confirmed subsurface archaeological deposit at Martin Road South Creek PAD 1 within the study area corridor. The site was located on the alluvial flat landform adjacent to the former South Creek channel. Given the presence of Aboriginal objects at the identified PAD area, it has been designated as archaeological site, Martin Road South Creek AFT. Test excavation resulted in the sampling of the alluvial flat adjacent to the dammed former South Creek channel. In general, results supported the existing understanding of the archaeological landscape within the region, namely that more intensive, focused and/or repeated Aboriginal occupation took place on landforms in close proximity to water such as South Creek and its tributaries.

Test squares at Martin Road South Creek AFT 1 were positioned across an alluvial flat landform adjacent to the dammed former South Creek channel, bounded to the west and south by a fenceline. The test area incorporated the location of previously recorded PAD area, Martin Road South Creek PAD 1. Testing identified the presence of a low density subsurface archaeological deposit, with 13 artefacts retrieved from six of the 10 excavated test squares. Testing identified the presence of subsurface archaeological deposit across the north eastern and central portion of the test area with the highest density identified at TS8. TS8 was placed adjacent to the tree line at the north eastern extent of the PAD area to assess the extent of archaeological deposit and disturbance within the landform. Land use disturbance was evident across the tested area, with soil mixing evident throughout most soil profiles. A small patch of relatively intact natural soils was encountered at TS8. The site displayed an extrapolated low mean artefact density of 5.2 artefacts/m^2, with a highly fragmented assemblage comprised predominantly of angular fragments and flake fragments. Artefacts consisted of silcrete (61.5% of the total assemblage material) and IMT (38.5% of the total assemblage material). The assemblage was typical of the region in terms of raw materials used and reduction types. It is likely that the artefacts recovered comprised a disturbed remnant of Aboriginal objects which have been impacted by pasture improvement activities and fluvial activity.

Impacts from agricultural land use disturbance was evident throughout the tested area. Manmade disturbance ranged from low to moderate. Moderate levels of disturbance within the soil profiles generally resulted from the effects of ploughing and soil mixing. Despite some levels of manmade disturbance across the tested site area, a small patch within the north eastern portion of the test area retained natural and relatively intact soils. Natural soils consisted of a greyish brown silty loam overlying a yellowish brown silty clay loam. Basal clays consisted of dark reddish brown heavy clay. Soils were generally typical of the alluvial South Creek soil landscape. Ferromanganese flecking and nodule inclusions were present in all soil profiles throughout the test area. The presence of these inclusions indicates the effects of water movement and possible water logging cycles on soils throughout the landscape. Bioturbation resulting from insect activity, grass roots and tree roots was frequent throughout test squares and across soil profiles at all test areas.

The physical evidence of Aboriginal landscape use in the local area predominantly consists of artefact scatters and isolated artefacts. Previous studies have demonstrated the relationship between artefact densities and proximity to water sources and landform. Relatively elevated landforms along the margins of creeks (especially those offering permanent water) would have been favourable for occupation by Aboriginal people. This is reflected in the archaeological record by higher artefact densities recorded at these sites, potentially reflecting repeated or more intensive use of these locations. Archaeological potential is increased where disturbance levels are low and frequent flood effects are absent or aggrading. The nature and distribution of the archaeological deposit identified during the current test excavation program fits this regional model.

The additional test excavation program revealed that the alluvial flat landform associated with the South Creek watercourse was utilised by Aboriginal people. One newly recorded Aboriginal archaeological site was recorded within the study area (Martin Road South Creek AFT 1) as a result of additional testing. The site location and extent is shown on Figure 19. Martin Road South Creek AFT 1 was located on a landform which had been subject to disturbance from land use activities and fluvial processes. The site contained a low density archaeological deposit comprised of silcrete and IMT which was consistent with regional trends. The site was considered unlikely to provide further archaeological information on Aboriginal landscape use in the region.

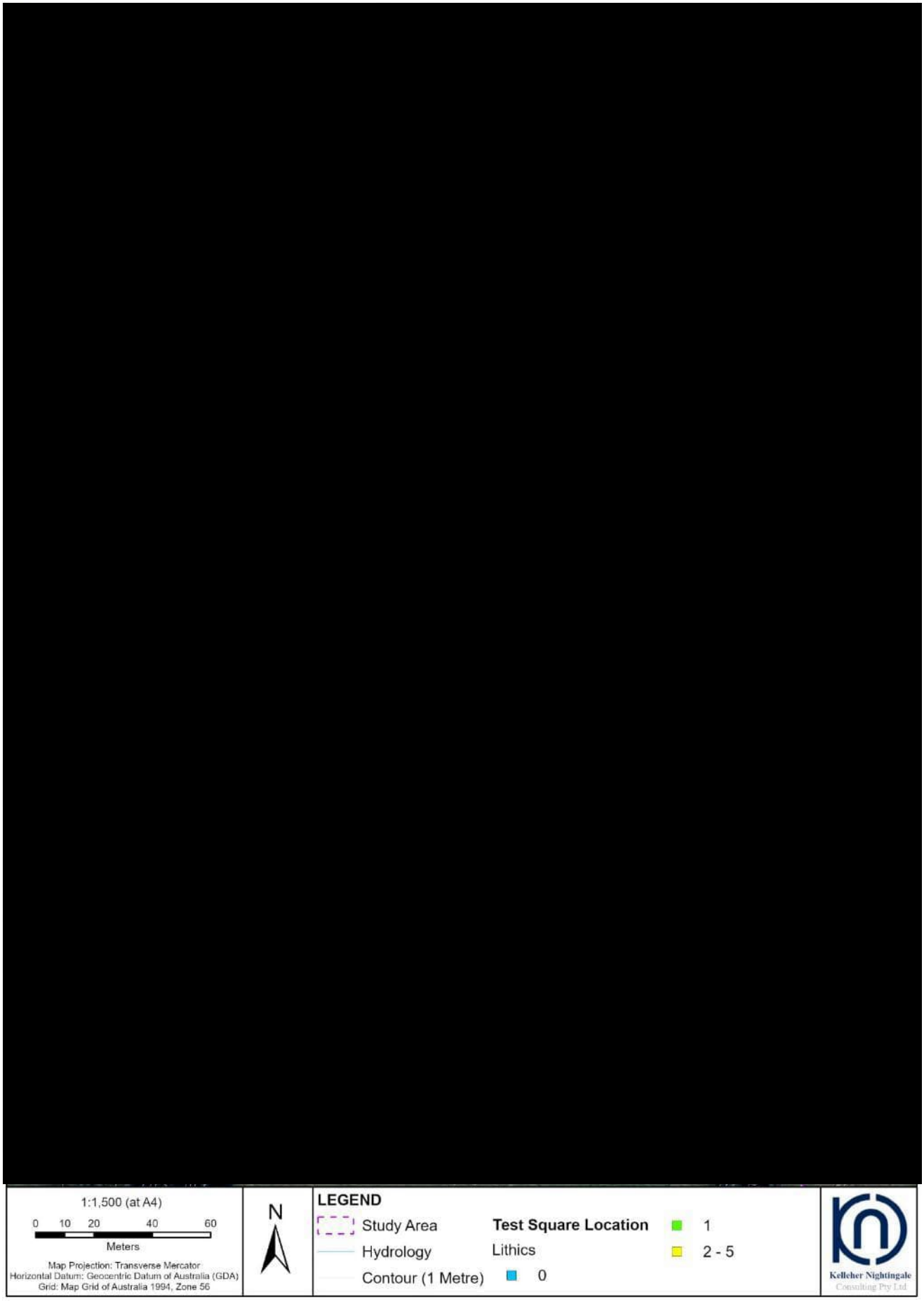

Figure 18. Test square distribution and results at Martin Road South Creek PAD 1

5 Consultation Process

5.1 Consultation for the CHAR and AHIP application

The aim of consultation is to integrate cultural and archaeological knowledge and ensure registered stakeholders have information to make decisions on Aboriginal cultural heritage. For the preparation of this CHAR and application for an AHIP for the study area, consultation has been undertaken in accordance with the Heritage NSW *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010* (OEH 2010a) and the requirements of Clause 60 of the *National Parks and Wildlife Regulation 2019*.

The formal consultation process has included:

- Notification of Aboriginal persons, including register of native title determinations search and Government agency notification letters;
- Advertising for registered stakeholders in local print media (Appendix A);
- Notification of closing date for registration (5/12/2023);
- Provision of project information and proposed cultural heritage assessment methodology (letters dated 7/12/2023) allowing for a 28 day review period;
- Invitation to advise on Aboriginal cultural value of the study area;
- Provision of draft CHAR review (a 28 day review period was provided);
- Ongoing consultation with Aboriginal stakeholders including regular project updates.

5.2 Registration of interest

Aboriginal people who hold knowledge relevant to determining the cultural heritage significance of Aboriginal objects and Aboriginal places in the study area were invited to register an interest in a process of community consultation. Investigations for the current project have included consultation with 26 Aboriginal community groups and individuals as listed in Table 8.

Table 8. Registered Aboriginal stakeholders

Registered Aboriginal Stakeholder	Representative and/or Contact Person
Deerubbin Local Aboriginal Land Council	CEO
Gandangara Local Aboriginal Land Council	CEO
A1 Indigenous Services	Carolyn Hickey
BCS Group	Lee Field
Butucarbin Aboriginal Corporation	Jennifer Beale
Damo Digs	Damien Morrison
Darug Custodian Aboriginal Corporation	Justine Coplin
Didge Ngunawal Clan	Paul Boyd & Lilly Carroll
Goobah	Basil Smith
Kamilaroi Yankuntjatjara Working Group	Phil Khan
Koori Digs	Korri Currell
Long Gully Cultural Services	Ethan Trewlynn
Mundawari Heritage Consultants	Dean Delponte
Muragadi Heritage Indigenous Corporation	Anthony Johnson
Murra Bidgee Mullangari Aboriginal Corporation	Darleen Johnson
Raw Cultural Healing	Raymond Weatherall
Registered Aboriginal Stakeholder	Details withheld
Registered Aboriginal Stakeholder	Details withheld

Registered Aboriginal Stakeholder	Representative and/or Contact Person
Thoorga Nura	John Carriage
Waawaar Awaa Aboriginal Corporation	Rodney Gunther
Widescope Indigenous Group	Steven Hickey
Wori Wooilywa	Daniel Chalker
Wurrumay Pty Ltd	Vicky Slater
Yarrawalk Pty Limited	Scott Franks
Yurrandaali	Bo Field
Yurwang Gundana Cultural Heritage Services	Merekai Bell

*Two Aboriginal stakeholders have registered for the project but have chosen to withhold their details in accordance with item 4.1.5 of the *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010* (OEH 2010a).

5.3 Consultation regarding the land and proposed activity

Following on from Stage 1 of the consultation process undertaken by KNC (stakeholder identification and registration), project-specific consultation was undertaken. Information regarding the broader Thompsons Creek and South Creek Catchments Wastewater Network Project was provided to registered Aboriginal stakeholder groups in a letter dated 21/11/2023. Information included an outline of the project, location of the study area and an invitation to consult during the assessment.

Stakeholders were also provided with the proposed assessment methodology for the cultural heritage assessment report and proposed archaeological test excavation, and invited to review and provide feedback (review period of 28 days, closing on 12/01/2024). Stakeholders were provided with an overview of the proposed assessment process for the CHAR and the rationale, sampling strategy and field methodology for the test excavation. An invitation was extended for Aboriginal cultural knowledge holders and stakeholders to provide comments on the proposed cultural heritage assessment methodology, including any protocols regarding the gathering of information and any matters such as issues/areas of cultural significance that might affect, inform or refine the assessment methodology.

5.4 Stakeholder responses to the proposed assessment methodology for the CHAR and proposed test excavation program

Formal responses to the proposed assessment methodology were received from the following stakeholder groups: A1 Indigenous Services Pty Ltd (A1), Koori Digs (KDS), Kamilaroi Yunkuntjatjara Working Group (KYWG), Long Gully Cultural Services (LGCS), Murra Bidgee Mullangari Aboriginal Corporation (MBMAC), Mundawari Heritage Consultants (MHC) and Muragadi Heritage Indigenous Corporation (MHIC).

A1 stated that they had reviewed and supported the proposed assessment methodology (email dated 19/01/2023).

KDS indicated that they agreed with the proposed assessment methodology for the project (email dated 12/12/2023).

KYWG agreed with and supported the recommendations set out in the proposed assessment methodology, including for a test excavation program (email dated 18/01/2024).

LGCS expressed that they agreed with the proposed assessment methodology for the project (email dated 11/12/2023).

MBMAC stated that they had read the proposed assessment methodology for the project and agreed with the recommendations made (email dated 10/01/2024).

MHC stated that they agreed with the proposed assessment methodology (email response dated 19/01/2023).

MHIC stated that they had read the proposed assessment methodology for the project and agreed with the recommendations made (email dated 10/01/2024).

5.5 Stakeholder responses to the draft CHAR

A draft CHAR was sent to stakeholders for the broader Thompsons Creek and South Creek Catchments Wastewater Network Project (includes the current study area alignment) on 12 August 2024. The draft CHAR was provided to stakeholders for a 28 day review and comment period. Formal comments were received from the following stakeholder groups: Cubbitch Barta and MHIC.

Cubbitch Barta provided a response to the draft CHAR regarding the participation of Aboriginal stakeholders in surveys undertaken for the project, the salvage excavation methodology, the significance assessment, intergenerational equity and the preference of reburial of salvaged artefacts (email dated 6/09/2024). Cubbitch Barta's comments are attached in full in Appendix B.

KNC confirms that Aboriginal site officers participated in both the survey and test excavation program.

KNC notes that the current proposed salvage excavation methodology is considered to be best practice and will salvage an adequate sample. The methodology is flexible, in that it allows for adjustments, should salvage results identify the need for additional salvage as per triggers identified in the proposed salvage methodology. Additional comments on the archaeological methodology (i.e. use of wet-sieving, sieve mesh sizes) are also acknowledged. The salvage methodology (Appendix C) allows for the use of wet sieving and smaller mesh sizes where required.

KNC acknowledges Cubbitch Barta's preference that Aboriginal objects identified through the salvage excavation program be reburied. The reburial of Aboriginal objects will be determined in consultation with the project's registered Aboriginal stakeholders and undertaken in accordance with the conditions of the AHIP.

MHIC stated that they had read the project information and the draft CHAR for the project and agreed with the recommendations put forth (email dated 3/09/2024).

5.6 Updated draft CHAR review

The updated draft CHAR was sent to stakeholders on 9 July 2025. The updated draft CHAR was provided to stakeholders for a 28 day review and comment period. Formal comments and information received from stakeholders are attached in full in Appendix B and summarised below.

KYWG stated that they agreed with and supported the recommendations put forth in the updated Draft CHAR. They added that they recommended reburial of artefact assemblages (email dated 6/08/2025).

MBMAC stated that they had read the project information and updated draft CHAR and endorsed the recommendations made (email dated 22/07/2025).

MHIC expressed that they had read the project information and the updated draft CHAR for the project and agreed with the recommendations (email dated 14/07/2025).

5.7 Aboriginal cultural values

It has been identified during the consultation process that the study area has cultural heritage value to the local Aboriginal community. Some of the Aboriginal cultural heritage values expressed by stakeholders include:

- strong association with the land
- responsibility to look after the land, including the heritage sites, plants and animals, creeks and the land itself
- scarred trees
- artefact sites and landscape features
- creek lines and prominent watercourse; particularly South Creek and its tributaries
- indigenous plants and animals
- connectivity of sites and places in the landscape.

Additional cultural values for the study area have been provided by stakeholders throughout the consultation process.

Long Gully Cultural Services indicated that they retained a strong connection the area, with members having grown up around the area (email dated 23/11/2023). They added that they anticipated that silcrete and mudstone raw materials would likely be present in the local area (email dated 11/12/2023).

One stakeholder who chose to withhold their details in accordance with item 4.1.5 of the *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010* (OEH 2010b) expressed strong familial connections to the area (email dated 21/11/2023.

6 Summary and Analysis of Background Information

Analysis of the background information presented in the preceding chapters allows an assessment of the cultural heritage values within the study area to be made. Combining data from historical/ethnographic sources, Aboriginal community consultation, landscape evaluation and archaeological context provides an insight into how the landscape around the study area was used and what sort of events took place in the past.

The study area and surrounding region are known to have been important to and extensively used by past Aboriginal people. Early colonial interest in the area led to conflicts between the British and the local Aboriginal people relatively soon after the arrival of Europeans to Australia. Aboriginal people's use of the wider Cumberland Plain is well-documented in historic accounts and members of the contemporary Aboriginal community continue to experience connection with the area through cultural and family associations.

Archaeological investigations have been undertaken in the region that have revealed physical traces of a range of Aboriginal land use activities which have survived in the form of Aboriginal archaeological sites. The Aboriginal archaeological sites identified in the region have been predominantly surface artefact scatters, isolated artefacts and subsurface archaeological deposits of varying artefact density and integrity while trees with bark removal scars, grinding grooves and areas of PAD have also been recorded. Soil landscape, vegetation and land use practices have been identified as factors influencing the preservation of Aboriginal archaeological sites in the region. The preservation of intact archaeological deposit in the vicinity of South Creek and Thompsons Creek is strongly affected by environmental factors such as proximity to flood zones, landform, slope stability and historical or modern land use disturbances. Large portions of the current study area have also been disturbed by modern land use practices including residential development, market gardening and drainage works along the creeklines.

Investigations within neighbouring and environmentally comparable areas have indicated that more archaeologically valuable information exists at the margins of the flood zone where elevated and stable micro-topographic landforms have suffered minimal disturbance. Previous excavations along South Creek north of Elizabeth Drive have demonstrated that patterned activity areas can be discerned where deposits are intact bordering the flood zone. These results suggest that similar intact deposits may remain at identified sites within the study area. The information contained within these deposits would further our understanding of Aboriginal landscape use along lower order creeklines.

6.1 Summary of known Aboriginal archaeological sites within the study area

Review of background information, Aboriginal community consultation, and archaeological assessment has resulted in the identification of six Aboriginal archaeological sites within the study area (Table 9; Figures 19 and 20).

Table 9. Identified Aboriginal archaeological sites within the study area

Site name	AHIMS number	Site feature
Martin Road South Creek AFT 1	45-5-6015	Artefact Scatter
Western Road AFT 1	45-5-5930	Artefact Scatter
Rossmore Grange	45-5-5842	PAD
Rossmore Grange AFT 1	45-5-5933	Artefact scatter
Medich Place AFT 1	45-5-5931	Artefact Scatter
Medich Place AFT 2	45-5-5932	Artefact Scatter

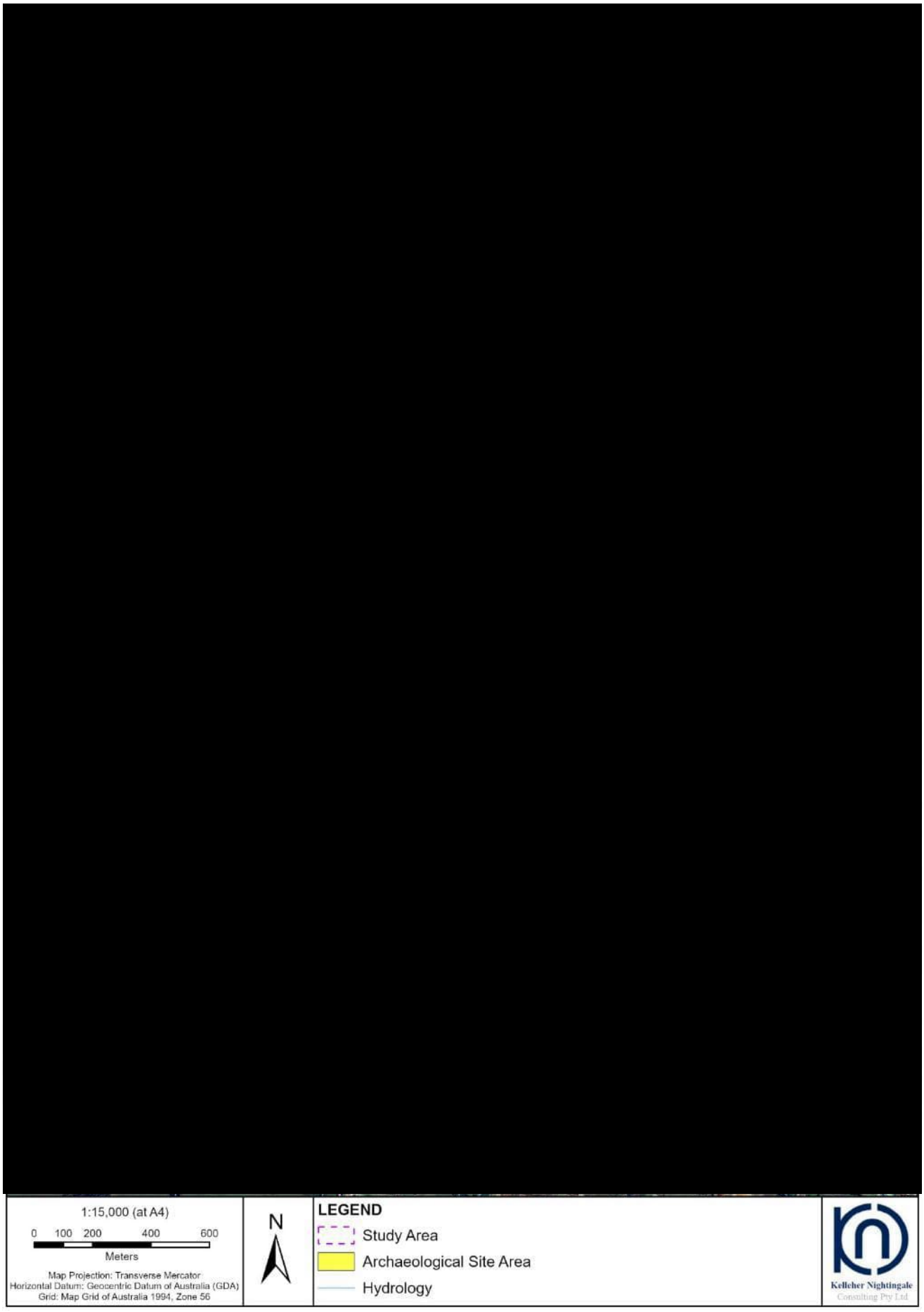

Figure 19. Identified Aboriginal archaeological sites within the study area

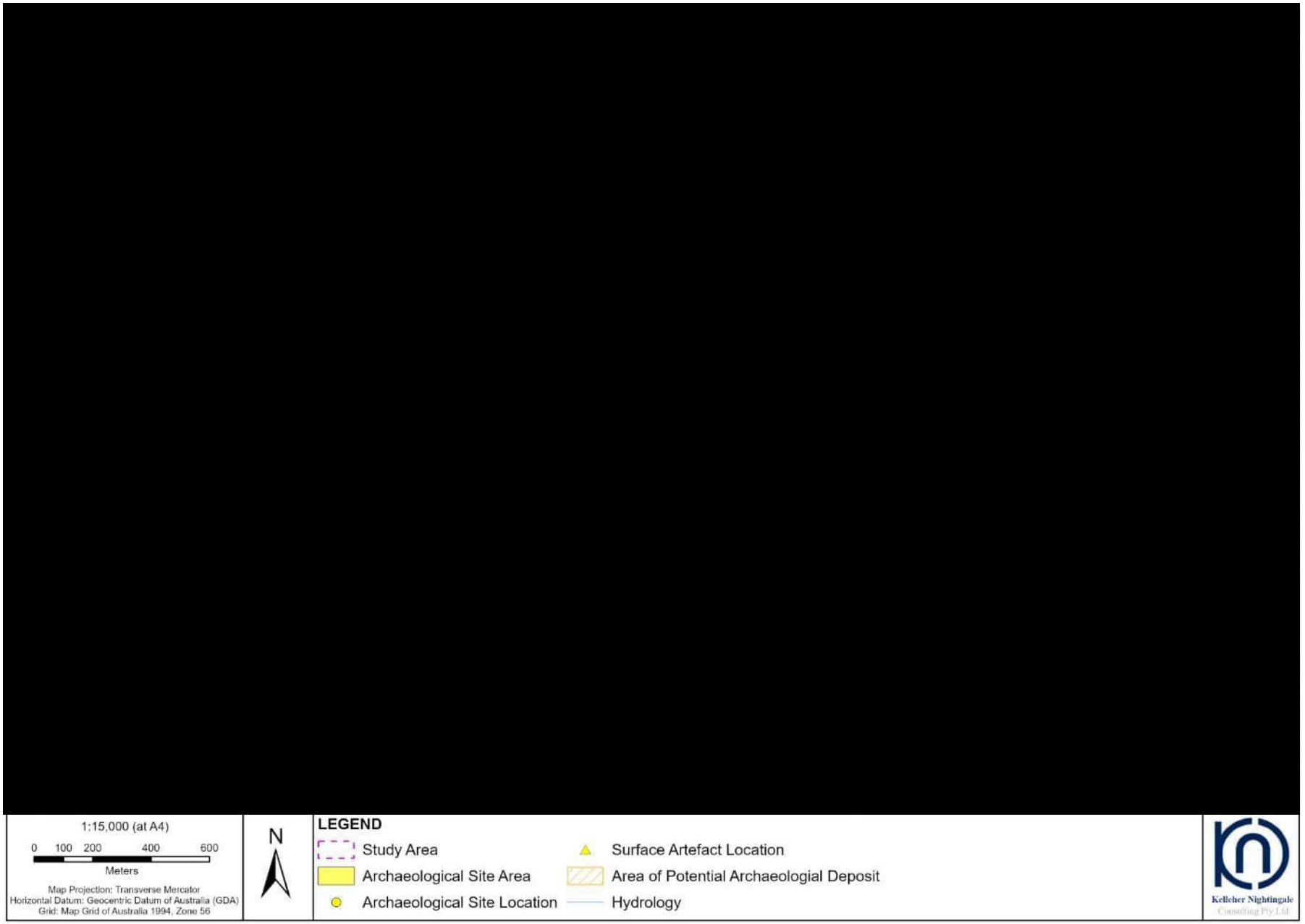

Figure 20. Identified Aboriginal sites within the study area – south

7 Cultural Heritage Values and Statement of Significance

7.1 Significance Assessment Criteria

One of the primary steps in the process of cultural heritage management is the assessment of significance. Not all sites are equally significant and not all are worthy of equal consideration and management (Sullivan and Bowdler 1984, Pearson and Sullivan 1995:7). The determination of significance can be a difficult process as the social and scientific context within which these decisions are made is subject to change (Sullivan and Bowdler 1984). This does not lessen the value of the heritage approach, but enriches both the process and the long-term outcomes for future generations, as the nature of what is conserved and why, also changes over time.

Significance assessments can generally be described under three broad headings (Pearson and Sullivan 1995:7):

- value to groups such as Aboriginal communities
- value to scientists and other information gatherers
- value to the general public in the context of regional, state and national heritage.

The assessment of significance is a key step in the process of impact assessment for a proposed activity as the significance or value of an object, site or place will be reflected in resultant recommendations for conservation, management or mitigation.

The *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (OEH 2010b) requires significance assessment according to criteria established in the *Australia ICOMOS Burra Charter* (Australia ICOMOS 2013). The *Burra Charter* and its accompanying guidelines are considered best practice standard for cultural heritage management, specifically conservation, in Australia. Guidelines to the *Burra Charter* set out four criteria for the assessment of cultural significance:

- Aesthetic value - relates to the sense of the beauty of a place, object, site or item;
- Historic value - relates to the association of a place, object, site or item with historical events, people, activities or periods;
- Scientific value - scientific (or research) value relates to the importance of the data available for a place, object, site or item, based on its rarity, quality or representativeness, as well as on the degree to which the place (object, site or item) may contribute further substantial information; and
- Social value - relates to the qualities for which a place, object, site or item has become a focus of spiritual, political, national or other cultural sentiment to a group of people. In accordance with the Heritage NSW *Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW*, the social or cultural value of a place (object, site or item) may be related to spiritual, traditional, historical or contemporary associations. "Social or cultural value can only be identified though consultation with Aboriginal people" (OEH 2011:8).
- Spiritual value - refers to the intangible values and meanings embodied in or evoked by a place which make it important to the spiritual identity, traditional knowledge, art or practices of a cultural group. Spiritual value is strongly connected to social value.

Significance assessment for identified archaeological sites focusses on the social/spiritual, historic, scientific and aesthetic significance of Aboriginal heritage values as identified in *The Burra Charter* (Australia ICOMOS 2013). The identification of significance is developed in consultation with the registered Aboriginal stakeholders. Assessed values for the sites within the study area are detailed below.

Cultural / social significance

This area of assessment concerns the value(s) of a place, feature or site to a particular community group, in this case the local Aboriginal community. Aspects of social significance are relevant to sites, objects and landscapes that are important or have become important to the local Aboriginal community. This importance involves both traditional links with specific areas as well as an overall concern by Aboriginal people for sites generally and their continued protection. Aboriginal cultural significance may include social, spiritual, historic and archaeological values and is determined by the Aboriginal community.

It has been identified during the consultation process that the local area has cultural heritage value (social value) to the local Aboriginal community. No specific cultural or social values for the sites within the study area were provided by the registered Aboriginal stakeholders following the review of the updated draft CHAR. Cubbitch Barta noted during the original draft CHAR review that land use disturbance does not reduce the cultural significance of archaeological sites (email dated 6/09/2024).

Historic significance
Community consultation and historical research has not identified any information regarding specific historical significance of identified Aboriginal archaeological sites in or near the study area. No specific historical values for the sites within the study area were provided by the registered Aboriginal stakeholders following the review of the updated draft CHAR. Archaeologically, the study area does not contain these values in relation to Aboriginal heritage.

Scientific / archaeological significance
For archaeologists, scientific significance refers to the potential of a site to contribute to current research questions. Alternately, a site may be an in situ repository of demonstrably important information, for example rare artefacts of unusually high antiquity.

Scientific significance is assessed using criteria to evaluate the contents of a site, state of preservation, integrity of deposits, representativeness of the site type, rarity/uniqueness and potential to answer research questions on past human behaviour. Heritage NSW's recommended criteria for assessing archaeological significance include:

- Archaeological Research Potential - significance may be based on the potential of a site or landscape to explain past human behaviour and can incorporate the intactness, stratigraphic integrity or state of preservation of a site, the association of the site to other sites in the region (connectivity), or a datable chronology.

- Representativeness - all sites are representative of those in their class (site type/subtype) however the issue here relates to whether particular sites should be conserved to ensure a representative sample of the archaeological record is retained. Representativeness is based on an understanding of the regional archaeological context in terms of site variability in and around the study area, the resources already conserved and the relationship of sites across the landscape.

- Rarity – which defines how distinctive a site may be, based on an understanding of what is unique in the archaeological record and consideration of key archaeological research questions (i.e. some sites are considered more important due to their ability to provide certain information). It may be assessed at local, regional, state and national levels.

High significance is usually attributed to sites which are so rare or unique that the loss of the site would affect our ability to understand an aspect of past Aboriginal use/occupation of an area. In some cases a site may be considered highly significant because it is now rare due to destruction of the archaeological record through development.

Moderate (medium) significance is attributed to sites which provide information on an established research question. Sites with moderate significance are those that offer the potential to yield information that will contribute to the growing holistic understanding of the Aboriginal cultural landscape of the project area. Archaeological investigation of moderately significant sites will contribute knowledge regarding site type interrelationships, cultural use of landscape features and occupation patterns.

Low significance is attributed to sites which cannot contribute new information about past Aboriginal use/occupation of an area. This may be due to site disturbance or the nature of the site's contents.

Aesthetic Values
Aesthetic values are often closely related to the social values of a site or broader cultural landscape. Aspects may include scenic sights, smells and sounds, architectural fabric and creative aspects of a place. Regarding Aboriginal sites identified within the study area, no specific aesthetic values have been identified by registered Aboriginal parties to date. No specific aesthetic values for the sites within the study area were provided by the registered Aboriginal stakeholders following the review of the updated draft CHAR. Archaeologically; the study area does not contain these values.

7.2 Statements of Significance/Potential

The study area has cultural value for the local Aboriginal community. The identified cultural value is a feeling of attachment and responsibility for the land. These values become tangible when tied to identified Aboriginal objects found at the archaeological sites. In this way, the Aboriginal objects can be seen as exhibiting both scientific information and cultural meaning, knowledge about the past tied with social values and belief systems.

The study area contains six identified Aboriginal archaeological sites as defined under the *National Parks and Wildlife Act 1974*. This assessment is based on a consideration of the research value, representativeness, intactness and rarity of the sites in a local and regional context. The significance/potential of the three identified Aboriginal archaeological sites are discussed below.

Martin Road South Creek AFT 1
AHIMS 45-5-6015
Martin Road South Creek AFT 1 was a low density subsurface artefact scatter of 13 artefacts recorded on an alluvial flat adjacent to the former South Creek channel. The site was identified during test excavation undertaken for the current project. Artefacts comprised one silcrete multidirectional core, one IMT complete flake and silcrete and IMT flake fragments. The site was found to have been subject to disturbance associated with historic and contemporary landuse activities. Martin Road South Creek AFT 1 represents a commonly occurring site type and the artefacts identified are typical in terms of type and raw material. The archaeological research potential and scientific value of the site are low. Any further investigations undertaken at the site would be unlikely to contribute to our understanding of past Aboriginal landscape use bordering South Creek. Based on the intactness, representativeness and research potential of the site, Martin Road South Creek AFT 1 was assessed as displaying *low archaeological significance*.

Western Road AFT 1
AHIMS 45-5-5930
Western Road AFT 1 comprised a subsurface artefact scatter identified on a rise on the floodplain adjacent to South Creek. A total of 58 artefacts were recovered from 15 of 18 excavated test squares. Artefacts identified at the site comprised two silcrete cores, backed artefacts and artefacts with retouch and usewear. The majority of artefacts were of indurated mudstone/tuff raw material, followed closely by silcrete and a total of four quartz artefacts. Western Road AFT 1 represents a commonly occurring site type and the artefacts identified are typical in terms of type and raw material. The site demonstrated moderate scientific value and it is likely that further investigation could contribute to our understanding of past Aboriginal landscape use within this portion of the South Creek catchment. Based on the intactness, representativeness, and research potential of the site, Western Road AFT 1 is assessed as displaying *moderate archaeological significance.*

Rossmore Grange PAD
45-5-5842
The AHIMS recording comprises a large PAD identified across an extensive area located on the eastern side of Thompsons Creek. The PAD area was estimated at 642 metres in width and 1.72 kilometres in length. Three large surface artefact scatters were identified within the broader PAD area (see Rossmore Grange AFT 1 below). Rossmore Grange PAD represents a commonly occurring archaeological feature. The portion of the PAD within the study area exhibits low archaeological potential (apart from the specific part identified as Rossmore Grange AFT 1). Based on the intactness, representativeness, and research potential of the site, Rossmore Grange is assessed as displaying *low archaeological significance.*

Rossmore Grange AFT 1
AHIMS 45-5-5933
Rossmore Grange AFT 1 was a surface and subsurface artefact scatter recorded on a terrace above a palaeochannel of South Creek and a small rise above the active South Creek channel. (Rossmore Grange AFT 1 represents the more archaeologically sensitive portion of Rossmore Creek PAD AHIMS 45-5-5842 within the study area.) Surface artefacts identified at the site comprised six silcrete artefacts (flakes and flake and fragments). Recent test excavation recorded a total of 161 artefacts from 19 of 20 excavated test squares. Artefacts comprised complete flakes, proximal, medial and distal flake fragments, angular fragments and split flakes. A total of five cores, a geometric microlith, two ground tool fragments and several backed artefacts were identified at the site. Raw materials included silcrete, indurated mudstone/tuff, FGS, chert, igneous, MGS, and quartz. Rossmore Grange AFT 1 represents a commonly occurring site type and the artefacts identified are typical in terms of type and raw material. The site demonstrated moderate scientific value and it is likely that further investigation could contribute to our understanding of past Aboriginal landscape use at the junction between Thompson Creek and South Creek. Based on the intactness, representativeness, and research potential of the site, Rossmore Grange AFT 1 is assessed as displaying *moderate archaeological significance.*

Medich Place AFT 1
AHIMS 45-5-5931
Medich Place AFT 1 was a low density subsurface artefact scatter of five artefacts recorded on a low rise above Thompsons Creek during test excavation undertaken for the current project. Artefacts comprised one quartzite core, one quartz flake and three silcrete flake and flake fragments. Aboriginal objects recovered from the site were considered to form part of general 'background scatter' in the landscape. Medich Place AFT 1 represents a commonly occurring site type and the artefacts identified are typical in terms of type and raw material. The archaeological research potential and scientific value of the site are low. Any further investigations undertaken at the site would be unlikely to contribute to our understanding of past Aboriginal landscape use bordering Thompsons Creek. Based on the intactness, representativeness and research potential of the site, Medich Place AFT 1 was assessed as displaying *low archaeological significance.*

Medich Place AFT 2
AHIMS 45-5-5932

Medich Place AFT 2 was a low density subsurface artefact scatter of three silcrete artefacts recorded on a low rise above Thompsons Creek during test excavation undertaken for the current project. Artefacts comprised one bondi point, one retouched flake and one distal flake fragment. Aboriginal objects recovered from the site were considered to form part of general 'background scatter' in the landscape. Medich Place AFT 2 represents a commonly occurring site type and the artefacts identified are typical in terms of type and raw material. The archaeological research potential and scientific value of the site are low. Any further investigations undertaken at the site would be unlikely to contribute to our understanding of past Aboriginal landscape use bordering Thompsons Creek. Based on the intactness, representativeness and research potential of the site, Medich Place AFT 2 was assessed as displaying *low archaeological significance.*

8 The Proposed Activity and Impact Assessment

Sydney Water plans to build the Thompsons Creek Wastewater Network Project Stage 1 corridor (which consists of the southern half of the broader Thompsons Creek and South Creek Catchments Wastewater Network Project). The project works would include the following main components:

- new wastewater pumping stations (SP1228 (interim), SP1241 & SP1243), including new access roads and DN500 overflow pipes
- Approximately 5.5. kilometres of pressure mains (including temporary and permanent pressure mains)
- Approximately nine kilometres of gravity pipeline (comprising three gravity carriers)
- vent shafts, maintenance holes, scour pits and air valves at various locations along the alignment

Construction will include a combination of trenched and trenchless methods, including horizontal directional drilling (HDD), microtunneling, and horizontal auger boring (HAB) across the alignment and at pump station locations.

Assessed impact to Aboriginal sites within the current study area is shown on Figures 21 and 22, and detailed in Table 10 below.

Table 10. Proposed impact to Aboriginal archaeological sites within the study area

Site name	AHIMS number	Significance	Type / Degree of harm	Consequence of harm
Martin Road South Creek AFT 1	45-5-6015	Low	Direct / Partial	Partial loss of value
Western Road AFT 1	45-5-5930	Moderate	Direct / Total	Total loss of value
Rossmore Grange	45-5-5842	Low	Direct / Partial	Partial loss of value
Rossmore Grange AFT 1	45-5-5933	Moderate	Direct / Partial	Partial loss of value
Medich Place AFT 1	45-5-5931	Low	Direct / Total	Total loss of value
Medich Place AFT 2	45-5-5932	Low	Direct / Total	Total loss of value

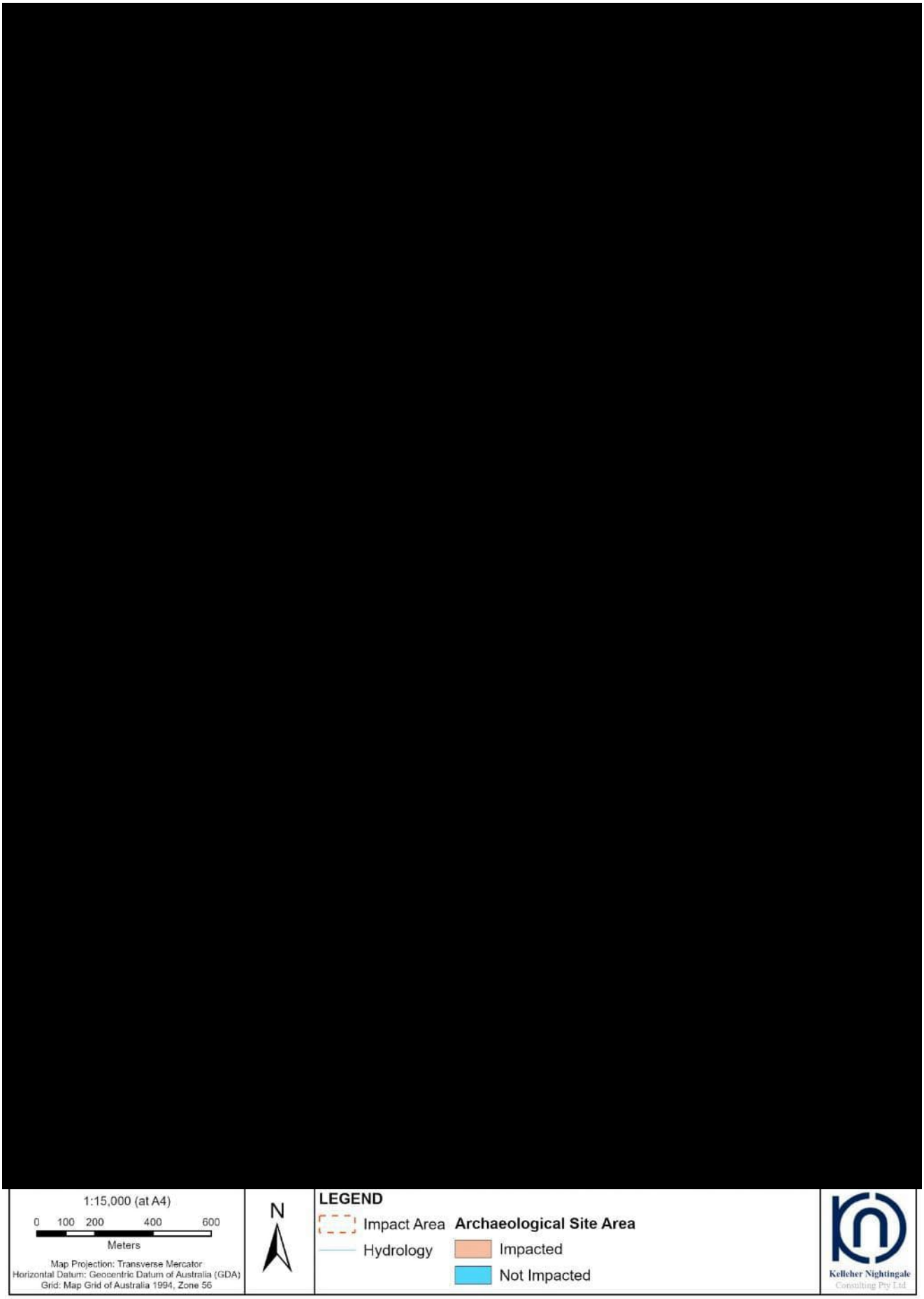

Figure 21. Proposed impacts to Aboriginal heritage - north

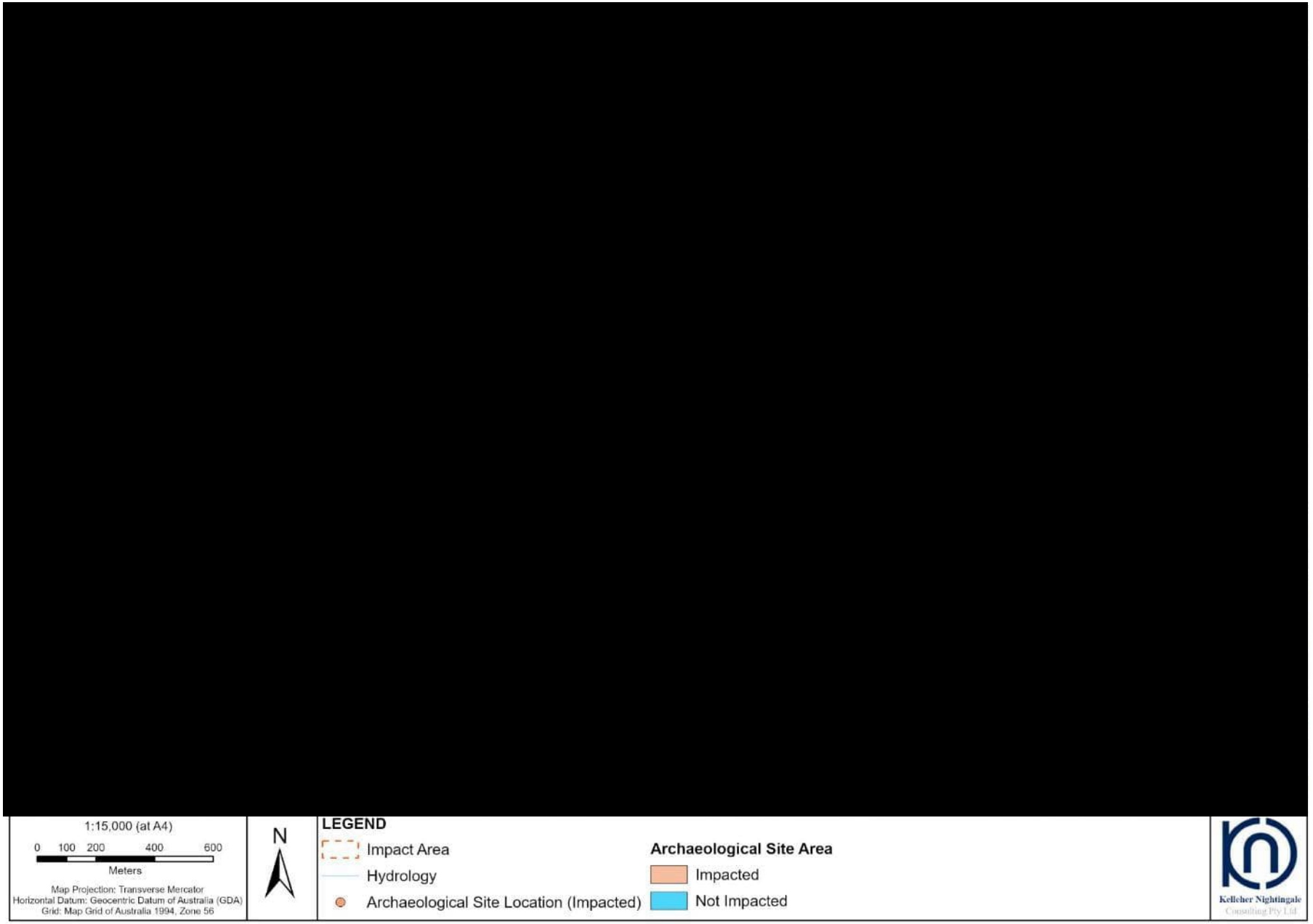

Figure 22. Proposed impacts to Aboriginal heritage - south

9 Mitigating Harm

The assessment applied the principles of Ecologically Sustainable Development (ESD) to the current project. The principles of Ecologically Sustainable Development are defined in Section 6 of the NSW *Protection of the Environment Administration Act 1991*. The ESD principles relevant to Aboriginal cultural heritage within the study area are: the Precautionary Principle and the Principle of Inter-Generational Equity. The application of these principles in relation to the project is discussed below.

9.1 The Precautionary Principle

The Precautionary Principle states "that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation".

The identified Aboriginal archaeological sites have been considered by Sydney Water in relation to the proposed works. While conservation is the best approach when considering Aboriginal heritage, the avoidance of Aboriginal archaeological sites within the study area was not possible due to the spatial requirements of the project, limited area in which it could occur, and the location of the existing water related infrastructure. Early identification of Aboriginal heritage by Sydney Water allowed for refinement of the study area to avoid several nearby Aboriginal archaeological sites.

The Aboriginal sites located within the study area have been impacted by past land use/infrastructure activities and would be further impacted by current land use practices. Scientific confidence has been achieved through archaeological investigations (Section 4). Regarding Aboriginal cultural heritage value confidence, no specific cultural or social values expressed by these sites have been identified (Section 5). As detailed in Sections 6 and 7, the assessment has determined that the study area contains Aboriginal archaeological sites displaying low and moderate significance.

9.2 The Principle of Inter-Generational Equity

The Principle of Inter-Generational Equity states "that the present generation should ensure that the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations".

The archaeological sites located within the study area were evaluated in relation to intergenerational equality and in particular, the cumulative impact of the project on the Aboriginal heritage of the region. Ongoing development and the construction of infrastructure in the region over the last 30 years have identified and subsequently impacted numerous Aboriginal archaeological sites; however, information gained from site investigations has allowed for a better understanding of site types, distributions, and interrelationships through the landscape. This has enabled better planning and design which can facilitate avoiding impact on Aboriginal archaeological sites.

The project has been designed to have a reduced impact to three Aboriginal archaeological sites. Management measures to ensure non-impacted portions of sites are avoided by the proposed activities will be implemented (protective fencing, identification in the CEMP, toolbox talks).

9.3 Mitigation Measures

Suitable recommendations for the identified impact to the sites have been developed based on ESD, environmental context and condition, background research and consultation with stakeholders. The study area contains six Aboriginal archaeological sites.

Sites Martin Road South Creek AFT 1, Rossmore Grange, Medich Place AFT 1 and Medich Place AFT 2 are considered to display low archaeological value and significance. Deposits associated with these sites are located within disturbed environmental contexts, having been subject to ongoing land use disturbance and natural erosional processes. These sites are unlikely to retain intact and substantial subsurface archaeological deposit. Archaeological salvage mitigation is not required for Martin Road South Creek AFT 1, Rossmore Grange, Medich Place AFT 1 and Medich Place AFT 2.

Sites Western Road AFT 1 and Rossmore Grange AFT 1 display moderate archaeological potential/significance based on their scientific value and potential to inform on the Aboriginal landscape use of the South Creek catchment. The significance of harm to the sites is moderate, given the sites' overall moderate archaeological significance/potential. Their archaeological value is linked to the information that they contain. Recovery of this information through archaeological salvage excavation would mitigate the impact of the project and offer an opportunity to better understand the distribution of Aboriginal archaeological materials in these locations.

The non-impacted portions of Martin Road South Creek AFT 1, Rossmore Grange and Rossmore Grange AFT 1 should be demarcated with protective fencing during construction works and listed in the CEMP. These areas should be identified as “no-go zones” on the CEMP maps and workers inducted as to appropriate protection measures.

Suitable recommendations for the identified impacts to the sites have been developed based on environmental context and condition, background research and consultation with stakeholders. An AHIP is required for impacts to land and identified sites/objects prior to the commencement of pre-construction or construction activities associated with the project that would affect the sites. Measures for archaeologically mitigating harm to the sites are outlined in Table 11 below.

Table 11. Mitigation measures for impacted Aboriginal sites

Site name	AHIMS ID	Management and mitigation measures
Martin Road South Creek AFT 1	45-5-6015	Aboriginal heritage impact permit (AHIP) required prior to commencement of works affecting the site. Management measures to be implemented to ensure non-impacted portion of site is avoided by proposed activities (protective fencing, identification in the CEMP, toolbox talks).
Western Road AFT 1	45-5-5930	Aboriginal heritage impact permit (AHIP) required prior to commencement of works affecting the site. Given the moderate significance of the site and degree of proposed impact, salvage excavation of a representative sample of the site is required prior to impact.
Rossmore Grange	45-5-5842	Aboriginal heritage impact permit (AHIP) required prior to commencement of works affecting the site. Management measures to be implemented to ensure non-impacted portion of site is avoided by proposed activities (protective fencing, identification in the CEMP, toolbox talks).
Rossmore Grange AFT 1	45-5-5933	Aboriginal heritage impact permit (AHIP) required prior to commencement of works affecting the site. Given the moderate significance of the site and degree of proposed impact, salvage excavation of a representative sample of the site is required prior to impact. Management measures to be implemented to ensure non-impacted portion of site is avoided by proposed activities (protective fencing, identification in the CEMP, toolbox talks).
Medich Place AFT 1	45-5-5931	Aboriginal heritage impact permit (AHIP) required prior to commencement of works affecting the site.
Medich Place AFT 2	45-5-5932	Aboriginal heritage impact permit (AHIP) required prior to commencement of works affecting the site.

10 Summary and Recommendations

A total of six Aboriginal archaeological sites are located within the study area. An AHIP is being sought for Aboriginal objects within the boundaries of the study area, incorporating the archaeological sites listed in Table 12.

AHIP

An application for an AHIP should be made under section 90A of the *National Parks and Wildlife Act 1974* for the six Aboriginal archaeological sites within the study area. An AHIP is sought for the land and associated objects within the boundaries of the study area (Figure 23). The AHIP is also sought for the specified Aboriginal sites and objects contained within the sites listed in Table 12.

Table 12. Archaeological sites requiring AHIP and degree of harm

Site name	AHIMS ID	Degree of harm	Consequence of harm	Significance of harm	Mitigation
Martin Road South Creek AFT 1	45-5-6015	Low	Direct / Partial	Low	No archaeological mitigation
Western Road AFT 1	45-5-5930	Moderate	Direct / Total	Moderate	Salvage excavation
Rossmore Grange	45-5-5842	Low	Direct / Partial	Low	No archaeological mitigation
Rossmore Grange AFT 1	45-5-5933	Moderate	Direct / Partial	Moderate	Salvage excavation
Medich Place AFT 1	45-5-5931	Low	Direct / Total	Low	No archaeological mitigation
Medich Place AFT 2	45-5-5932	Low	Direct / Total	Low	No archaeological mitigation

Salvage program

The AHIP would include provision for impact mitigation through archaeological salvage excavation. Salvage excavation would be required at Western Road AFT 1 and Rossmore Grange AFT 1. Salvage excavation must be completed prior to any activities (including pre-construction activities) which may harm Aboriginal objects at these locations. Salvage excavation activities would be undertaken in accordance with the methodology attached as Appendix D.

Site Protection

The non-impacted portions of Martin Road South Creek AFT 1, Rossmore Grange and Rossmore Grange AFT 1 should be demarcated with protective fencing during construction works and listed in the CEMP. These areas should be identified as “no-go zones” on the CEMP maps and workers inducted as to appropriate protection measures.

Salvaged Aboriginal objects

The short term management of collected Aboriginal objects would be as follows:

- Any Aboriginal objects that are removed from the land by actions authorised by an AHIP, must be moved as soon as practicable to the temporary storage location (see below) pending any agreement reached about the long term management of the Aboriginal objects.
- The temporary storage location: Kelleher Nightingale Consulting Pty Ltd, Suite 505-507, 155 King Street, Sydney NSW 2000.
- Any Aboriginal objects stored at the temporary storage location must not be further harmed, except in accordance with the conditions of the AHIP.

The long term management of collected Aboriginal objects would be determined in consultation with the project’s registered Aboriginal stakeholders and in accordance with the conditions of the AHIP.

- If objects are to be transferred under a Care and Control Agreement to an Aboriginal person or organisation representing Aboriginal people in accordance with Section 85A(1)(c) of the *National Parks and Wildlife Act 1974*, an application for a Care Agreement must be completed.
- If reburial is to be undertaken of objects, Requirement 26 "Stone artefact deposition and storage” in the Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW must be complied with, unless the registered Aboriginal stakeholders agree to an alternative deposition method.
    - If reburial is to take place, registered Aboriginal stakeholders would be notified and given the opportunity to attend, and the reburial recorded on AHIMS.

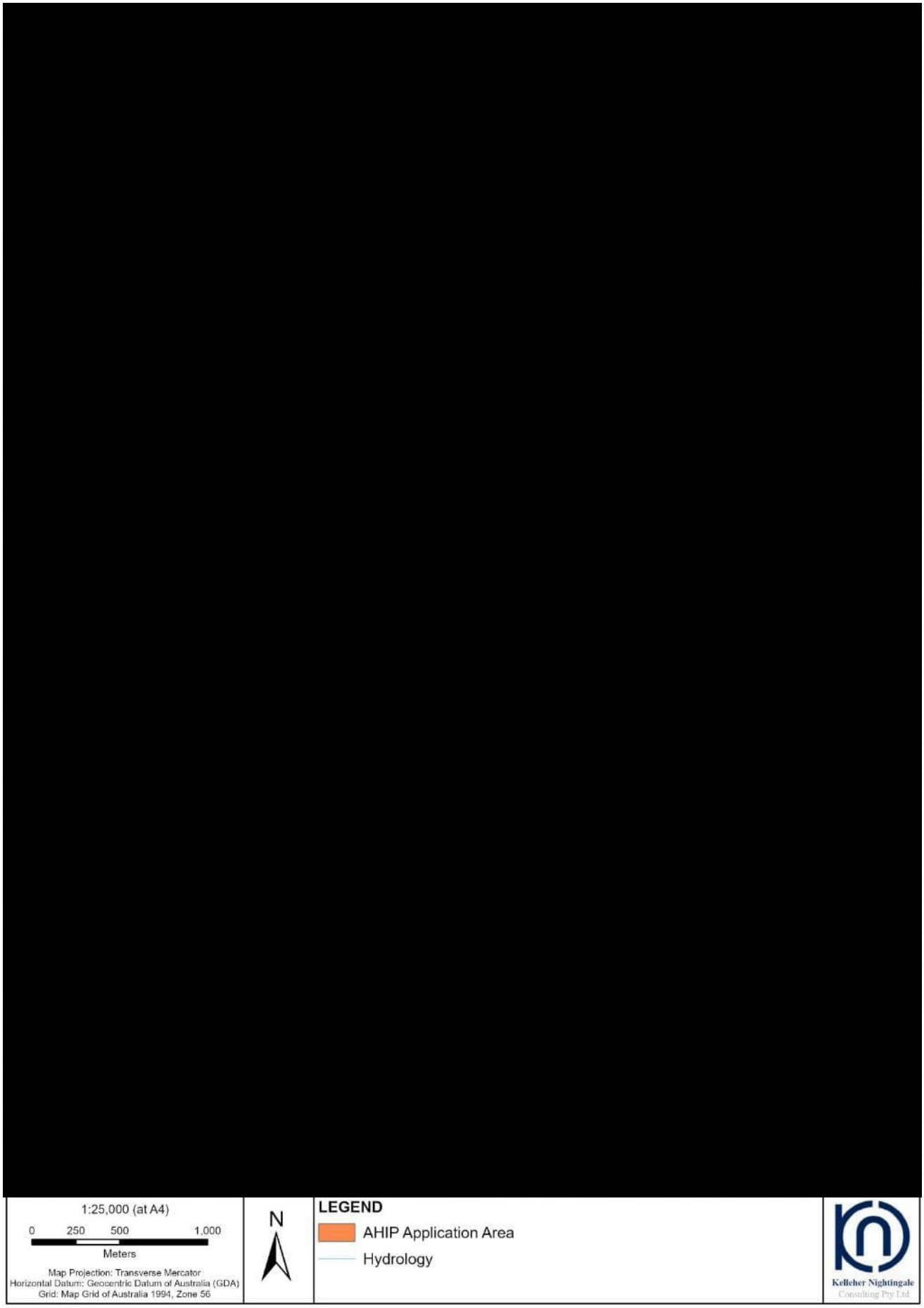

Figure 23. AHIP application area

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Appendix A Advertisement for registration of interest



ADVERTISEMENT

Notice for Registration of Interest

Sydney Water is proposing to carry out concept design, needs specification and Review of Environmental Factors for Stage 1 and Stage 2 trunk wastewater services to part of Badgerys Creek and Wianamatta South Creek precincts and part of Kemps Creek precinct. The project is located in the Liverpool and Penrith local government areas. The proponent is Sydney Water (Nitin Kundap, Senior Project Manager: Level 10, 1 Smith Street, Parramatta NSW 2150).

The proposal may be the subject of Aboriginal Heritage Impact Permit (AHIP) applications made under section 90A of the National Parks and Wildlife Act 1974. Sydney Water proposes to carry out consultation with Aboriginal communities in accordance with the Heritage NSW Aboriginal cultural heritage consultation requirements for proponents 2010. Information obtained from the consultation process may be used in the preparation of AHIP applications and will assist Heritage NSW in the consideration and determination of the AHIP applications. Kelleher Nightingale Consulting Pty Ltd has been engaged to facilitate the consultation process.

Sydney Water invites Aboriginal groups and/or Aboriginal people who hold cultural knowledge relevant to determining the significance of Aboriginal objects and/or places within the suburbs of Badgerys Creek and Kemps Creek to register interest in a process of community consultation with the contact shown below (on behalf of Sydney Water):

Kelleher Nightingale Consulting
Suite 505-507, 155 King Street
Sydney NSW 2000
phone 02 9232 5373

The closing date for registration is 5 December 2023.

Please be advised that in accordance with Heritage NSW requirements, we are required to record the names and contact details of each Aboriginal person who has registered an interest in this project and provide a copy of that record to the relevant Heritage NSW office and Local Aboriginal Land Council. If you are registering your interest, please let us know if you do not want your details forwarded to these organisations.

WW52658

Appeared in:
The Western Weekender, Friday 17 November 2023

Appendix B Aboriginal Community Comments



Contact



Sydney NSW 2000

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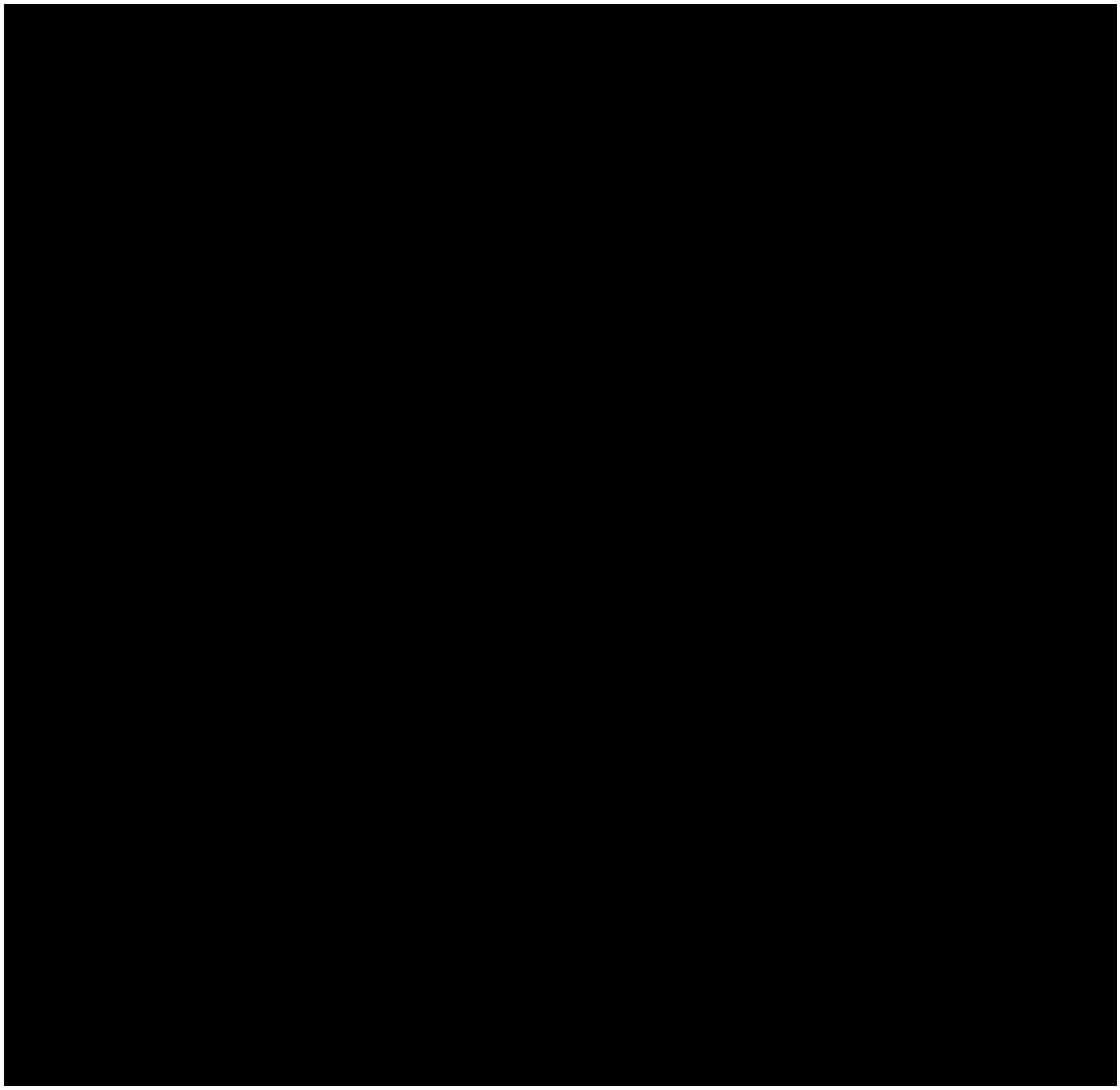
Contact

[redacted]



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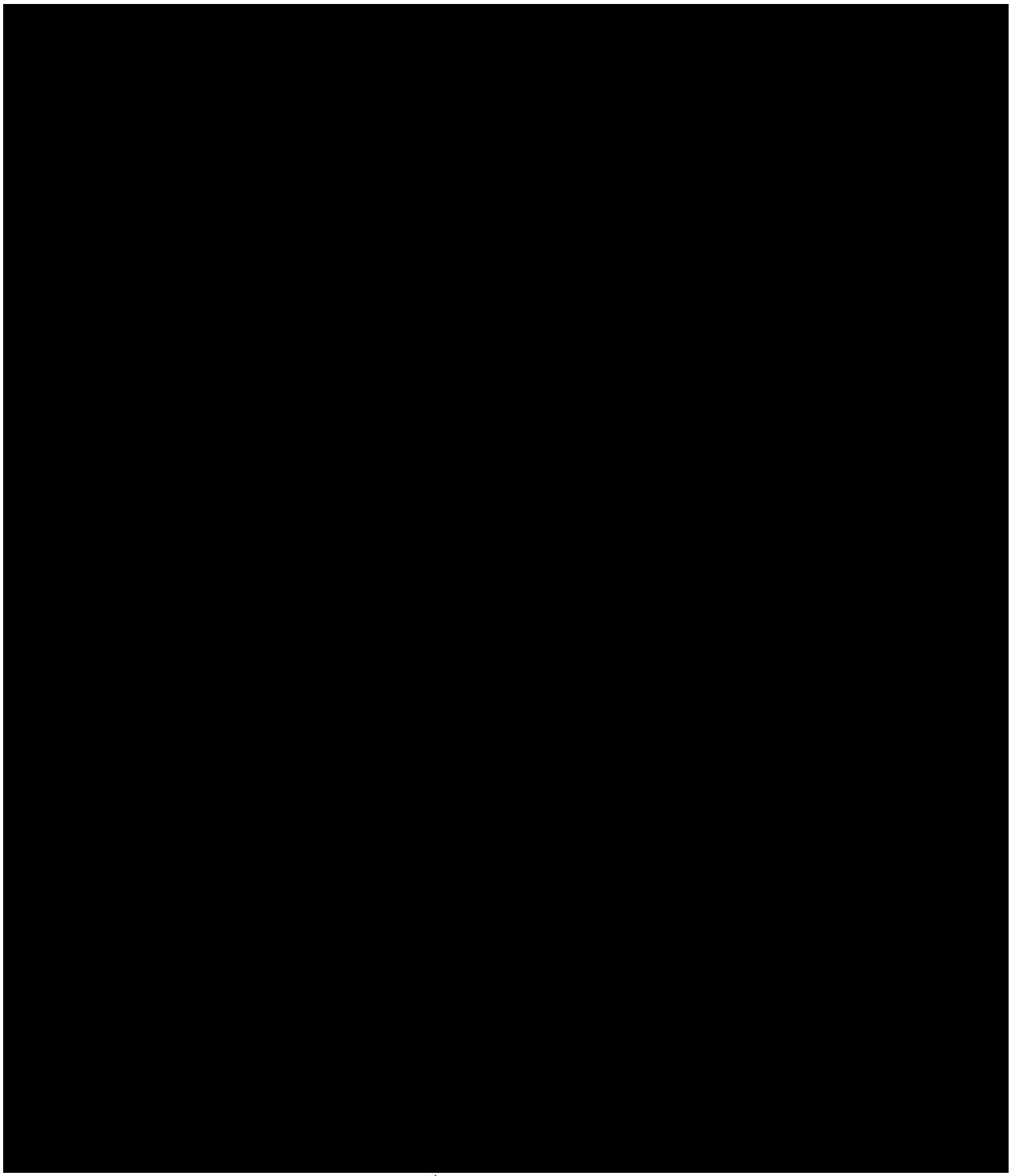

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Appendix C Lithics Spreadsheet

Test Area	ID No.	TS No.	Spit	Depth (cm)	Raw Material Type	Heat Affected?	Reduction Type	Tool/Core Type	Usewear	Cortex %	Weight (g)	Size Range mm	Termination Type	Platform Type	Length mm	Width mm	Thickness mm	Flake Shape
Martin Road South Creek PAD 1	1	TS3	1	0-10	Silcrete	No	Angular Fragment		None Observed	0%	0.25	5-10						
Martin Road South Creek PAD 1	2	TS3	1	0-10	Silcrete	Dull Heat Fracture	Medial Fragment		None Observed	0%	0.54	10-15			13.22	9.37	4.23	
Martin Road South Creek PAD 1	3	TS6	2	10-20	Silcrete	Glossy reds/greys	Proximal Fragment		None Observed	0%	0.52	10-15		Plain	14.36	8.97	4.71	
Martin Road South Creek PAD 1	4	TS7	1	0-10	IMT	No	Proximal Fragment		None Observed	0%	0.25	10-15		Faceted	9.12	10.50	2.63	
Martin Road South Creek PAD 1	5	TS7	2	10-20	Silcrete	Dull Heat Fracture	Angular Fragment		None Observed	0%	3.13	25-30						
Martin Road South Creek PAD 1	6	TS7	2	10-20	IMT	Dull Heat Fracture	Flake		None Observed	0%	0.53	15-20	Hinge	Focal	17.53	15.08	2.72	L>W
Martin Road South Creek PAD 1	7	TS8	2	10-20	IMT	Dull Heat Fracture	Medial Fragment		None Observed	0%	0.24	10-15			9.29	13.30	1.98	
Martin Road South Creek PAD 1	8	TS8	2	10-20	Silcrete	Dull Heat Fracture	Medial Fragment		None Observed	0%	1.66	15-20			15.32	18.27	5.39	
Martin Road South Creek PAD 1	9	TS8	3	20-30	Silcrete	Glossy reds/greys	Core	Multi-directional	None Observed	1-30%	21.39	35-40			39.79	26.13	22.87	
Martin Road South Creek PAD 1	10	TS8	4	30-40	IMT	Dull Heat Fracture	Angular Fragment		None Observed	0%	6.96	25-30						
Martin Road South Creek PAD 1	11	TS9	1	0-10	IMT	No	Proximal Fragment		None Observed	1-30%	8.63	35-40		Scarred	29.82	37.76	9.70	
Martin Road South Creek PAD 1	12	TS10	1	0-10	Silcrete	Glossy reds/greys	Distal Fragment		None Observed	0%	0.15	5-10	Feather					
Martin Road South Creek PAD 1	13	TS10	1	0-10	Silcrete	Dull Heat Fracture	Distal Fragment		None Observed	0%	0.94	10-15	Axial		12.64	12.06	6.65	

Appendix D Salvage Excavation Methodology

Sites Western Road AFT 1 and Rossmore Grange AFT 1 display moderate archaeological potential/significance based on their scientific value and potential to inform on the Aboriginal landscape use of the South Creek catchment. The significance of harm to the sites is moderate, given the sites' overall moderate archaeological significance/potential.

The archaeological value of the sites is linked to the information that they contain. Recovery of this information through archaeological salvage excavation would help to mitigate the impact of the project and offer an opportunity to better understand the activities which were undertaken at these sites and the effect of land use disturbance and natural processes on subsurface archaeological deposits in the vicinity of South Creek.

Methodology

Research Aims

The main aims of the proposed salvage excavation program are:

- To salvage a representative sample of the identified archaeological sites prior to development impact.
- To analyse the salvaged archaeological material to gain and conserve knowledge and understanding of the scientific and cultural information exhibited by the activities associated with landforms along the catchment of South Creek.
- To use the excavation results to gain insight into the subsurface archaeology of the adjacent areas not being impacted by the project. This would increase future educational opportunities and allow more informed management of Aboriginal heritage.

The further scientific aim of the salvage excavation program would be to determine the subsurface integrity, extent, spatial distribution and nature of the cultural deposit and the specific types of associated archaeological/cultural activities.

- Determining the integrity of the deposit involves assessing the degree of disturbance which is present.
- Determining the statistical extent of the sites and/or activity areas involves identifying the boundaries associated with the identified archaeological deposit.
- Assessing the spatial distribution involves identifying the presence/absence of archaeological material across the identified archaeological sites.
- The nature of the sites refers to the type of activities indicated by the artefactual material (e.g. primary production, domestic knapping, hunting camps). The goal would be to retrieve entire assemblages from specific activities if such activities were present.
- Retrieved assemblages would be compared with the results from other relevant archaeological projects in order to assess significance, particularly data from adjacent excavation programs including the M12 Motorway, Western Sydney Airport and Upper South Creek Advanced Water Recycling Centre.

Research Questions

The results of the proposed salvage excavation would increase our understanding of subsurface archaeology of the study area. Research would focus on the creek margins addressing questions about the survivability of archaeological deposit as well as investigating the possible spatial relationship between the archaeological deposit and paleochannels of South Creek and whether this has implications for site formation/taphonomy.

The study area also has a long history of disturbance both from natural factors such as flooding and from European settlement. Understanding how environmental and modern land use processes have impacted archaeological deposits assists the planning process and potentially increases conservation outcomes. Understanding the relationship between archaeology and site soils will inform the interpretation of archaeological significance, as opposed to an assessment of the presence or absence of artefacts.

Question 1: What are the taphonomic features of the salvaged archaeological sites? What does this indicate about site integrity and artefact survivability for portions of the sites not impacted by the proposed works and for similar landforms along the South Creek catchment?

Question 2: What is the effect of fluvial processes and modern land use practices on the preservation of Aboriginal archaeological sites associated with the higher-order and lower-order creek confluences of the South Creek system, and does this have implications for our understanding of site taphonomy within the broader South Creek catchment?

Question 3: What cultural activities are archaeologically identifiable at the sites? How do they compare to each other and to other Aboriginal sites within the South Creek catchment? Relevant comparative data from neighbouring archaeological projects including the M12 Motorway, Western Sydney Airport and Upper South Creek Advanced Water Recycling Centre may be employed to provide a comprehensive picture of Aboriginal land use within the study area.

What can we expect?
It is anticipated that differences in stone tool assemblages may be related to different cultural activities (e.g. primary reduction vs maintenance flaking). The science of archaeology is paramount to any research question and it is important to stress that the goal for the salvage program for all excavated sites is straight forward: to retrieve a viable sample for comparative analysis using established techniques (see Field Methods below). In this regard interpretation would not precede data collection. The proposed archaeological program would systematically sample the relevant area using standard techniques with the outcome being a viable, robust and comparable sample. Analysis of the sample would follow and interpretations would be made distinctly separate from the results.

Archaeological Salvage Areas
Salvage excavation would be undertaken at identified archaeological sites, Western Road AFT 1 and Rossmore Grange AFT 1. Salvage excavation of the sites would focus on the extraction of collections of artefacts related to activity areas and geomorphic information.

Conservation is a primary goal of all Aboriginal heritage management. All archaeological excavation undertaken during the proposed program would be restricted to the actual construction corridor and approved AHIP area associated with the impacted sites.

FIELD METHODS
Salvage Program
In order to achieve the most robust and comparable result, KNC advocates an open area salvage excavation. The first phase in open area salvage is to establish the statistical boundaries of the archaeological deposit identified during Phase 1. In other words, recording the spread of activities across the site/landscape. This approach is designed to salvage the spatial properties of the site as shown in the lithic continuum.

Phase 1
A series of 1 m^2 squares are excavated on a transect grid at regular intervals overlain on each site to mark the spread of lithics and related geomorphic activity.

GDA 94 coordinates would be recorded for each square to enable spatial modelling. Statistical salvage following this method is highly beneficial because it creates a robust inter-site sample, sufficiently random, critical for regional comparative analysis. No other method is as efficient or effective. It is anticipated that a minimum of 5m^2 would be excavated within each site during Phase 1.

Individual excavation squares measuring 1 m^2 would be hand excavated in stratigraphic units (Unit A, Unit B, etc.). Squares would be excavated until the basal layer or culturally sterile deposit is reached (usually 25-35 cm). Previous excavation of the podzolic soils associated with the area indicates no archaeological stratigraphy within units. As such the A1 and A2 soil layers are culturally one layer (suffering from cyclical soil transfer resulting in a mixed cultural profile within the soil) and can be salvaged as one unit where possible. All excavated deposit would be wet sieved using nested 5.0 mm and 2.5 mm sieves. Where potential micro-debitage is recovered 1.0mm sieves will be utilised.

The location of each excavated square would be identified on a surveyed plan of the site. Stratigraphic sections detailing the stratigraphy and features within the excavated deposit would be drawn and all squares would be photographed. Soil samples as well as thin section profiles (where feasible) would also be collected. The stratigraphy of all excavated areas would be fully documented and appropriate records archived.

Phase 2
Open area salvage of significant deposit follows the Phase 1 assessment. Additional 1 m^2 squares, constituting a contiguous open area, will be excavated around information bearing deposits along the excavation grid. Information bearing deposits are identified by triggers such as: significant quantities of artefacts, variations in raw material, unusual artefacts, chronological material and/or taphonomic indicators. In this context chronologic material is anything that can be used to date artefacts or deposit: charcoal or charcoal bearing deposit (e.g., hearth ash), sandy deposit, gravels (e.g., aluminium feldspar). Phase 2 open area investigation would expand to encompass entire activity areas. The location of Phase 2 open area investigation would be based on Phase 1 and existing test results. Suggested minimum Phase 2 totals for each site are as follows:

- Western Road AFT 1 - 25m^2
- Rossmore Grange AFT 1 - 25m^2

Where possible, carbon samples will be collected and analysed for material relating to both the archaeology and geomorphology. Where appropriate, cosmogenic and radiometric dating of soils and rock surfaces will be applied (Nishiizumi et al. 1986, 1993). Chronologic dating is an important part of the salvage program as this information will assist in interpreting the wider South Creek catchment.

Analysis

Artefacts would be analysed on a comparable level with previous analyses of excavated assemblages. Information derived from this analysis; in particular the identification of specific artefact types and their distributions and associations; would be used to put together interpretations about how sites were used, where sites were located across the landscape, the age of sites and to assess cultural heritage values. By comparing different areas, it would be possible to determine whether there were differences in the kinds of activities carried out and if different activities were related to different landforms.

A range of stone artefacts may be present across the salvage areas and the analysis would expand accordingly to account for artefact variability. All information would be recorded in database form (MS Excel). Various types of evidence would be used to determine the kinds of activities that were carried out. A short description of the proposed analysis in outlined below.

- Field analysis would record basic data, such as material type, number and any significant technological characteristics, such as backing or bipolar techniques; added to this would be any provenance data such as pit ID and spit number. The purpose of the field recording is twofold: 1) establish a basic recording of artefacts retrieved and 2) to allow on-going assessment of the excavation regime (e.g. whether higher stratigraphic resolution is required while digging).
- Detailed (laboratory) analysis would entail recording a larger number of characteristics for each individual artefact. These details would be recorded in matrices suitable for comparative analysis (e.g. multivariate and univariate) of the excavated assemblage on a local and regional basis.
- Lithic characteristics to be recorded cover a range of basic information but are not limited to these categories (see example below). For transparency, terms and category types would in large part be derived from Holdaway and Stern (2004).

Sample Categories		
Record Number	% Cortex	Flake Type
Pit ID	Length	Termination Type
Spit Number	Width	Core Type
Count	Thickness	Number of Scars (Core)
Raw Material	Weight	Scar Type (Core)
Colour	Modification	Shape of Flake
Quality	Reduction Type	Platform Type

- A detailed explanation and glossary would be provided with the final excavation report.
- Minimum Number of Flake (MNF) calculations formulated by Hiscock (2000, 2002) would be undertaken where applicable (although past experience indicates MNF calculations would not be required for this excavation program).

The analysis of artefacts recovered during the excavation program would be undertaken in a transparent and replicable fashion so as to permit the comparison of the entire excavated assemblage with data from other areas. This would also allow for an interpretation of the study area's archaeological significance.

Field Team

KNC directors, Dr Matthew Kelleher and Alison Nightingale, would be responsible for the salvage excavation program. Dr Matthew Kelleher would direct the excavation component of the Aboriginal archaeological assessment. Matthew has extensive experience in managing archaeological excavations and research projects. Matthew would also be the principal contact for the overall Aboriginal archaeological assessment for the project. The salvage excavation will be undertaken in association with registered Aboriginal stakeholders.

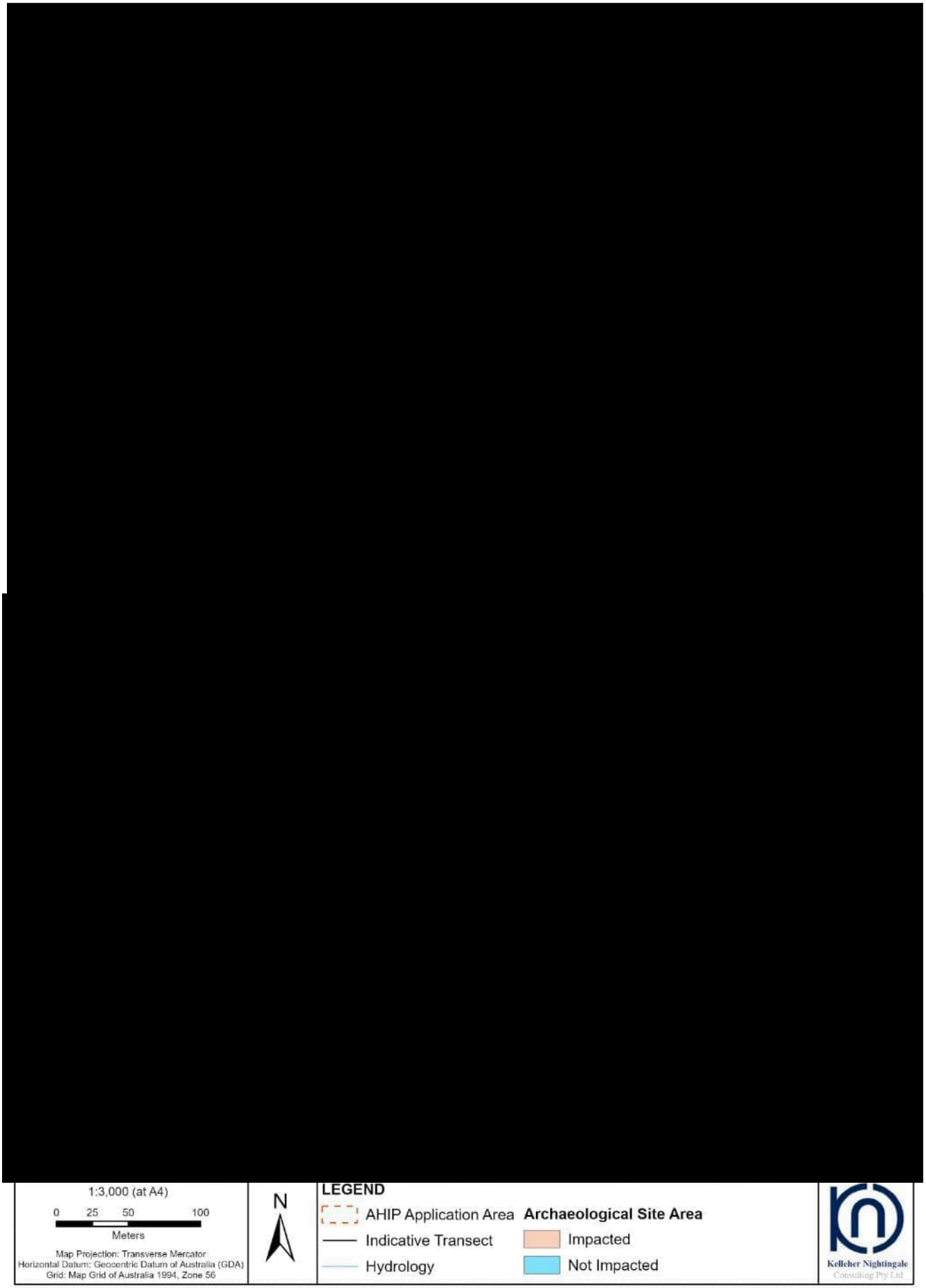

Figure 24. Indicative Phase 1 Transects – Rossmore Grange AFT 1 and Western Road AFT 1