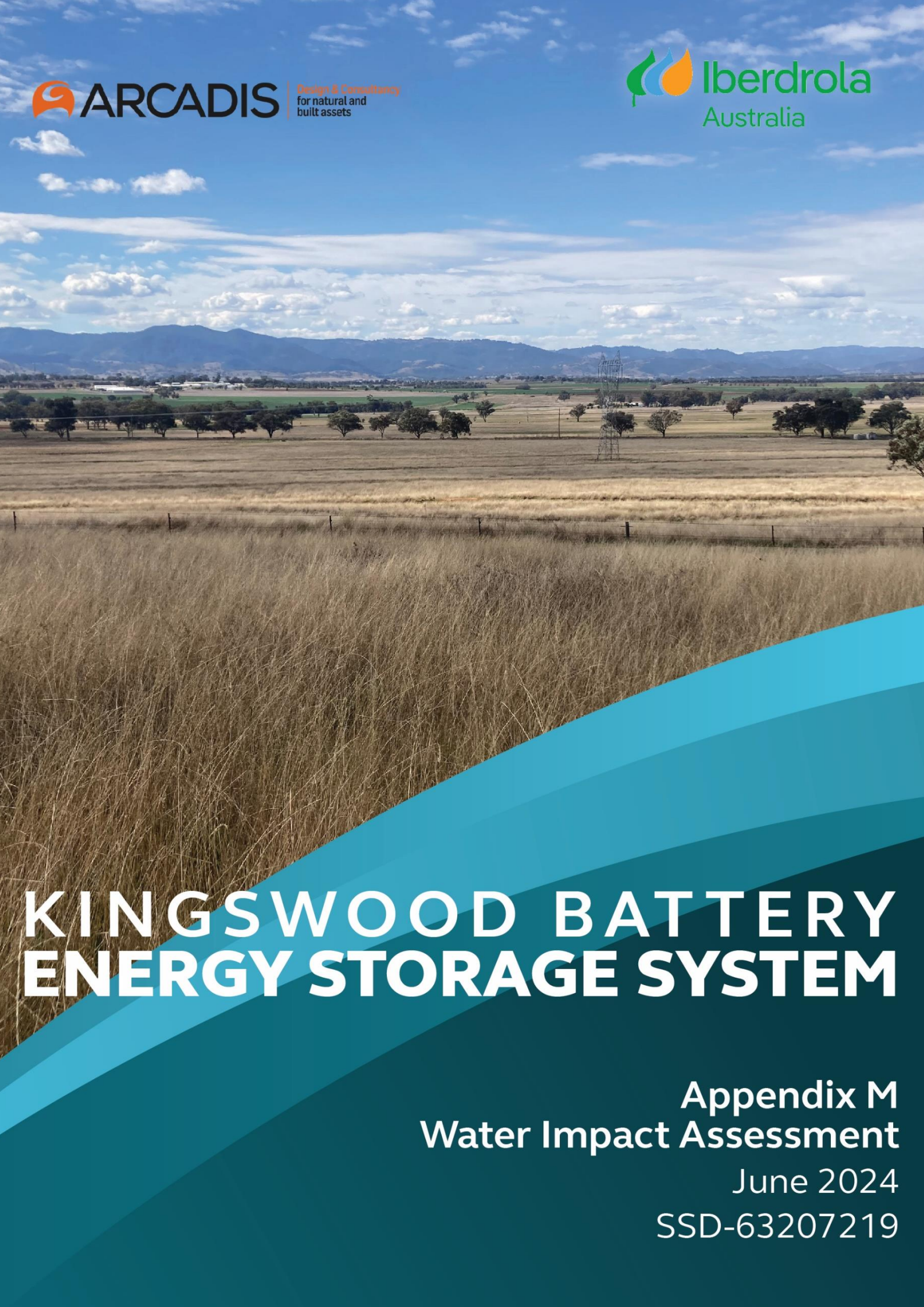




KINGSWOOD BATTERY ENERGY STORAGE SYSTEM

Appendix M
Water Impact Assessment

June 2024

SSD-63207219

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1 Introduction

1.1 Project overview

Iberdrola Australia Limited (Iberdrola) (the Proponent) is seeking development consent for the construction, operation and maintenance of a large-scale Battery Energy Storage System (BESS) in Kingswood, NSW at 744 Burgmanns Lane, Kingswood 2340 (Lot 43 DP1064582) (the Project Site). The BESS would have a capacity of up to 270 Megawatts (MW) and up to 1080 Megawatt-hours (MWh) of battery storage capacity (the Project).

The Project is considered to meet the definition of State Significant Development under Clause 2.6 of the *State Environmental Planning Policy (Planning Systems) 2021*. The Project would be for electricity generating works on land that is permitted with development consent under Clause 2.35 of the *State Environmental Planning Policy (Transport and Infrastructure) 2021*.

The Proponent is seeking State Significant Development (SSD) approval for the Project under Part 4, Division 4.7 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

The Project Site is within the Tamworth Regional Local Government Area (LGA), around six kilometres southeast of Tamworth and two kilometres west-south-west of Calala town centre and borders the suburb of Calala.

The Project would involve construction and operation of the following:

- BESS including battery enclosures, inverters, transformers, switch gear and control building
- Onsite 33/330 kV substation to convert electricity between the high voltage transmission network and medium voltage BESS
- High voltage transmission connection (above ground and/or below ground) between the BESS and the Tamworth substation
- Ancillary infrastructure and mitigative features including:
 - Site access to the BESS from Ascot-Calala Road
 - Internal site access road and parking
 - Permanent office and staff amenities
 - Operations and maintenance building
 - Stormwater management infrastructure
 - Services and utilities
 - Lighting, fencing and security devices
 - Noise acoustic barriers
 - Asset protection zone
 - Landscaping and screening vegetation.

The BESS would operate 24 hours a day, seven days a week and be monitored remotely, with infrastructure maintenance undertaken onsite. Figure 1-1 shows the operational overview of the Project.

Kingswood BESS – Water Assessment

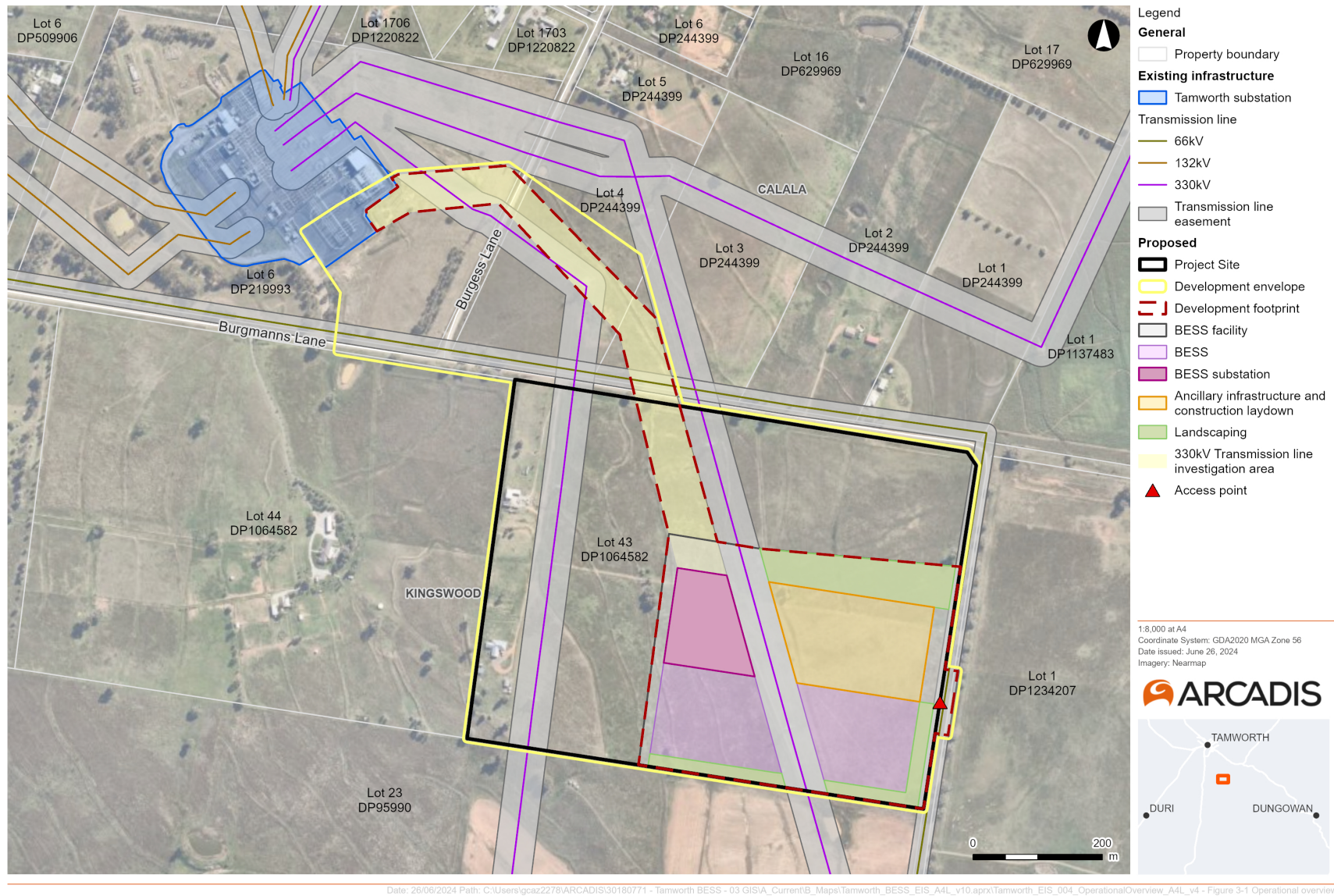


Figure 1-1: Project overview

1.2 Assessment framework and purpose

The purpose of this Water Impact Assessment (WIA) is to identify, evaluate and mitigate the expected impacts resulting from the construction and operational stage of the Project on the surrounding water network.

The assessment was prepared in accordance with the requirements of the NSW Department of Planning and Environment (DPE) (now Department of Planning, Housing and Infrastructure (DPHI)), which are set out in the Secretary's Environmental Assessment Requirements (SEARs) (SSD 63207219) for the Project, issued on 30 October 2023. The SEARs identify matters which must be addressed in the Project Environmental Impact Statement (EIS). This WIA responds to SEARs relating to water issues.

Table 1-1 lists requirements for the Project relevant to this assessment and references where they are addressed in this report or in the EIS.

Table 1-1: SEARs for the assessment of water

Requirement	Section reference
Water	
A detailed and consolidated site water balance and an assessment of the likely impacts of the development (including flooding) on surrounding watercourses (including their Strahler Stream Order) and groundwater resources and measures proposed to monitor, reduce and mitigate these impacts including water management issues;	Section 5.1 Chapter 6 Chapter 7
Details of water requirements and supply arrangements for construction and operation	Section 5.1
A description of the erosion and sediment control measures that would be implemented to mitigate any impacts in accordance with Managing Urban Stormwater: Soils & Construction (Landcom 2004)	Chapter 5.2
Assessing the impacts of the development, including any changes to flood risk and overland flows on-site or off-site, and detail design solutions and operational procedures to mitigate flood risk where required	Chapter 6
Where the project involves works within 40 metres of any river, lake or wetlands (collectively waterfront land), identify likely impacts to the waterfront land, and how the activities are to be designed and implemented in accordance with the DPI Guidelines for Controlled Activities on Waterfront Land (2018) and (if necessary) Why Do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings (DPI 2003), and Policy & Guidelines for Fish Habitat Conservation & Management (DPE, 2013)	Not applicable, no works are proposed to occur within 40m metres of any river, lake or wetland.

In addition to the above SEARs, Tamworth Regional Council (TRC), as part of pre-SEARs advice in a letter dated 26 October, raised additional comments. TRC water related comments and the response is provided in Table 1-2.

Table 1-2: TRC comments as part of the SEARs submission

Comment	Response / section reference
Water	
The site itself is not mapped as flood prone land. However, access to the site is affected by flooding with different potential access routes affected by road closures to different degrees. The assessment of the site access route(s) needs to consider flooding	The proposed route for heavy vehicle traffic will be via Whitehouse Lane and Ascot-Calala Road, which will avoid passing through the urban portion of Calala. This avoids the Burgmanns Lane causeway which is known to be prone to flooding (Goonoo Goonoo Creek). It is noted that this causeway is proposed to be replaced / upgraded in the future. The Traffic Management Plan for the Project will identify the emergency route to be used in consultation with stakeholders prior to construction.

1.3 Report structure

This report has been structured as below:

- **Chapter 1:** An overview of the Project and purpose of the assessment
- **Chapter 2:** An overview of the relevant regulatory framework
- **Chapter 3:** A description of the existing environment within and surrounding the Project
- **Chapter 4:** An overview of the Project design and construction activities
- **Chapter 5:** A description of the proposed water management strategy
- **Chapter 6:** Identification of potential impacts of the Project on water during both the construction and operational phases
- **Chapter 7:** Required mitigation measures to avoid, minimise, mitigate and/or manage the potential impacts of the Project
- **Chapter 8:** An overall conclusion of the report with respect to water management and potential impacts of the Project.

2 Regulatory framework

2.1 Water Management Act 2000

The objects of the *Water Management Act 2000* (WM Act) are to provide for the sustainable and integrated management of the water sources (surface and alluvial) of the state for the benefit of both present and future generations. The WM Act provides for water sharing between different water users, including environmental, basic rights or existing water access holders and provides security for licence holders.

The licensing provisions of the WM Act apply to those areas where a water sharing plan (WSP) has commenced. WSPs are statutory documents that apply to one or more water sources. They define the rules for sharing and managing water resources within water source areas. WSPs describe the basis for water sharing and document the water available and how it is shared between environmental, extractive and other uses. The WSPs outline the water available for extractive uses within different categories, such as local water utilities, domestic and stock, basic landholder rights, irrigation and industrial uses.

No take from the surface water resource is proposed as part of the Project, however, water extracted from the participating landholder's existing bore (GW055998) may be utilised to supplement potable water and imported water for construction use and operational irrigation. To use water from bores onsite, a Water Access Licence (WAL) would need to be obtained (refer Section 5.1).

2.2 Waterfront land requirements

Approval for development on waterfront land must be obtained from the Natural Resources Access Regulator (NRAR). The NRAR administers the *Water Management Act 2000* to ensure that no more than minimal harm will be done to waterfront land as a consequence of carrying out a controlled activity. The overarching objective of the act is to establish and preserve the integrity of riparian corridors.

Waterfront land applies to all land within 40 meters of the highest bank of a river, lake or estuary. The Guidelines for Controlled Activities on Waterfront Land (NRAR, 2018) outline the required riparian corridor widths based on the watercourse order and identify which works can take place within the riparian corridor.

Where a watercourse does not exhibit the features of a defined channel with bed and banks, the Office of Water may determine that the watercourse is not waterfront land for the purposes of the *Water Management Act 2000*.

No watercourses are within or immediately surrounding the Project Site and no road upgrades are proposed for the Project.

2.3 Australian and New Zealand Guidelines for Fresh and Marine Water Quality

The New South Wales Water Quality and River Flow Objectives provide guideline levels to help manage water quality that have been developed for each catchment in NSW. The Project Site is within the Naomi River catchment where stormwater runoff ultimately flows north to the Peel River, a major regulated river.

The waterways immediately downstream of the Project Site are categorised as uncontrolled streams where flow patterns are largely natural and typically ephemeral. The water quality objectives for these streams include the protection of aquatic systems, visual amenity, secondary contact recreation, primary contact

recreation, livestock water supply, irrigation water supply, homestead water supply, drinking water (disinfection only, clarification and disinfection and groundwater), aquatic foods (to be cooked before eating).

River objectives for these uncontrolled streams include protecting pools in dry times, protecting natural low flows, protecting important rises in water levels, maintaining wetland and floodplain inundation, managing groundwater resources for ecosystems and minimising effects of weirs and other structures.

These water quality and river objectives draw examples of water quality criteria from the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC, 2000). Any required water quality monitoring is to refer to the ANZECC guidelines for the selection of appropriate monitoring parameters and assess measurements against the defined trigger values. The trigger values may require refinement for local conditions but must still protect the environmental value and drive local protection or improvement of water quality.

2.4 Tamworth Regional Council

2.4.1 Development control plan

Under Section 2.10 of the *State Environmental Planning Policy (Planning Systems) 2021*, development control plans, developed under local environmental plans (LEPs), are not applicable to SSD. Notwithstanding, the TRC Development Control Plan (DCP) 2010 has been considered in determining existing conditions and constraints and ensuring impacts are minimised where feasible and reasonable. Key development controls related to stormwater management and flooding are outlined below, with extracts provided as Appendix A.

Environmental Controls

The DCP provides the following environmental controls relating to all development:

- Environmental effects:
 - The application documentation shall identify any potential environmental impacts of the development and demonstrate how they will be mitigated. These impacts may relate to:
 - Traffic
 - Flood liability
 - Slope
 - Construction impacts
 - Solid and Liquid Waste
 - Air quality (odour and pollution)
 - Noise emissions
 - Water quality
 - Sustainability
- Soil and Erosion Control:
 - Runoff shall be managed to prevent any land degradation including offsite sedimentation.
 - Reference shall be made to the NSW Governments Managing urban stormwater: soils and construction, Volume 1 (available from Landcom), commonly referred to as “The Blue Book”.
 - Cut and fill will be minimised and the site stabilised during and after construction.
 - Arrangements in place to prompt revegetation of earthworks to minimise erosion.

Development on Flood Affected Land

The DCP outlines flood related development controls which apply to land below the flood planning level, referred to as “flood affected land”. The DCP defines the 1% AEP (100-year ARI) flood event as its flood planning level. However, the DCP notes the TRC Local Environmental Plan (LEP) 2010 defines the flood planning level as the 1% AEP flood event plus 0.5 metre freeboard which is to take precedence.

Both the DCP and LEP provide mapping of the flood affected land. The Project Site is located beyond the mapped flood extent (as illustrated in Appendix A). TRC also noted in their pre-SEARs advice that the Project Site is not mapped a flood prone. Flooding of Goonoo Goonoo Creek at Burgmanns Lane and Whitehouse Lane is apparent in this mapping, as discussed further in Section 3.7.

2.4.2 Engineering Design Minimum Standards

The Engineering Design Minimum Standards for Subdivision and Developments, Version 2, May 2023 outlines Council’s general procedures and practices in respect of the engineering design requirements for subdivision and development of land within the Council area. Part 3 provides minimum standards for stormwater drainage. For the purposes of stormwater drainage design the existing Project Site would be considered a rural area as it is predominately undeveloped and greater than 10 hectares. In accordance with this Council guideline, the applicable Drainage Design Standard for the Project Site is anticipated to be DDS 3. This categorisation is based on the existing conditions of the Project Site with no formal kerb and gutter or underground piped drainage network in place either within or immediately downstream of the site, as discussed further in Chapter 3.

This guideline also provides methodology, modelling and design parameters to be used in the design of stormwater drainage networks. The following design recurrence intervals are applicable:

- Minor drainage system – rural areas – 20% AEP (5-year ARI)
- Major drainage systems – 1% AEP (100-year ARI)
- Transverse Drainage Structures – minor road – 10% AEP (10-year ARI)

2.5 Standards and guidelines

The following standards and guidelines are relevant to the Project:

- Australian Rainfall and Runoff (Commonwealth of Australia, 2019)
- Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC, 2000)
- Flood Risk Management Manual (State of NSW and Department of Planning and Environment, 2023)
- Liquid Chemical Storage, Handling and Spill Management: Review of Best Practice Regulation (DEC, 2005)
- Managing Urban Stormwater: Soils and Construction – Volume 1, commonly known as the ‘Blue Book’ (Landcom, 2004)
- Storing and Handling liquids: Environmental Protection: Participant’s Manual (DEC, 2007)

3 Existing environment

Site Photos from January 2024 illustrating the existing conditions within an surrounding the Project Site are provided as Appendix B.

3.1 Climate

Climate data was sourced from the Bureau of Meteorology website for the Tamworth Airport AWS weather station (station number 055325). The weather station located 14 km northwest of the Project Site is currently operational and has collected data from 1992. The average total annual rainfall over this 32 year period was 649 mm. The monthly variation in average rainfall and temperature is shown below in Figure 3-1. Rainfall occurred on an average of 61 days of the year with April and May being the driest months.

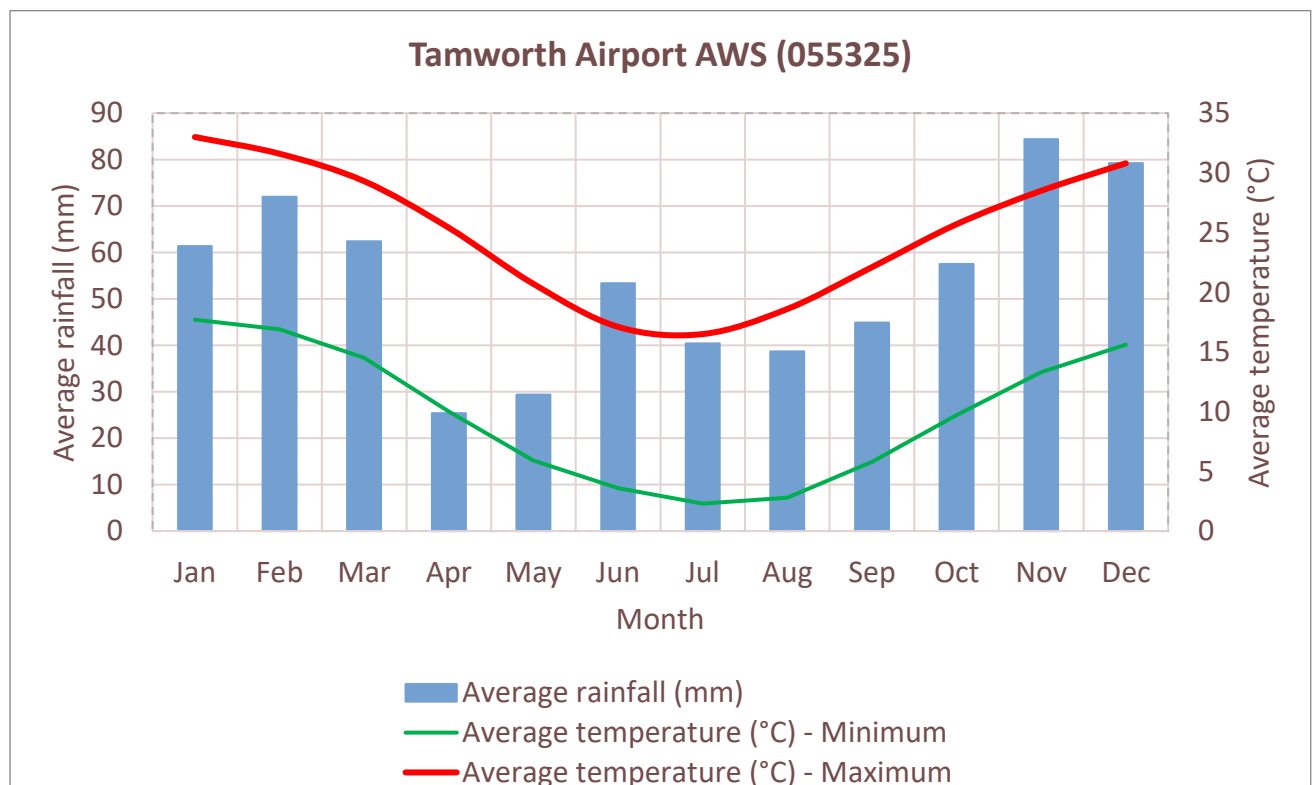


Figure 3-1: Tamworth climate statistics

3.2 Land use

The existing Project Site and immediately surrounding properties are large rural blocks of cleared grazing land bounded by wire fencing. The ground cover is long grasses with unsealed gravel roadways bordering the site. A few isolated patches of vegetation and trees are present within the site. A residential house and several sheds are located along the western edge of the Project Site accessed via a dirt driveway. Livestock graze within the Project Site. Two overhead transmission lines cut through the Project Site as shown in Figure 1-1.

3.3 Water and sewer supply

It is understood that the existing site is not serviced by any mains water or sewer connections. No new connections are proposed as part of the Proposal, as discussed further in Section 5.1.

3.4 Soils

The soil runoff potential and erosion hazard has been reviewed based on the Landcom 2004 Managing Urban Stormwater: Soils and Construction – Volume 1 (commonly known as the ‘Blue Book’). The following soils landscapes were identified for the Project Site based on the Soil Conservation Service of NSW Sydney 1:100,000 Soil Landscapes Series Tamworth Sheet:

- Fullwoods Hill (fh) – erosional: located in the higher elevations of the Project Site
 - complex soils; localised engineering hazard; inherent erosion risk; localised poor moisture availability; localised known recharge area; localised rock outcrop; shallow soils; sheet erosion risk. Soil materials have localised low wet strength; organic topsoils; high erodibility; hardsetting topsoils; and low permeability.
- Duri (du) – residual: located in the lower elevations of the Project Site
 - Complex soils; localised dieback; localised poor drainage; localised engineering hazard; gully erosion risk; inherent erosion risk; localised permanently high watertables; localised known discharge and recharge area; localised high run-on; localised dryland salinity; localised seasonal waterlogging; localised shallow soils; sheet erosion risk; localised wind erosion risk (under traditional cultivation). Soil materials have localised low wet strength; organic topsoils; stoniness; localised sodicity; localised high structural decline hazard; erodibility; localised hardsetting surfaces; and low permeability.

Sheet erosion is common to these soil landscape. The erosion hazard is considered low for a grazing land with sheet flow, and increases to a high hazard for concentrated flows. Based on the typical slopes for the Project Site the potential erosion hazard was generally found to be low.

3.5 Topography

A review of the site topography has been undertaken based on the 1 metre 2022 digital elevation model data covering the Project Site, 10m contour data for the region and hydroline spatial data sourced from the NSW Government Spatial Services, as illustrated below in Figure 3-2.

The Project Site is located along a ridgeline running north to south near the western lot boundary. The majority of the Project Site falls towards the east with elevations ranging from 460m AHD at the ridge in the southwest to 420m AHD in the northeast. A small area of the Project Site along the western boundary falls from the ridgeline to the north-west. The Project Site is steepest near the ridgeline with grades around 1:7 flattening out to less than 1:25 for the majority of the Project Site.

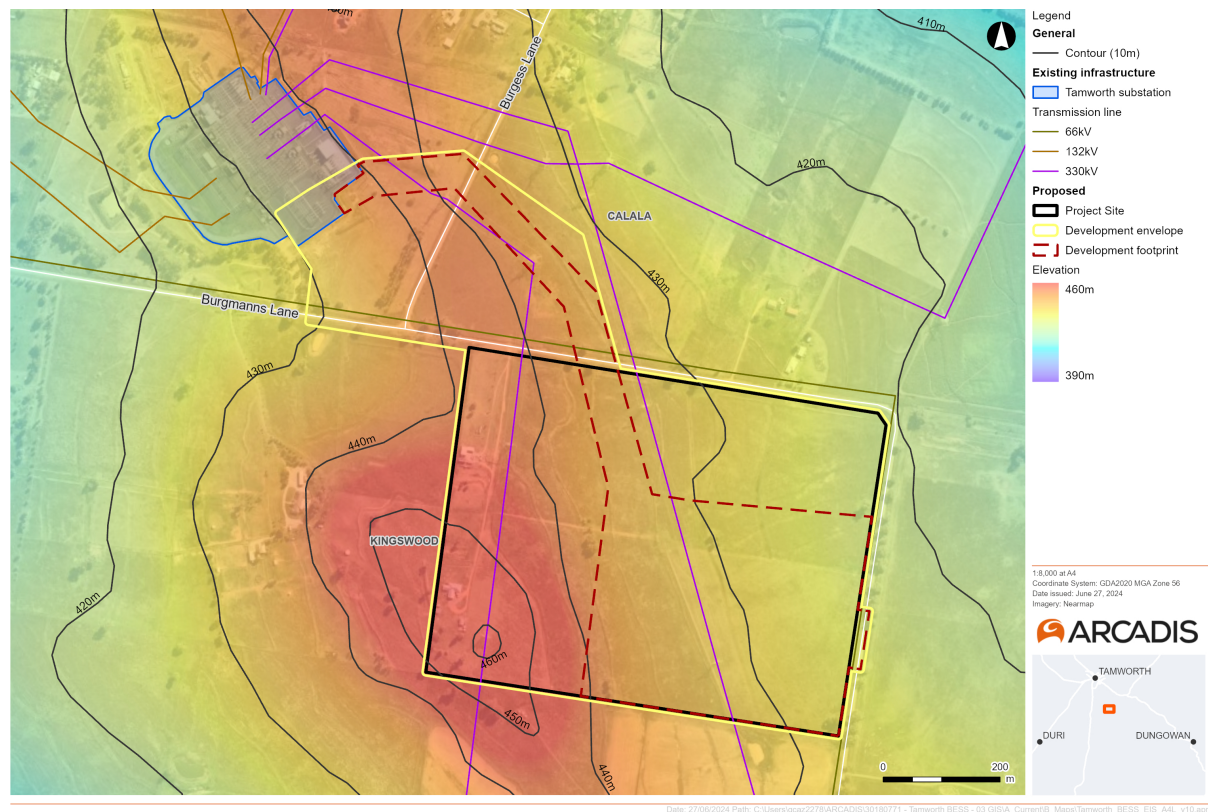


Figure 3-2: Topography

3.6 Hydrology

Stormwater runoff from the Project Site will travel overland to the downstream with minimal formal infrastructure in place to manage flows. No upstream catchments drain into the Project Site.

Alike other grazing land in the area, surface channels with parallel downstream bunds have been cut along the contours of the site to manage stormwater runoff. No other formal drainage infrastructure, including farm dams, are present within the Project Site. Downstream of the Project Site stormwater is expected to collect and be conveyed alongside overgrown roadside swales. Several minor cross drainage structures (circular culverts) are located beneath the roadways bordering the Project Site to convey flows to the downstream.

The majority of stormwater runoff from the Project Site area will drain east across similar rural properties to Calala Creek approximately 800 metres downstream of the Project Site. Stormwater runoff from a small portion of the Project Site will drain northwest to Goonoo Goonoo Creek approximately 1,300 metres downstream. No ephemeral watercourses are noted within or immediately downstream of the Project Site. Both Calala Creek and Goonoo Goonoo Creek drain north approximately 6 – 7 kilometres to the Peel River at Tamworth which ultimately drains to the Namoi River located within the northern basin area of the Murray-Darling Basin. Watercourses in the area are illustrated in Figure 3-3 below.

Kingswood BESS – Water Assessment

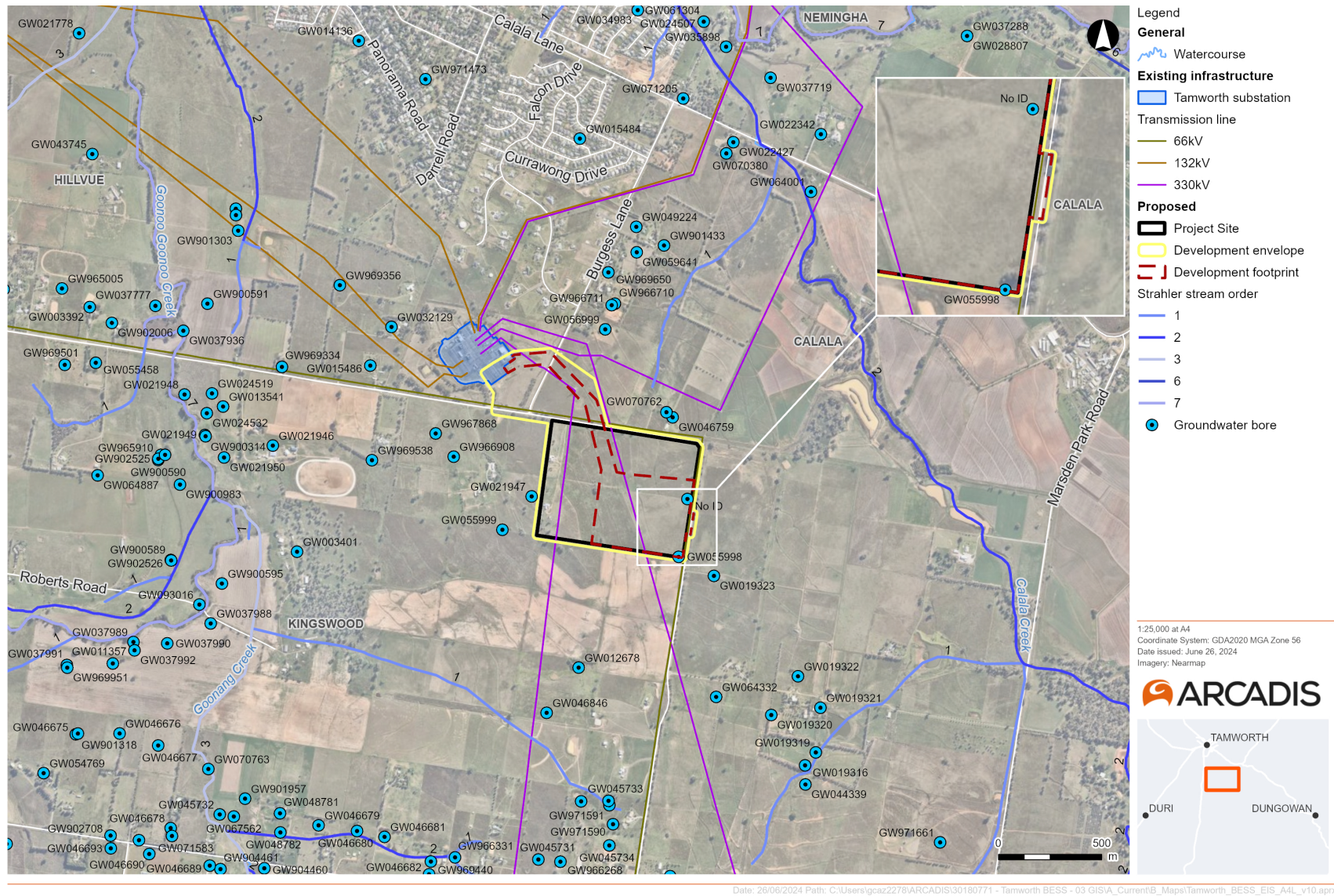


Figure 3-3: Watercourses

3.7 Flooding

The Tamworth City Wide Floodplain Risk Management Study (2023), produced by HydroSpatial for TRC, provides the latest flood information for the region. Flood mapping extracts from the Floodplain Risk Management Study have been provided as Appendix C.

A series of hydraulic models were developed for the Floodplain Risk Management Study with the Peel River and Kingswood TUFLOW models located nearest to the Project Site. The Project Site was not included in the hydraulic model extents given its elevation along the ridgeline making it beyond the flood extents of the major creeks modelled.

The Kingswood TUFLOW model extends along Goonoo Goonoo Creek from Whitehouse Lane to Burgmanns Lane located downstream of the Project Site and provides information for the creek crossings at these locations. The Peel River TUFLOW model also covers this extent, as well as the upstream of the confluence with Goonoo Goonoo Creek and Calala Creek, considering regional flood conditions for these areas.

For the Goonoo Goonoo Creek crossings at Whitehouse Lane to Burgmanns Lane, the Floodplain Risk Management Study found the time between rainfall commencing and peak flood levels being reached was less than 9 hours for the Peel River TUFLOW model and less than 5 hours for the Kingswood TUFLOW model for the 1% AEP (100 year ARI) design rainfall event. The duration of inundation of depths greater than 0.3 metres was greater than 10 hours for the Peel River TUFLOW model and less than 5 hours for the Kingswood TUFLOW model.

The preceding Tamworth City Wide Flooding Investigation (2019), produced by Lyall & Associated for TRC provides additional flood mapping of the peak flood depths for the 5% AEP (20 year ARI) (Figure 3-4), 1% AEP (100 year ARI), 0.5% AEP (200 year ARI) and Probable Maximum Flood (PMF) (Figure 3-5) events, as provided in Appendix C. For the Goonoo Goonoo Creek crossings, these maps illustrate flood depths greater than 1 metre in the 5% AEP event. The design water surface profiles for Goonoo Goonoo Creek illustrate the PMF peak flood extents and flood depths are considerably greater than the 0.5% AEP. Goonoo Goonoo Creek at the crossings is categorised as a high provisional hydraulic hazard and floodway in the 1% AEP event.

The real time water levels information is available online from WaterNSW for the Peel River at Tamworth (station number 419070) and Goonoo Goonoo Creek at Meadow Lane (station number 419097).

The Project Site was not indicated as being subject to flood-related development controls or within the flood planning area in the Floodplain Risk Management Study or Tamworth City Wide Flooding Investigation. As mentioned in Section 2.4.1 above, the Project Site is beyond the mapped extent for flood affected land (as illustrated in Appendix A) as outlined in the TRC DCP (2010).

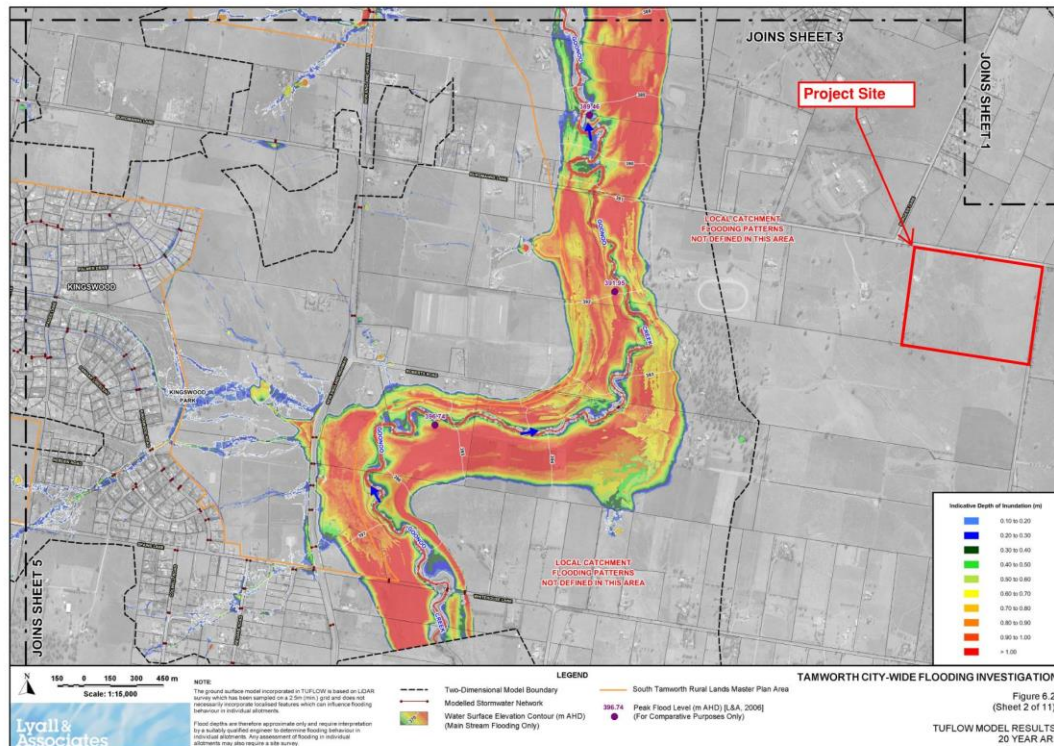


Figure 3-4: Flood Depth Mapping – 20-year ARI (5% AEP)

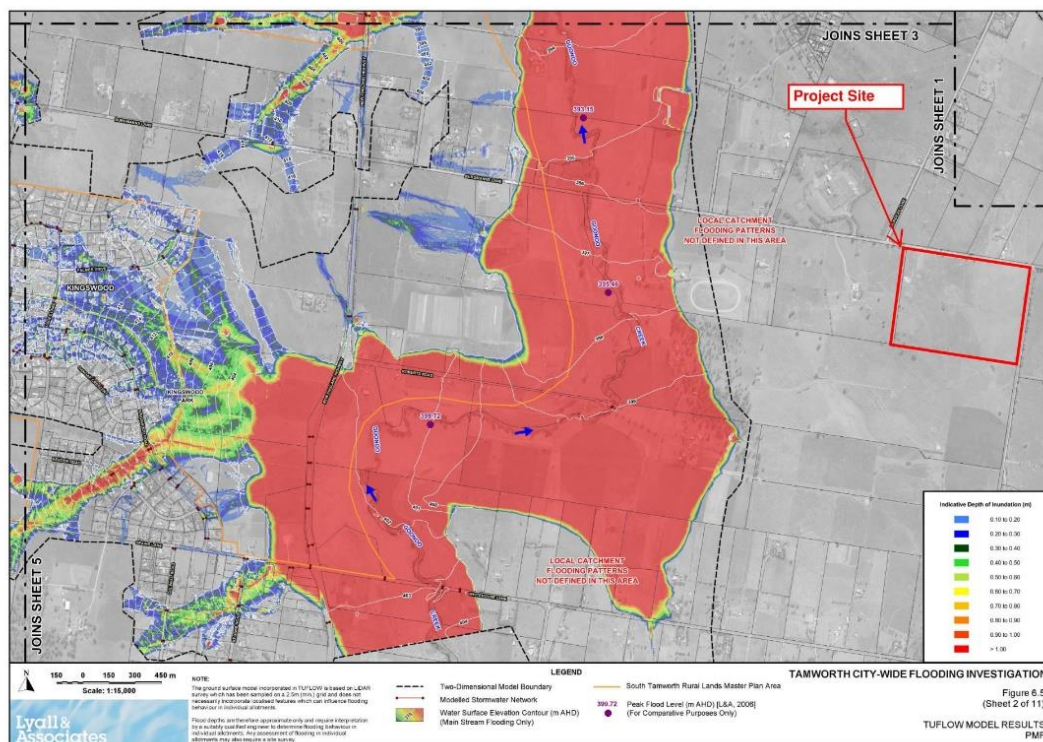


Figure 3-5: Flood Depth Mapping – PMF

3.8 Water quality

The Project Site is located downstream of the Chaffey Dam along the Peel River which supplies water to the city of Tamworth. As such flows and water quality along the Peel River are impacted by dam operations. Chaffey Dam is the primary water source for Tamworth with water treatment taking place at the Calala Water Treatment Plant located downstream of the Project Site.

No known water quality monitoring data is available for the Project Site or immediate downstream areas. Water quality monitoring results for stations along the Peel River were included in the Namoi Valley Annual Surface Water Quality Report 2021-2022. For this period flooding was the main driver for water quality across the Namoi Valley given the heavy rainfall experienced from December 2021 through to March 2022. The water quality scores for the Peel River stations are noted below in Table 3-1. The Peel River downstream of Chaffey Dam also had a red alert warning for blue-green algae during the January to February 2022 period.

Table 3-1: Peel River Water Quality Scores

Water Quality Monitoring Station	Station Number	Latitude Longitude	Location	Water Quality Score (2021-2022)
Peel River upstream of Paradise Weir	419024	-31.100560 150.938627	Upstream of Goonoo Goonoo Creek and Calala Creek confluences	73 Moderate*
Peel River at Carrol Gap	419006	-30.938601 150.529189	Approx 55km downstream of Tamworth	49 Poor*

(*) Score maintained within 5 points compared to 2020-2021

3.9 Groundwater

Existing groundwater bores surrounding the Project Site are shown in Figure 3-6. There are total of 41 groundwater bores located within a 1 km radius of the Project Site, used predominantly for water supply and irrigation purposes. Standing water level data was available for five of the groundwater bores, which reported water level ranging from 4 mAHD to 27.6 mAHD.

Based on the location of the surface watercourses and Project Site topography, the inferred groundwater flow direction at the Project Site is considered likely to be towards the northeast. The aquifer is considered to be porous, extensive and of high productivity.

There are two existing bores located on the Project Site along the eastern property boundary as shown in Figure 3-7 and Figure 3-8 below.



Figure 3-6: Existing groundwater bore (GW055998) – located at the southeast boundary of the Project Site



Figure 3-7: Existing groundwater bore (no known ID) – located along the midpoint of the eastern boundary of the Project Site

4 Project description

4.1 Project design and built form

4.1.1 BESS

The BESS is proposed to be located in the south east corner of the Project Site. The BESS would comprise the following components:

- Lithium-ion battery technology consisting of pre-assembled battery enclosures housing lithium-ion type battery cells, associated control systems and HVAC (heating, ventilation and air conditioning) units
- Power conversion system (PCS) incorporating inverters and transformers
- Ancillary infrastructure (electrical switchroom, control and office building, security fencing)

Each battery enclosure would contain a group of lithium-ion (Li-ion) batteries, housed within weather-proof enclosures. Battery enclosures will be arranged in rows and comprise:

- Racks of lithium-ion type batteries
- Battery management system to protect cells from harmful excesses of voltage, temperature, and current
- Energy management system that is responsible for system power flow control
- Thermal management system that controls all functions related to the heating, ventilation, and air-conditioning of the enclosure system.

The size of the individual battery enclosure would be dependent on the selected supplier. Each battery unit would be mounted on concrete footings, built foundations, compacted gravel, plinths or piles. The layout and spacing would be designed in accordance with appropriate standards to ensure integrity of the system.

4.1.2 33/330 kV Substation

A substation would be established to convert the medium voltage power produced by the BESS facility to high voltage power to enable connection to the Tamworth substation (and subsequently the grid). The substation would be fenced and include transformer switch bays and switchgear housed in portable substation containers. The substation would connect to the BESS facility by underground 33 kV cables.

4.1.3 Transmission connection

An approximate 800 m 330 kV transmission line (either above ground and/or below ground) would extend from the BESS substation to the southern end of the Tamworth substation. The connection would include a transmission easement in accordance with Transgrid requirements for 330 kV lines.

If above ground, the transmission line would be strung on two 330 kV double circuit steel lattice tension structures with 330 kV steel pole terminal structures.

As the final alignment of the transmission connection is subject to ongoing engagement with Transgrid, a broader area has been identified for the transmission connection.

4.1.4 Ancillary infrastructure

To support the operation of the Project several ancillary elements are proposed. These are described below in Table 4-1.

Table 4-1: Ancillary infrastructure

Ancillary infrastructure	Description
Site access and parking	Entry and egress access to the BESS would be via a new access road from Ascot-Calala Road. A car parking area for staff would be provided adjacent to the control and office building and would accommodate up to around ten spaces for operational and maintenance staff and visitors.
Operational and maintenance warehouse	An operations and maintenance area will be used to support the Project. The dimensions of the building are expected to be approximately 20 m long, 25 m wide and 5m high. The building is expected to be constructed using neutral Colorbond™-style materials. Alternatively, shipping containers may be used instead of a building. The operations and maintenance building will house materials and equipment for the upkeep and maintenance of the site and a small workshop.
Fencing	Security fencing (eg chain link or palisade) would be installed along the perimeter of the Project. Fencing would also be utilised to separate operational areas within the Project (i.e. the BESS, the BESS substation) to maintain operational safety.
Signage	Signs would be situated at several locations. These signs would be for the purposes of way finding, safety and building identification
Lighting	Standard lighting would be located around the Project, including the BESS, BESS substation, office and control building and internal roads and car park. Lighting would be used to maintain safety and security and to allow for out of daylight hours maintenance, as required. External lighting design would be consistent with <i>AS/NZS 1680.5:2012 Australian and New Zealand Interior and workplace, Part 5: Outdoor workplace lighting</i> and <i>AS 4282-1997 Control of the obtrusive effects of outdoor lighting</i> .
Lightning mast	Lightning protection masts would be installed with the final number and siting to be determined during detailed design and dependent on meteorological conditions at the site. The lightning protection masts are typically thin, tubular structures, and approximately 15 metres tall, with a concrete base and earthing.
Stormwater infrastructure	The Project would include the installation of stormwater management infrastructure, incorporated into the design of the Project to manage water quality during operation of the Project.
Services and utilities	Proposed service and utility connections to the Project include: - On-site security system including but not limited to, CCTV and an integrated telecommunication system - Connections to telecommunications infrastructure via fibre optic cable for high-speed internet 330 kV back fed supply for supervisory control and data acquisition (SCADA) system - Water tanks for offices and amenities. Potable water would also be brought in via tanker as required - Sewage would be managed via on-site septic tank or transported for management off-site via tanker.

Ancillary infrastructure	Description
Fire management	Firefighting water tanks would be located on the Project Site for fire suppression. These would be filled via water tankers and refilled as required.
Noise acoustic barriers	The Project would include the installation of noise acoustic barriers, incorporated into the design of the Project to manage noise during operation of the Project. The noise acoustic barrier will have a minimum surface density of 15 kg/m². Typical options include steel, timber, glass, perspex, polycarbonate, brick and concrete. The height of noise acoustic barriers will be refined following selection of the preferred supplier and be located around the BESS.
Landscaping and screening vegetation	The Project would include the installation of landscaping, incorporated into the design of the Project to manage visual during operation of the Project.

4.2 Construction activities

Key construction activities are expected to include:

- Civil and enabling works:
 - Establishment of temporary environmental and safety controls
 - Establishment of temporary construction compound and laydown areas
 - Establishment of site access point and construction of an internal access road and car park. The internal access road would become the permanent operational access road at the completion of construction
 - Surveying and investigations of onsite condition to implement final design
 - Environmental investigations or protection works (for example heritage, geotechnical and contamination investigations, where required)
 - Vegetation clearing to accommodate proposed infrastructure and asset protection zones
 - Earthworks (cut and fill), levelling, compaction and other civil and ground preparation activities to desired design levels (including the removal of spoil)
- Construction of concrete pads / hardstand areas to support BESS and associated infrastructure
- Delivery, installation and electrical fit-out for the Project, including control building, battery enclosures, inverters, transformers and associated cabling and infrastructure (BESS components are largely prefabricated and will be lifted directly into place from the delivery vehicle)
- Installation of overhead or underground cabling from the BESS substation to the Tamworth substation, including construction of foundation piles for transmission tower structures (if overhead)
- Construction of ancillary elements including, offices and amenities, installation of utility services, fire systems and signage
- Installation of permanent fencing and security system
- Landscaping
- Testing and commissioning
- Removal of construction equipment and rehabilitation of construction areas.

5 Water management strategy

This chapter describes the proposed water management approach for the Project. A conceptual approach to water management for the Project has been developed to inform this EIS. This will be subject to further design development as part of detailed design.

5.1 Water requirements and supply arrangements

Water supply will be required for construction activities, primarily for dust suppression as well as the initial filling of the 20,000 litre water tank for fire suppression, and staff amenities. The operation of the Project will require minimal water use as the proposed BESS infrastructure does not require water to operate and would be remotely operated. Operational water would generally be limited to staff amenities, landscaping irrigation and topping up of the fire water tank as required. As water use during for the operational phase of the Project is minimal, a detailed site water balance has not been prepared for this EIS.

Water sources appropriate for the specific water usage and demand volumes would be employed. The likely water sources are outlined in Table 5-1 and water demand estimates for the Project are outlined in Table 5-2.

Table 5-1: Water sources

Water source option	Discussion
Reuse of captured rainwater and stormwater runoff within rainwater tanks and temporary / permanent stormwater infrastructure (i.e. operational basin)	Would not require any licenses or approvals under the <i>Water Management Act 2000</i> .
Arrangement with the local utility (TRC) to utilise the Tamworth town water supply network	Potable water would be brought in via tanker in agreement between the Proponent and TRC. Would not require any licenses or approvals under the <i>Water Management Act 2000</i> . Preliminary feedback from the TRC identified that an agreement would be possible, however the volume of water available would be subject to water restrictions during periods of drought.
Use of the existing groundwater bore (GW055998) (Figure 3-7) or construction of a new water supply bore within the Project Site.	Pump testing would be required to ensure the existing water bore has the required capability, capacity and quality of water required, if the existing water bore is to be used. A WAL would need to be established and entitlement could be secured, either temporally or permanently via the water trading market. Providing the existing landholder's bore is sufficient to supply water potentially required to supplement construction and operation, a water supply work approval (WA) will be required to change the approved usage of the bore from stock and domestic use to water supply use

Table 5-2: Water demands

Phase	Primary water demands	Water estimate
Construction	- Dust suppression and washdown - Maintaining access routes - Workforce consumption and amenities - Construction activities (earthworks, compaction, concreting) - Fire suppression	Potable water source would be required for workforce consumption (drinking water), fire suppression water and concreting. Water consumption demand is estimated to be up to 1kl per day (based on 10l/person/day). Fire suppression water would total 20kl and in the unlikely event of an emergency a top-up would be required. Construction will require dust suppression of active disturbed areas. Assumed to occur on days with no rain (304 days/year on average). Active disturbed areas will be minimised through construction staging and erosion and sediment control planning, including consideration of chemical suppressants to reduce dust generation and associated water demands. Details of the construction staging would be finalised during detailed design and appointment of the contractor, however, water demands anticipated to be typical for civil projects of this nature and size. Based on the above, the overall demand on water resources during construction are considered to be temporary and manageable.
Operation	- Amenities - Fire suppression - Landscaping irrigation	Potable water source would be required for workforce consumption (drinking water) and fire suppression water. Drinking water would be minimal given the Project would be remotely operated (assumed to be 20l per day (based on 2FTE, 10l/person/day). Fire suppression water would total 20kl and in the unlikely event of an emergency a top-up would be required.

5.2 Construction

Prior to construction, a Soil and Water Management Plan (SWMP) and Erosion and Sediment Control Plan (ESCP), or equivalent, would be incorporated into the Environmental Management Strategy (EMS) for the construction of the Project. The SWMP and ESCP would be developed in accordance with the principles and requirements of the Landcom 2004 Managing Urban Stormwater: Soils and Construction – Volume 1 (commonly known as the ‘Blue Book’).

Temporary construction erosion and sediment control measures that would be implemented prior to construction of the Project include sediment fences, temporary sediment basins, shaker grids and/or wash down areas at the vehicle access point. The ESCP will be progressively updated to reflect the changing nature of the Project site as construction activities progress.

The ESCP will be progressively updated to reflect the changing nature of the Project site as construction activities progress. The following aspects would be addressed within the SWMP and ESCP:

- Appropriate sediment and erosion controls are to be implemented prior to soil disturbance
- Demarcation of vegetation clearing boundaries, sensitive areas and vegetation within vicinity of the construction footprint that is to be retained prior to construction, clearing or stripping works commencing.
- Limiting the area and duration of disturbance and avoid working in wet weather.
- Stormwater management to avoid flow over exposed soils

- Location of stockpiles to be outside of localised depressions, overland flow paths and areas below the 1% AEP flood level as far as practicable
- Inspection of all erosion and sedimentation control works and existing stormwater drainage network prior to and post rainfall events
- Stabilisation of disturbed areas (including access roads) is to be undertaken as soon as practicable, progressively, throughout the phased works to minimise disturbed areas exposed to the forces of erosion at any one time
- Dust suppression within Project Site and immediately surrounding roadways
- Wheel wash or rumble grid systems installed at Project Site entry/exit to minimise transfer of dirt onto external roadways
- Construction traffic restricted to delineated access tracks and maintained until construction complete
- Pre-start checks, as well as maintenance in accordance with manufacturer requirements to be undertaken on equipment to minimise the potential for leaks and spills from vehicles
- Storage of materials on-site to be minimised
- Suitable waste receptacles to be provided and maintained
- Storage of any fuels, oils, lubricants, chemicals, Dangerous Goods and similar products will be stored in accordance with appropriate standards with emergency spill kits maintained on-site
- Wet weather monitoring protocol including water levels for Goonoo Goonoo Creek (station number 419097) and the Peel River at Tamworth (station number 419070), as well as predicted rainfall events.

In general, the ESCP will aim to maximise the separation of ‘clean’ water from offsite, and ‘dirty’ water from on-site. Site boundary controls will be implemented (e.g. sediment fencing, earth banks, mulch bunds, swales and table/diversion drains) around the perimeter of the construction boundary, as early in the construction process as possible. Water diversion drains (channels/bunding) and swales will be stabilised to minimise channel erosion.

5.3 Operation

The details of water quality control infrastructure would be developed following final product specification based on the selected supplier during the detailed design process. The existing stormwater management infrastructure within and immediately downstream of the Project Site would be maintained where feasible. This includes the small surface channels/bunds, roadside swales and minor cross drainage culverts. Additional channels/bunding will be used to divert stormwater runoff around the operational areas to the downstream as needed. Level spreaders and/or scour protection measures will be employed where required to manage impacts of concentrated flows.

Within the operational area of the Project Site, stormwater runoff will be collected in surface drains and conveyed to a surface stormwater basin/s for retention, detention and water quality treatment. Where appropriate, the stormwater basin/s may function as temporary sediment basins during the construction period.

The basin/s will be designed as a wet basin to retain stormwater for on-site reuse (e.g. dust suppression), with a dedicated volume for collected sediment. The basin/s will have a sufficient volume to mitigate peaks stormwater flows leaving the Project Site to existing conditions up to the 1% AEP design event. The outlet of the basin/s will be designed with a closure mechanism (e.g. penstock gate) on the low level outlet which may be used to further detain flows from leaving the Project Site in the event of a spill/firewater discharge.

From the outlet of the stormwater basin/s, flows will be conveyed to the downstream (Ascot-Calala Road) via vegetated swales. Overland flow paths and concentrated flow outlet location are to be suitably stabilised and

protected from scour. The detailed design will review the capacity of the existing roadside swales and cross drainage culvert to confirm if additional upgrades/maintenance is required.

The detailed design would meet applicable Australian standards and guidelines and align with the TRC DCP (2010) where appropriate. Project infrastructure would be elevated above flood levels in accordance with applicable industry standards and guidelines. For the batteries and electrical equipment these will be elevated above the 1% AEP flood level as a minimum.

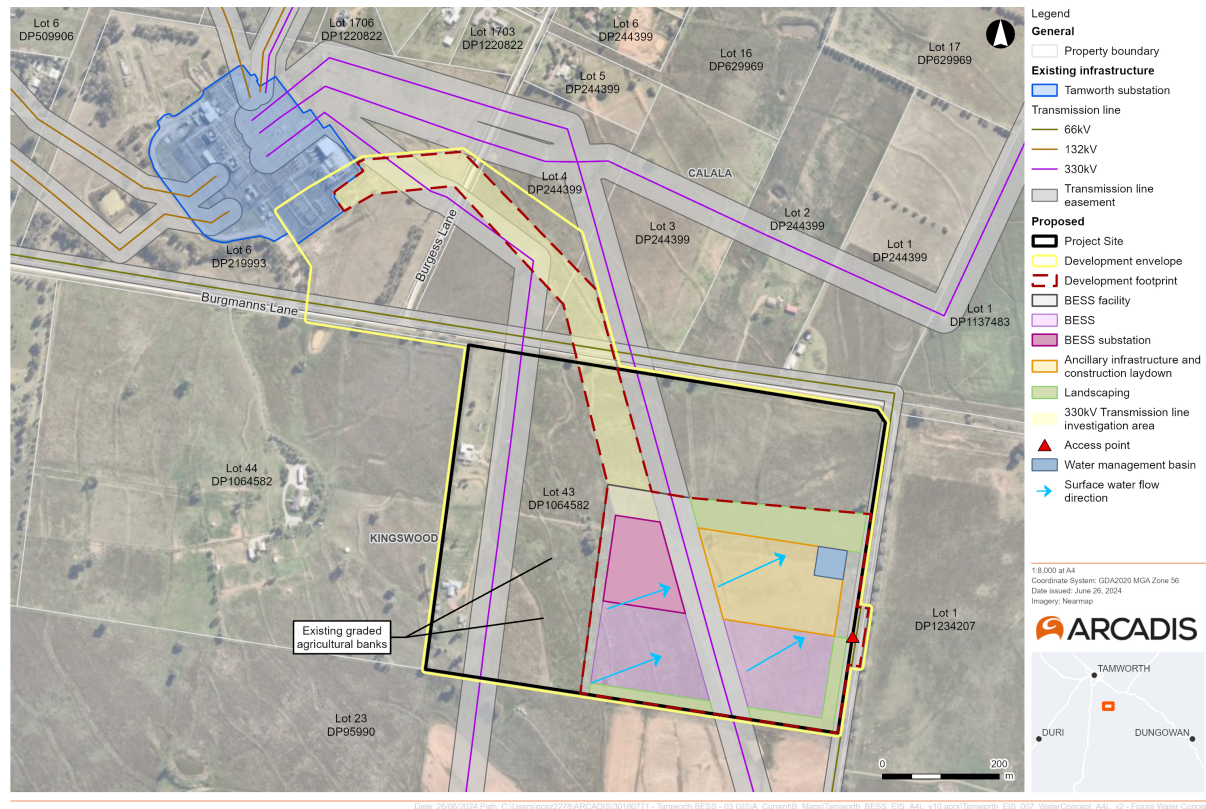


Figure 5-1 Indicative location of water management basin

6 Potential impacts

6.1 Construction

6.1.1 Water security

As described in Section 5.1, during development of detailed design and construction staging, a detailed construction water balance would be developed to ensure the works are staged appropriately such that water can be sourced in the required quantities. Where a shortfall is identified, the staging should be adjusted. Following implementation of these proposed mitigation measures no residual impact to water sourcing is anticipated for the Project.

6.1.2 Surface water quality and quantity

Construction activities with the potential to impact the surface water quality and quantity of the downstream environment associated with the Project construction include:

- Alteration of the topography of the Project site
- Vegetation clearing
- Concentration of surface water flows
- Use of water for construction activities such as dust suppression
- Stockpiling of materials
- Spills or leaks of substances such as oil, hydraulic fluids and fuels
- Waste materials from construction activities
- Movement of vehicles and equipment.

The risk of construction activities impacting water quality, flood risk or water quantity is increased in proximity to areas such as concentrated overland flow paths and construction compound areas where stockpiling of materials and equipment occurs. Offsite water quality impacts (including spills of stored materials and fuels), erosion and sedimentation could occur in the downstream during construction.

Access to the Project Site may be impacted should flooding occur along Goonoo Goonoo Creek at Whitehouse Lane or Burgmanns Lane. The Traffic Management Plan and Emergency Management Plan for the Project would detail the alternative route to be used in consultation with stakeholders during the detailed design of the Project.

Potential residual risks and impacts are considered minor and manageable for a Project of this scale with implementation of the SWMP and ESCP (Section 5.2) and the short term and temporary nature of construction works.

6.1.3 Groundwater

As identified in Section 3.9, 41 groundwater bores are located within a 1 km radius of the Project Site. Standing water level data was available for five of the groundwater bores, which reported water level ranging from 4 mAHD to 27.6 mAHD.

While exact details of the final design layout and foundation requirements are to be developed during detailed design, it is likely that works will include some surface excavation to permit slab installation and foundations as well as trenching to install services (such as the transmission connection). It is unlikely that depths of any earthworks would exceed 4 metres of depth below the ground level and, accordingly, interaction with the local aquifer is not anticipated.

6.2 Operation

6.2.1 Water security

During operation, minor water requirements are anticipated for onsite facilities, any maintenance, or to maintain volumes for fire-water management. No impacts to water sources during operation are predicted on this basis.

6.2.2 Surface water quality and quantity

Without mitigation measures, changes to the topography, ground cover and overland flow paths of the Project Site may increase stormwater runoff volumes and peak flows leaving the site. This may lead to erosion and sedimentation and reduced flood immunity/worsening flood conditions downstream.

Pollutants of concern would include typical stormwater pollutants such as gross pollutants (litter and small vegetation/debris), sediment (in the form of increased TSS loads/concentrations) and nutrients (in the form of increased TN and TP loads/concentrations).

The battery and transformer units would be fully enclosed without the generation of leachate or other process wastewaters. Notwithstanding this, handling of materials that pose enhanced water quality risks will occur, although infrequently, during the site's operation. Other Project specific pollutants and contaminants of concern would include:

- Hydrocarbons and oil/grease associated with the handling of fuels and hydrocarbons
- Chemical hazards and oil leakage from site infrastructure
- Exposure of materials during catastrophic conditions (e.g., battery fires).

As specified in Section 5.3 detailed design water quality control infrastructure will be developed following final product specification based on the selected Project supplier. The overarching design and development of infrastructure and engineered control during detailed design would include:

- Ongoing consultation with TRC on required water control controls to manage general risks associated with increases in impervious areas. Infrastructure would be developed with consideration to TRC's DCP (Appendix A)
- Design of oil-water management controls within the onsite BESS substation to consider relevant Australian Standards, as well as any requirements of electricity distributors
- Design of stormwater infrastructure would include a closure mechanism (e.g. penstock gate) or alternative arrangement to detain flows from leaving in the event of a spill/firewater discharge.

With implementation of the above, the Project is not anticipated to result in unacceptable risks with relation to general surface water quality, flood risk and quantity. Appropriate management plans, such as an Operational Water Management Plan (WMP) and Emergency Management Plan would be embedded in the EMS to monitor and manage operational water during routine and emergency scenarios.

6.2.3 Groundwater

Once operational, no ongoing interaction with groundwater is anticipated. Installation of the battery pad, BESS substation and associated infrastructure is anticipated to reduce the quantity of infiltrating water which may have otherwise interacted with the ground surface. No ongoing monitoring of groundwater for operation of this Project is proposed on this basis.

7 Mitigation

Mitigation measures can be implemented during the design and construction phases of the Project to avoid, minimise, mitigate and/or manage the potential impacts. These include adequate consideration of the stormwater management strategy in the design, the staging and timing of construction work to limit the disturbance of areas and avoid wet weather periods, best practice erosion and sediment control procedures and undertaking ongoing inspection and monitoring of activities to identify and rectify issues.

Table 7-1: Mitigation measures

ID	Mitigation
Detailed Design	
W1	A construction water balance will be undertaken to confirm the water requirements and ensure sustainable access to water sources.
W2	Excavations should be limited to depths above the observed groundwater levels. Where deeper excavation is required, the groundwater assessment will be reviewed.
W3	The overarching design and development of infrastructure and engineered control during detailed design will include: • Ongoing consultation with Tamworth Regional Council on required water quality targets and water controls to manage general risks associated with increases in impervious areas. Infrastructure would be developed with consideration to Tamworth Regional Council's DCP (Appendix A) • Design of oil-water management controls within the BESS substation to consider relevant Australian Standards, as well as any requirements of electricity distributors • Design of stormwater infrastructure would include a closure mechanism (e.g. penstock gate) or alternative arrangement to detain flows from leaving in the event of a spill/firewater discharge.
Construction / Operations	
W4	A Soil and Water Management Plan (SWMP) and Erosion and Sediment Control Plan (ESCP) will be developed to management potential water impacts during construction. The ESCP will be developed in accordance with the principles and requirements of the Landcom 2004 Managing Urban Stormwater: Soils and Construction – Volume 1 (commonly known as the 'Blue Book').
W5	Flood emergency response protocols will be prepared and implemented to address the potential for access routes to be affected by road closures during flood events.
W6	The Environmental Management Strategy, for the Project will include a management and maintenance schedule to ensure that stormwater management system devices are regularly inspected and maintained.

8 Conclusion

The construction and operation of the Project presents a range of potential water related impacts. However, it is expected that these impacts can be suitably managed through the detailed design process and the well-planned application of standard erosion and sediment controls in accordance with the Landcom 2004 Managing Urban Stormwater: Soils and Construction – Volume 1 (commonly known as the 'Blue Book').

The Project is not anticipated to have any significant operational impacts on water quality and quantity compared to the existing conditions given that the Project:

- Stormwater infrastructure is proposed to capture, treat, retain and detain stormwater runoff from operational areas of the Project Site
- Battery units are fully enclosed and would be elevated above the 1% AEP flood level
- Project does not require significant ongoing water usage.

To ensure any impacts of the Project are minimised, mitigated and/or managed appropriately mitigation measures have been proposed for both the design, construction and operational phases of the Project.

APPENDIX A

Tamworth Regional DCP (2010) – Extracts

Tamworth Regional Development Control Plan 2010

STEP 3: GENERAL DEVELOPMENT SPECIFICATIONS

Environmental Controls

These are the environmental controls relating to all developments. Please note, additional site specific requirements may also apply to your development, see STEP 4 : SITE SPECIFIC.

Environmental effects

- The application documentation shall identify any potential environmental impacts of the development and demonstrate how they will be mitigated. These impacts may relate to:
 - Traffic
 - Flood liability
 - Slope
 - Construction impacts
 - Solid and Liquid Waste
 - Air quality (odour and pollution)
 - Noise emissions
 - Water quality
 - Sustainability

Geology

- The design process must give consideration to the potential impact of erosive soils, saline soils, soils of low wet strength, highly reactive soils and steep slopes and document how these constraints are addressed.

Landscaping Poultry Farms

- A cash bond or bank guarantee to the value of \$1500 per shed and valid for a period of 5 years, must be submitted to Council prior to issue of a Construction Certificate.

Soil and Erosion Control

- Runoff shall be managed to prevent any land degradation including offsite sedimentation.
- Reference shall be made to the NSW Governments *Managing urban stormwater: soils and construction, Volume 1* (available from Landcom), commonly referred to as "The Blue Book".
- Cut and fill will be minimised and the site stabilised during and after construction.
- Arrangements in place to prompt revegetation of earthworks to minimise erosion.

Vegetation

- Development design shall accommodate the retention of any significant trees and vegetation.

Waste Management

- General waste storage and collection arrangements shall be specified.

Noise

- Where relevant, applications are to contain information about likely noise generation and the method of mitigation.

These are the development controls relating to development on flood control lots. Please note, **Step 2 – Type of Development** requirements may also apply to your development.

Dungowan Dam and Dungowan Valley

The flood planning level adopted in the Tamworth Regional Local Environmental Plan 2010 is defined as the level of a 1 : 100 ARI (average recurrent interval) flood event plus 0.5 metres freeboard.

This is inconsistent with the provisions of this Plan.

It will be necessary to amend the provisions of the DCP to be consistent and complementary to the LEP. This will be undertaken as a subsequent amendment to the DCP. In the interim, it should be noted that the provisions of the LEP override those of this Plan.

At the Ordinary Meeting on 9 August 2016, Council resolved to require that the controls contained in this chapter be applied to the Sunny Day Failure of Dungowan Dam for the properties between the Ogunbil Bridge and Dungowan Dam.

The properties affected by these provisions are shown on the map at the end of this chapter. Refer to the Tamworth Regional Council - Dungowan Dam Dambreak Assessment - Final - November 2013 prepared by Hunter Water Australia Pty Ltd for concise mapping of the Sunny Day Failure.

Is land flood affected?

Council has adopted the 1% Flood as its Flood Planning Level. Land below the Flood Planning Level is referred to as "flood affected land".

Flood affected land as shown on the Flood Affected Land Maps (Appendix C) is defined as the most current information available to Council and may be derived and interpreted from a combination of the following:

1. Flood Studies identifying the 1% flood undertaken in accordance with the Floodplain Development Manual, prepared by the NSW Government (as applicable at the time the Study was conducted)
2. Modelling undertaken for specific sites which identifies the 1% flood
3. Historic flood inundation records held by Council as the highest known flood

Land Behind Levees

4. Information contained within an environmental planning instrument or policy
5. Specific flood mapping for the site

- Development on land protected by the urban levee system is to include consideration of inundation resulting from a levee breach (failure of overtopping) or stormwater ponding when the river system is in flood.

Access

- Flood free vehicle access is required for all lots created by subdivision.
- For development of existing lots, where flood free vehicle access is not possible, the development must be able to achieve safe wading criteria as specified in Figure L1 of the Flood Planning Manual.

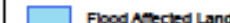
On-site Sewer Management

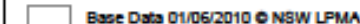
- Onsite sewer management facilities must be sited and designed to withstand flooding conditions (including consideration of structural adequacy, avoidance of inundation, and flushing/leaking into flowing flood waters). Tank and trench style of systems are not permitted on land affected by the Flood Planning Level.
- All sewer fixtures must be located above the 1% Flood.

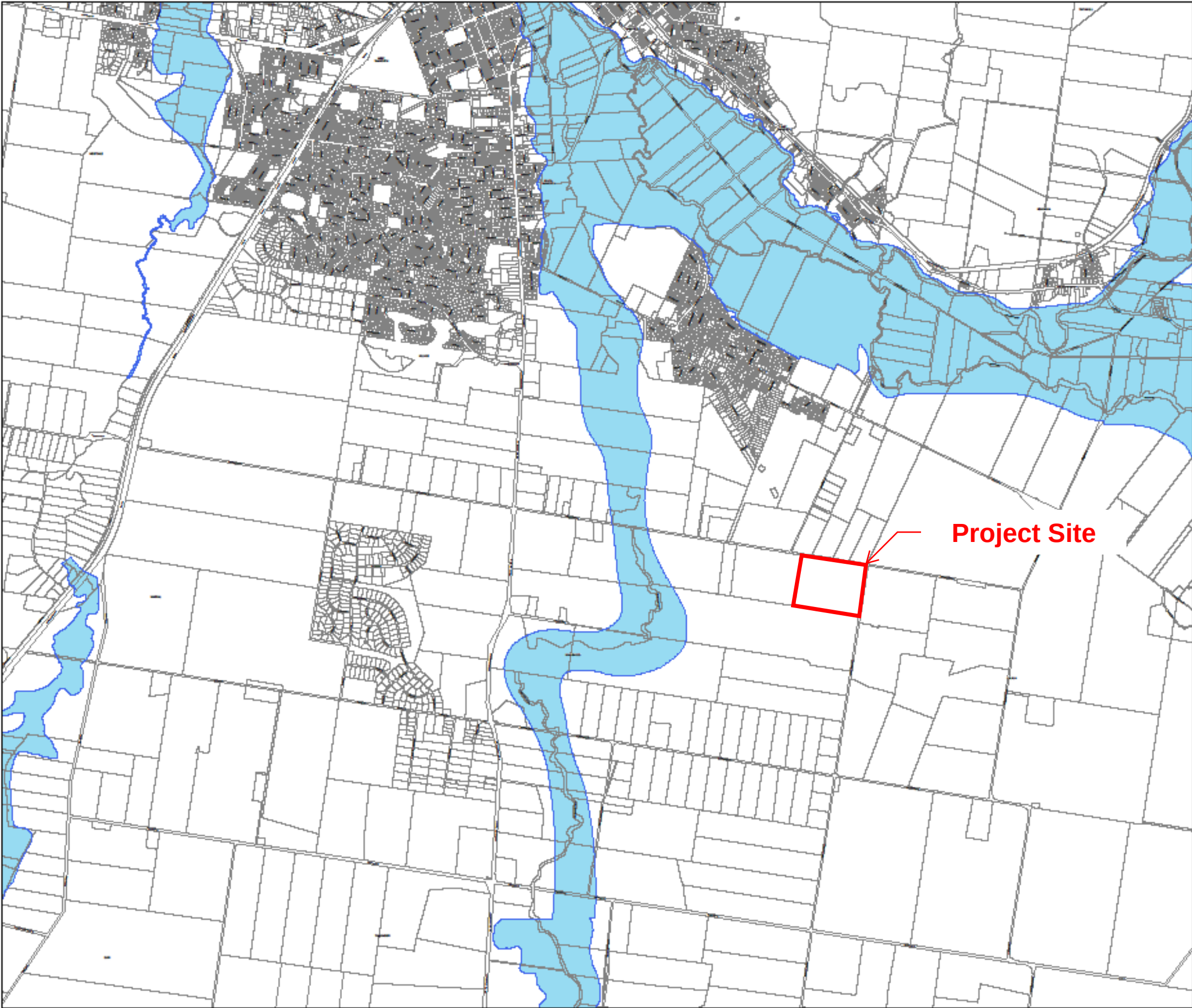
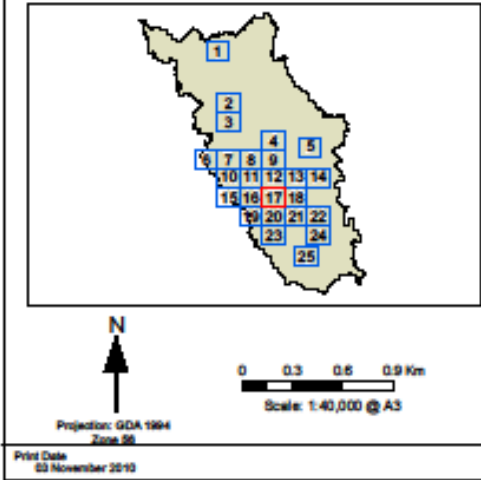
General Development Requirements

- No building or work (including land filling, fencing, excavation) shall be permitted on flood affected land where in the opinion of Council, such building or work will obstruct the movement of floodwater or cause concentration or diversion of floodwaters.
- DA must demonstrate the building or structure can withstand the force of flowing floodwaters, including debris and buoyancy forces as appropriate.
- A survey plan prepared by a registered surveyor showing existing ground levels, finished ground levels, finished floor levels, flood levels and location of existing/proposed buildings and safe evacuation path on the site relative to AHD.
- All materials used in construction shall be flood compatible.
- Development must be designed in accordance with the Flood Proofing Guidelines (refer Discretionary Development Standards).

Residential Development	This information must be supplied for development within the 1% ARI flood level and the Sunny Day Failure of Dungowan Dam for properties between the Ogunbil Bridge and Dungowan Dam.	Landfilling	Land filling proposals are to demonstrate consideration of AS3798.
	Floor levels of all habitable rooms, or rooms with connection to sewer infrastructure shall not be less than 500mm (freeboard) above the 1% ARI flood level, except for those properties between the Ogunbil Bridge and Dungowan Dam where the applicable flood height is 500mm above the Sunny Day Failure of Dungowan Dam.		Survey plan prepared by a registered surveyor is required, showing the contour levels of natural surface, any existing fill and the designed contour levels for the finished work.
Residential Development (cont.)	Upon completion and prior to the occupation (where relevant), a certificate by a registered surveyor showing the finished ground and floor levels conform to approved design levels shall be submitted to Council.		A report certified by a consulting engineer is required to detail the impact of the proposed fill on adjoining properties and, where levee banks are proposed, and the methods of internal drainage.
	- Additions to existing buildings will be only be permitted, with limitations, as follows: - where the floor level of the proposed addition is located below the standard 1% ARI or the Sunny Day Failure of Dungowan Dam for properties between the Ogunbil Bridge and Dungowan Dam, the maximum increase in floor area is not to exceed 10% of the floor area of the existing dwelling; or - where the floor level of the proposed addition is located above the standard 1% ARI or the Sunny Day Failure of Dungowan Dam for properties between the Ogunbil Bridge and Dungowan Dam, the maximum increase in habitable floor space shall not exceed 100m².		- Applications shall be accompanied by a construction management plan to show - source of fill, including contamination assessment - an assessment of the impact of haulage vehicles on roads - precondition report of all haulage routes - details of method of compaction of fill and associated impacts: control of dust, sedimentation, water quality impacts, noise and vibration - contingency for containment of fill in the event of a flood during placement
	Where additions are below the 500mm “freeboard” or the Sunny Day Failure of Dungowan Dam for properties between the Ogunbil Bridge and Dungowan Dam, Council must be satisfied that the addition will not increase risk to inhabitant in the event of a flood.	Non-residential rural buildings	Not permitted in “floodways”.
	Rebuilding part of a dwelling may be permitted provided the building maintains the same dimensions which result in the same impact on flood behaviour.		Floor areas shall be located above the 1% ARI and the Sunny Day Failure of Dungowan Dam for properties between the Ogunbil Bridge and Dungowan Dam, unless there are no alternative practical sites, in which case the building or structure must be designed to withstand the force of flowing floodwaters, including debris and buoyancy forces as appropriate and has been designed in accordance with the Flood Proofing Guidelines (refer Discretionary Development Standards).
		Definitions are as per the Flood Plain Management Manual (NSW Government)	
Commercial/ Retail/ Industrial Development	Development shall incorporate measures to seal or flood proof buildings, to avoid activities or fittings susceptible to flood damage, or to store the contents of buildings above the 1% ARI level.		
Subdivision	Residential subdivision will not be permitted where any lot to be created will be fully inundated by a 1% ARI event and the creation of such lot will create the potential for increased intensity of development on flood liable land.		

Flood Affected Land
 Flood Affected Land

Cadastral
 Base Data 01/06/2010 © NSW LPMA



APPENDIX B

Site photos (2024)



Figure B-1: Project Site – southern boundary looking north/west



Figure B-2: Project Site – southern boundary looking west



Figure B-3: Project Site – southern boundary looking north/east



Figure B-4: Project Site – eastern boundary (Ascot-Calala Rd) – looking north



Figure B-5: Ascot-Calala Rd at Burgmanns Lane – cross drainage culvert (approx. 450mm diameter)



Figure B-6: Downstream of Ascot-Calala Rd at Burgmanns Lane - looking east



Figure B-7: Ascot-Calala Rd roadside swale – looking south



Figure B-8: Burgmanns Lane approaching Goonoo Goonoo Ck - looking east



Figure B-9: Burgmanns Lane at Goonoo Goonoo Ck - looking north



Figure B-10: Burgmanns Lane at Goonoo Goonoo Ck - looking east



Figure B-11: Whitehouse Lane approaching Goonoo Goonoo Ck - looking west



Figure B-12: Whitehouse Lane at Goonoo Goonoo Ck box culverts - looking east



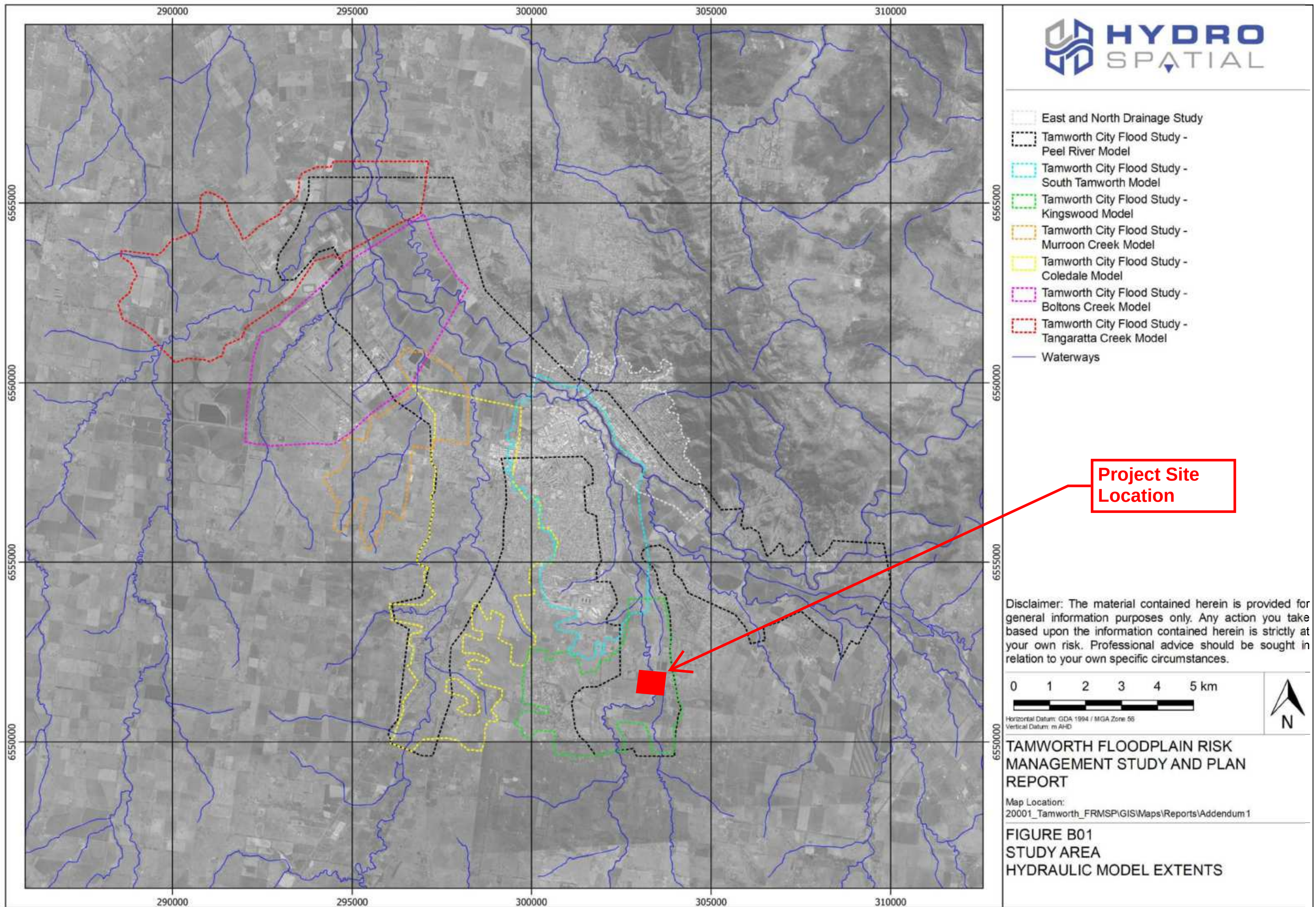
Figure B-13: Whitehouse Lane at Goonoo Goonoo Ck bridge - looking east



Figure B-14: Whitehouse Lane at Goonoo Goonoo Ck bridge - looking south

APPENDIX C

Tamworth City Wide Floodplain Risk Management Study (2023) – Extracts



Tamworth City Flood Study -
Peel River Model

Time to Peak

< 1 hours

< 2 hours

< 3 hours

< 4 hours

< 5 hours

< 6 hours

< 7 hours

< 8 hours

< 9 hours

< 10 hours

< 11 hours

< 12 hours

> 12 hours

**Project Site
Location**

Disclaimer: The material contained herein is provided for general information purposes only. Any action you take based upon the information contained herein is strictly at your own risk. Professional advice should be sought in relation to your own specific circumstances.

0 1 2 3 4 5 km



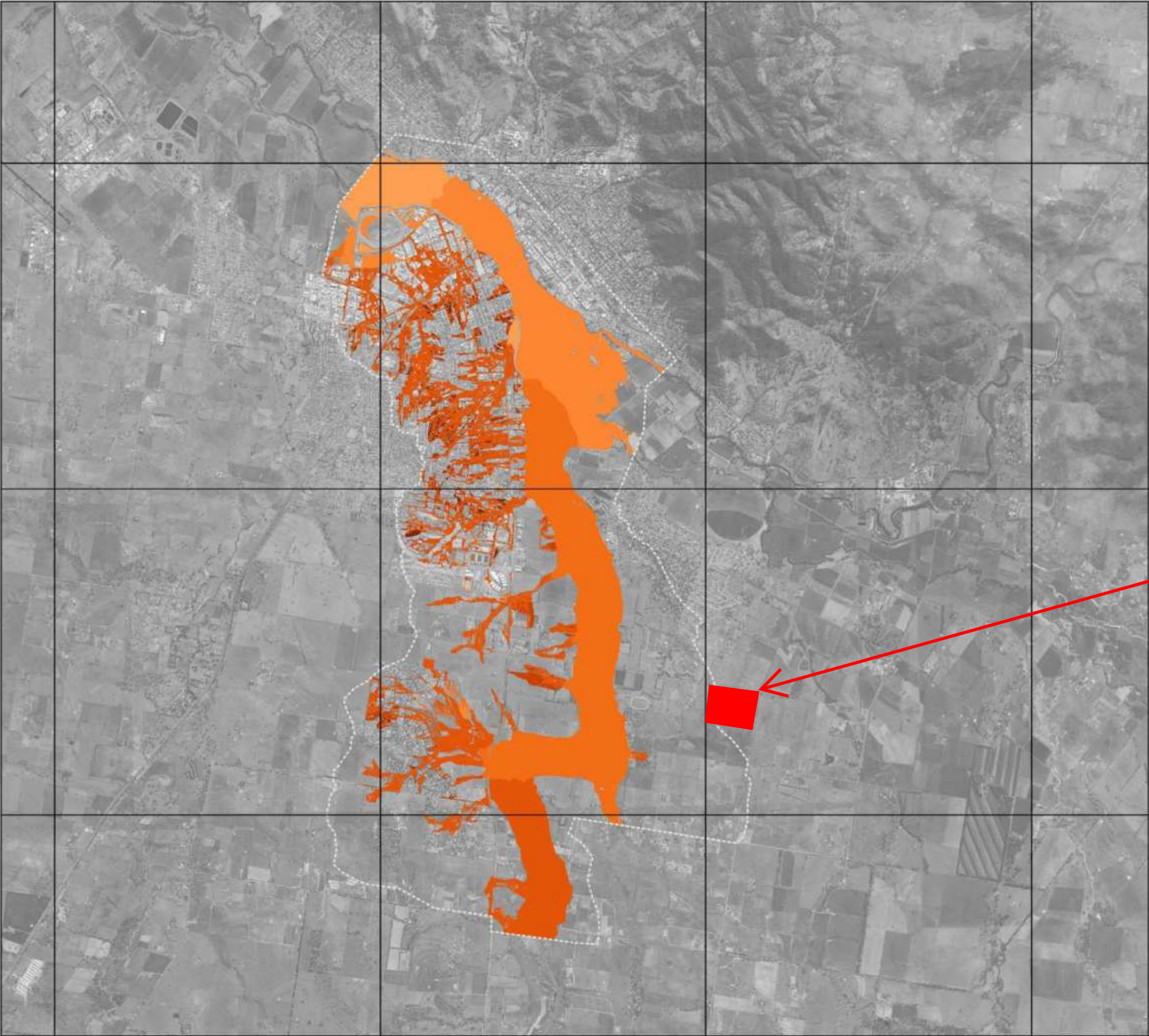
Horizontal Datum: GDA 1994 / MGA Zone 56
Vertical Datum: m AHD



TAMWORTH FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN REPORT

Map Location:
20001_Tamworth_FRMSP\GIS\Maps\Reports\Addendum1

**FIGURE B05A
PEEL RIVER MODEL
TIME TO PEAK
1% AEP EVENT (CRITICAL DURATION)**



Tamworth City Flood Study -
Goonoo Goonoo Creek Model

Time to Peak

- < 1 hours
- < 2 hours
- < 3 hours
- < 4 hours
- < 5 hours
- < 6 hours
- < 7 hours
- < 8 hours
- < 9 hours
- < 10 hours
- < 11 hours
- < 12 hours
- > 12 hours

**Project Site
Location**

Disclaimer: The material contained herein is provided for general information purposes only. Any action you take based upon the information contained herein is strictly at your own risk. Professional advice should be sought in relation to your own specific circumstances.

0 1 2 3 4 km



Horizontal Datum: GDA 1994 / MGA Zone 56
Vertical Datum: m AHD



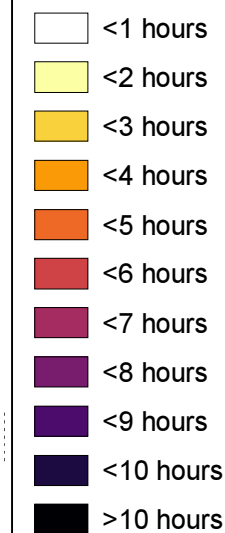
TAMWORTH FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN REPORT

Map Location:
20001_Tamworth_FRMSP\GIS\Maps\Reports\Addendum1

FIGURE B05B
GOONOO GOONOO CREEK MODEL
TIME TO PEAK
1% AEP EVENT (CRITICAL DURATION)

Tamworth City Flood Study -
Peel River Model

Duration of Inundation – Depths greater than 0.3m



**Project Site
Location**

Disclaimer: The material contained herein is provided for general information purposes only. Any action you take based upon the information contained herein is strictly at your own risk. Professional advice should be sought in relation to your own specific circumstances.

0 1 2 3 4 5 km



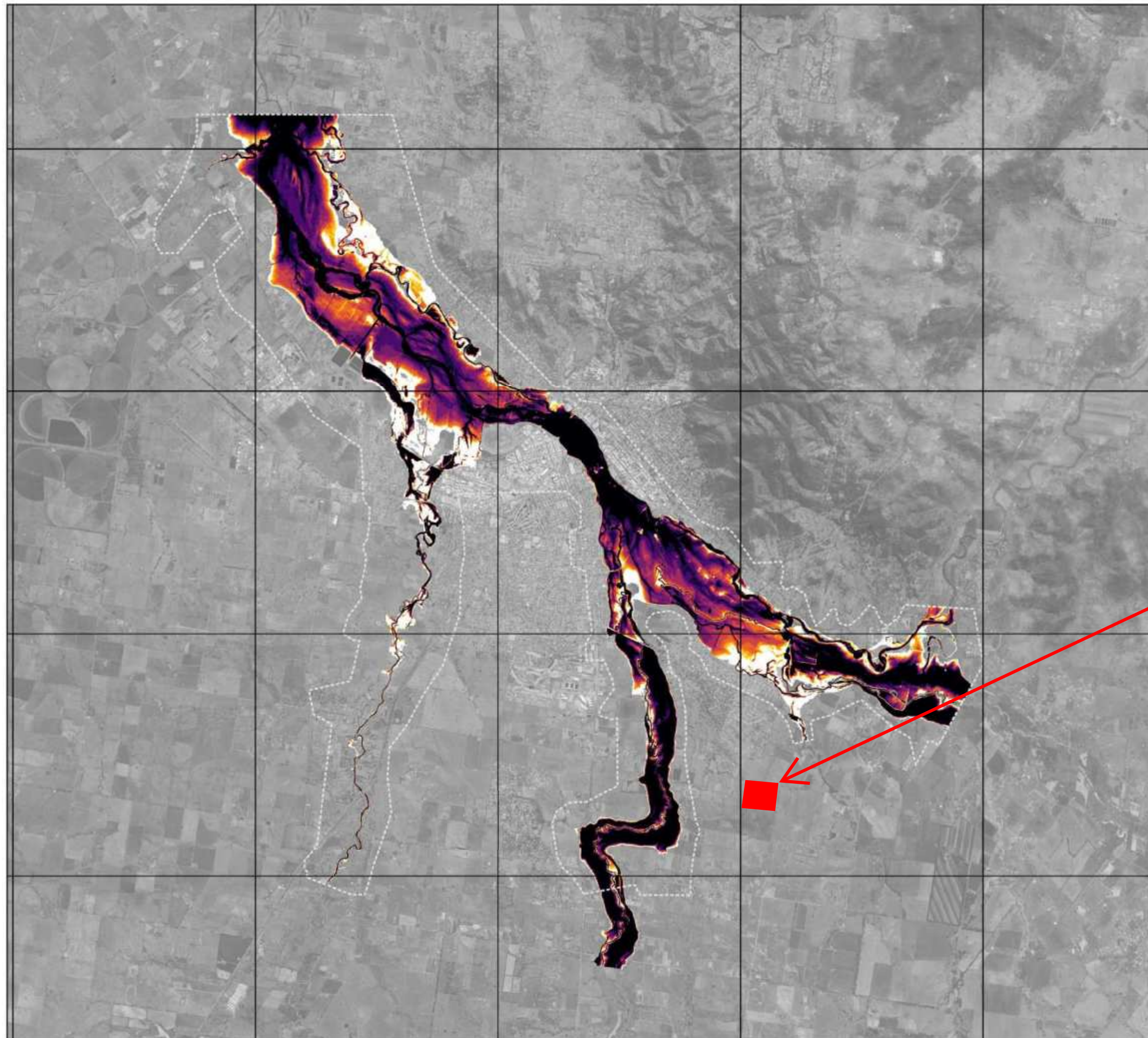
Horizontal Datum: GDA 1994 / MGA Zone 56
Vertical Datum: m AHD

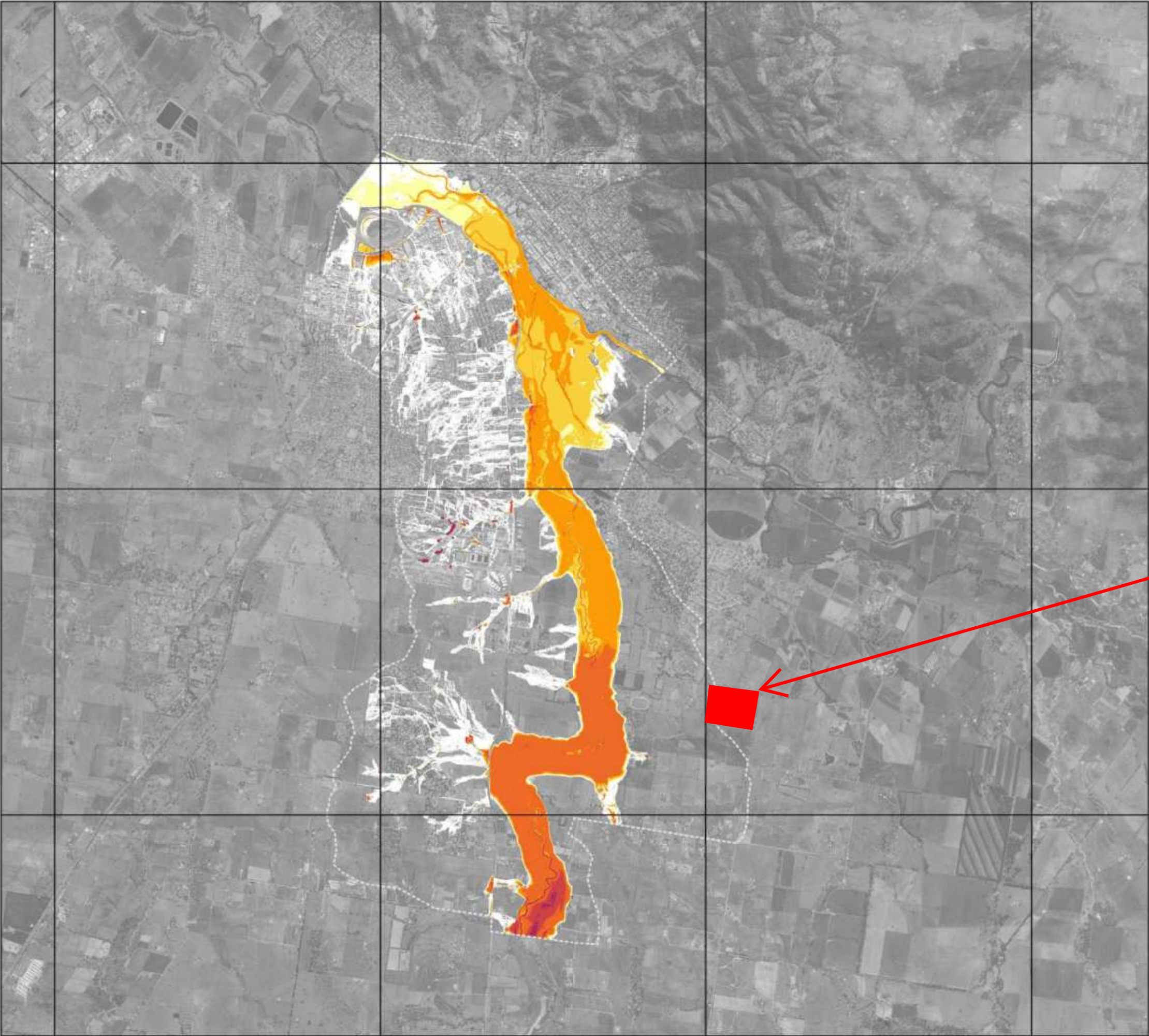


TAMWORTH FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN REPORT

Map Location:
20001_Tamworth_FRMSP\GIS\Maps\Reports\Addendum1

**FIGURE B06A
PEEL RIVER MODEL
DURATION OF INUNDATION
1% AEP EVENT (CRITICAL DURATION)**

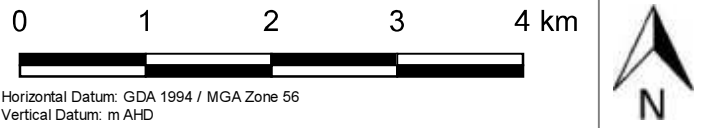




- Tamworth City Flood Study -
Goonoo Goonoo Creek Model
- Duration of Inundation – Depths greater than 0.3m
- <1 hours
 - <2 hours
 - <3 hours
 - <4 hours
 - <5 hours
 - <6 hours
 - <7 hours
 - <8 hours
 - <9 hours
 - <10 hours
 - >10 hours

**Project Site
Location**

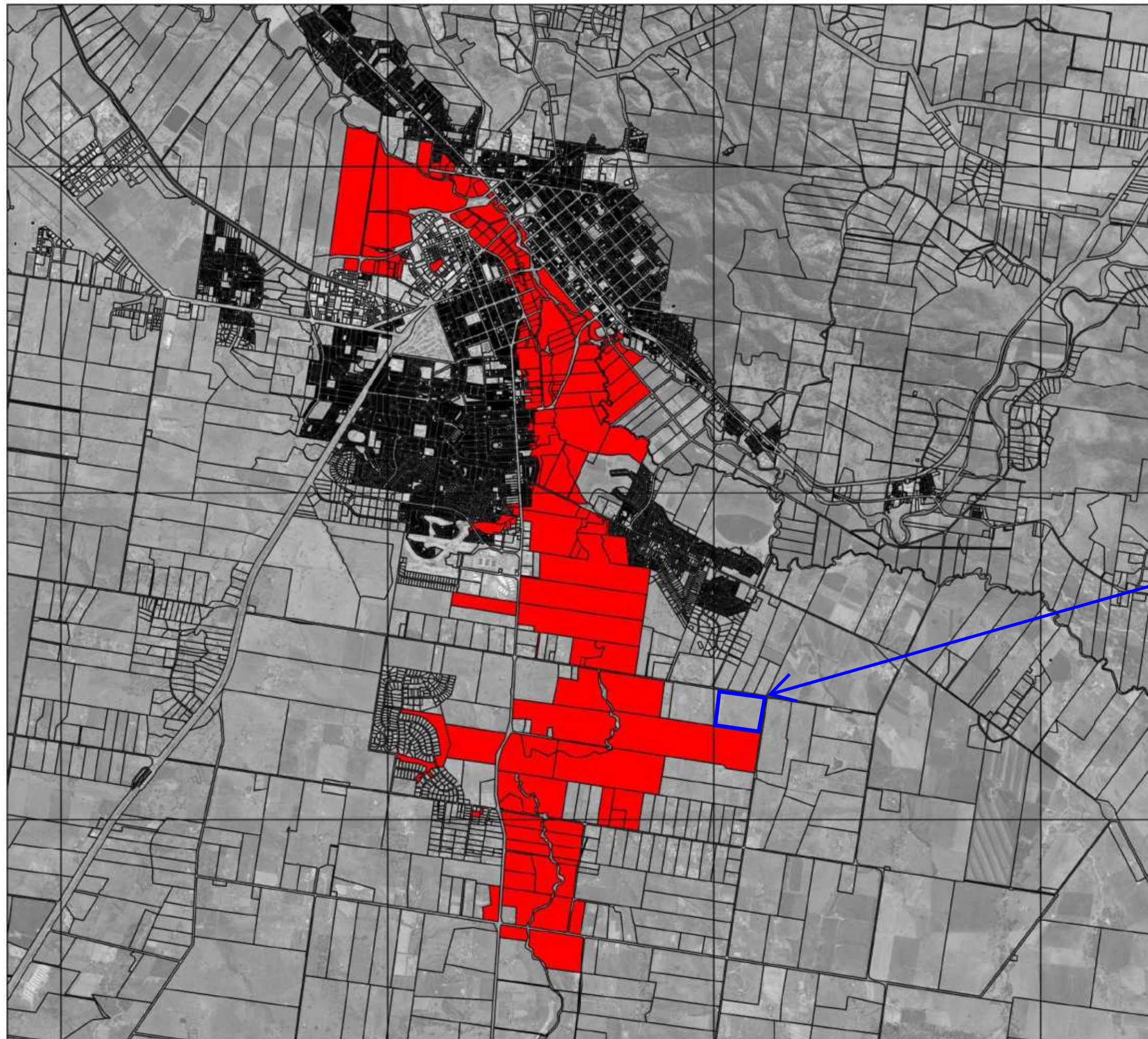
Disclaimer: The material contained herein is provided for general information purposes only. Any action you take based upon the information contained herein is strictly at your own risk. Professional advice should be sought in relation to your own specific circumstances.



**TAMWORTH FLOODPLAIN RISK
MANAGEMENT STUDY AND PLAN
REPORT**

Map Location:
20001_Tamworth_FRMSP\GIS\Maps\Reports\Addendum1

**FIGURE B06B
GOONOO GOONOO CREEK MODEL
DURATION OF INUNDATION
1% AEP EVENT (CRITICAL DURATION)**



-  Tamworth City Flood Study -
Goonoo Goonoo Creek Model
-  Properties subject to flood-related
development controls – overland flooding
-  Lot Boundaries

**Project Site
Location**

Disclaimer: The material contained herein is provided for general information purposes only. Any action you take based upon the information contained herein is strictly at your own risk. Professional advice should be sought in relation to your own specific circumstances.

0 1 2 3 4 km



Horizontal Datum: GDA 1994 / MGA Zone 56
Vertical Datum: m AHD



TAMWORTH FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN REPORT

Map Location:
20001_Tamworth_FRMSP\GIS\Maps\Reports\Addendum1

FIGURE C07A
GOONOO GOONOO CREEK MODEL
PRELIMINARY FLOOD-RELATED
DEVELOPMENT CONTROLS -
OVERLAND FLOODING



Tamworth City Flood Study -
Peel River Model
Flood Planning Area

**Project Site
Location**

Disclaimer: The material contained herein is provided for general information purposes only. Any action you take based upon the information contained herein is strictly at your own risk. Professional advice should be sought in relation to your own specific circumstances.

0 1 2 3 4 5 km



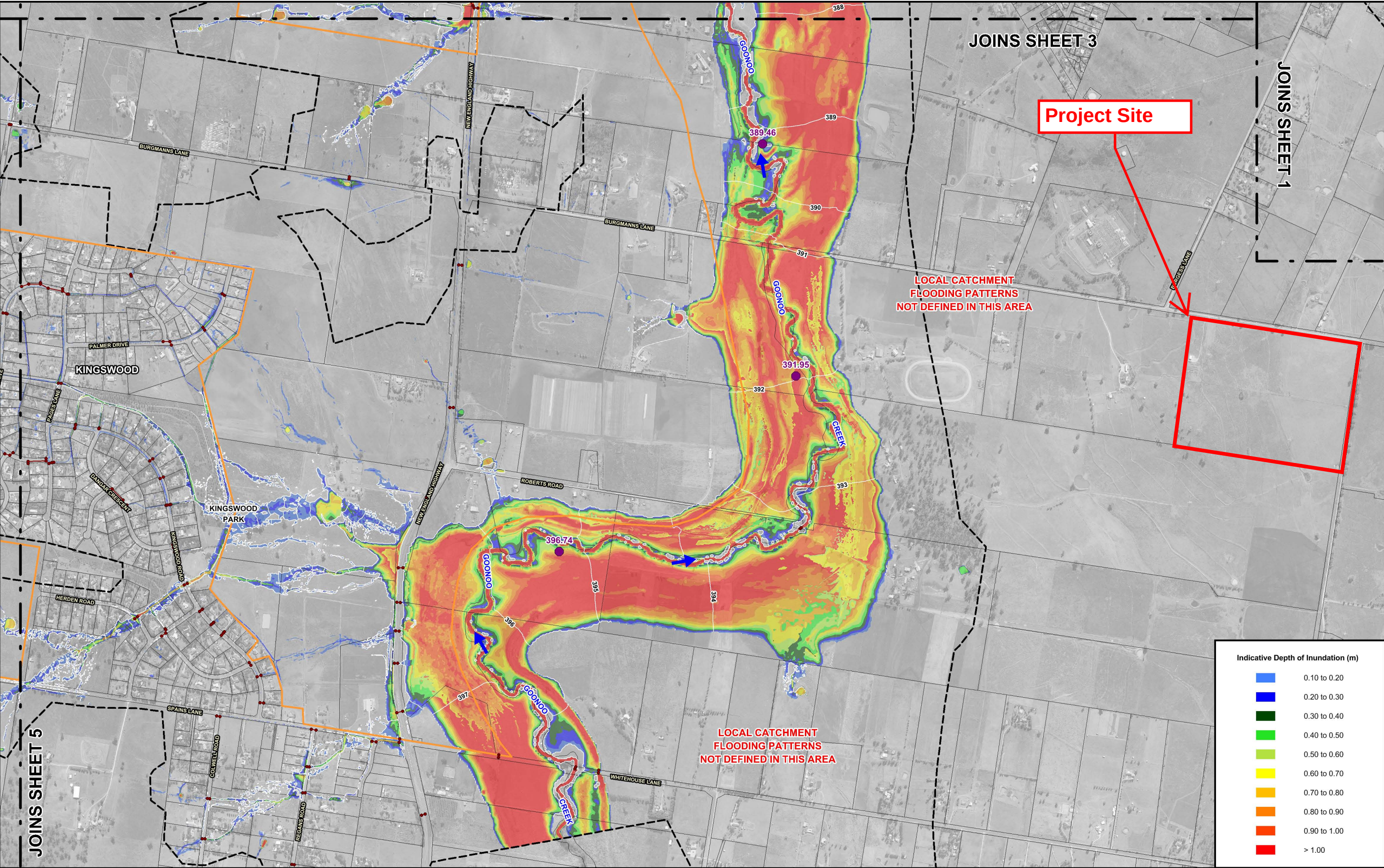
Horizontal Datum: GDA 1994 / MGA Zone 56
Vertical Datum: m AHD



TAMWORTH FLOODPLAIN RISK MANAGEMENT STUDY AND PLAN REPORT

Map Location:
20001_Tamworth_FRMSP\GIS\Maps\Reports\Addendum1

FIGURE B08A
PEEL RIVER MODEL
PRELIMINARY FLOOD-RELATED
DEVELOPMENT CONTROLS -
MAINSTREAM FLOODING



Indicative Depth of Inundation (m)	
■	0.10 to 0.20
■	0.20 to 0.30
■	0.30 to 0.40
■	0.40 to 0.50
■	0.50 to 0.60
■	0.60 to 0.70
■	0.70 to 0.80
■	0.80 to 0.90
■	0.90 to 1.00
■	> 1.00

N

1500150300450m

Scale: 1:15,000

Lyall & Associates

NOTE:
The ground surface model incorporated in TUFLOW is based on LiDAR survey which has been sampled on a 2.5m (min.) grid and does not necessarily incorporate localised features which can influence flooding behaviour in individual allotments.

Flood depths are therefore approximate only and require interpretation by a suitably qualified engineer to determine flooding behaviour in individual allotments. Any assessment of flooding in individual allotments may also require a site survey.

- Two-Dimensional Model Boundary

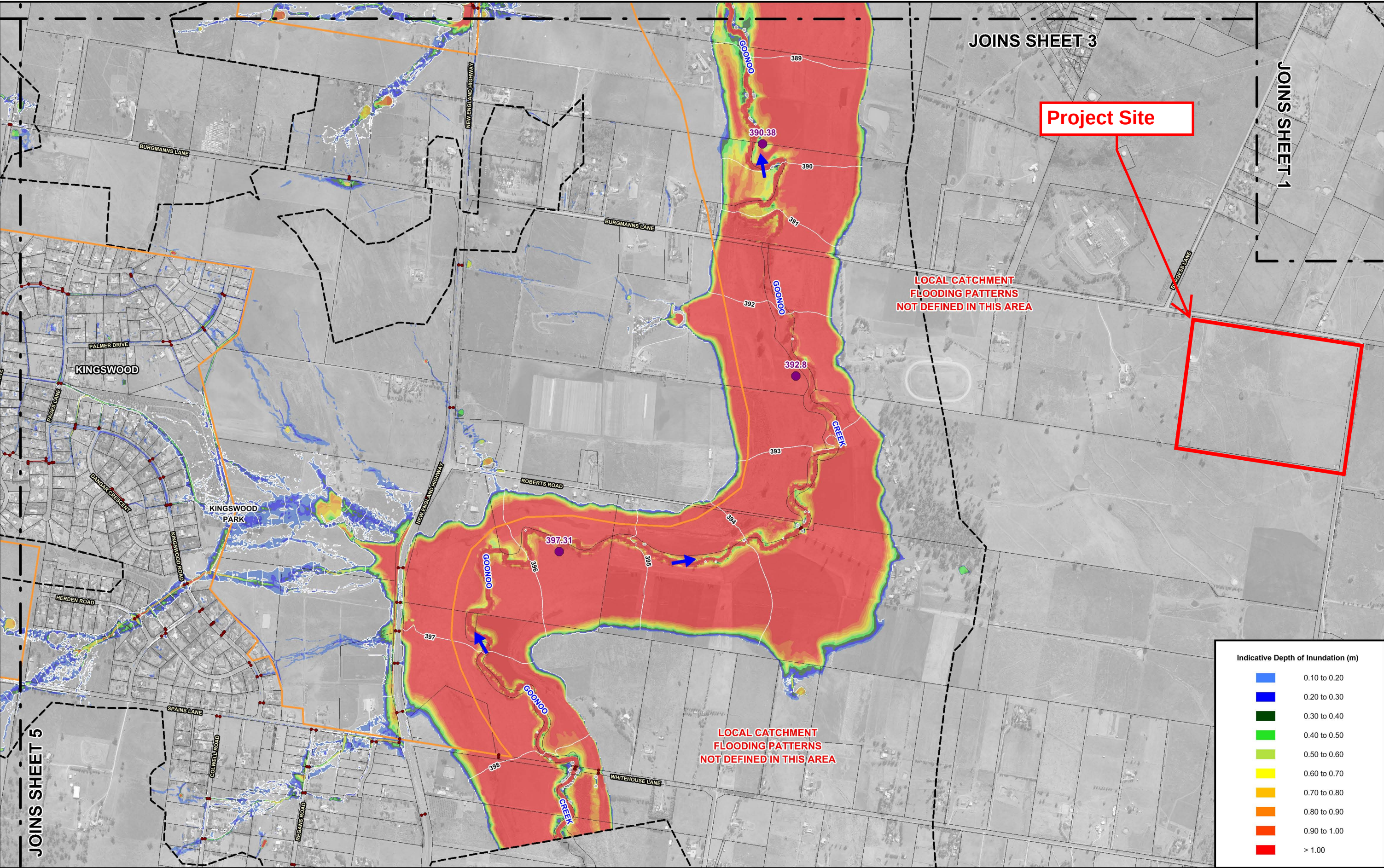
--- Modelled Stormwater Network

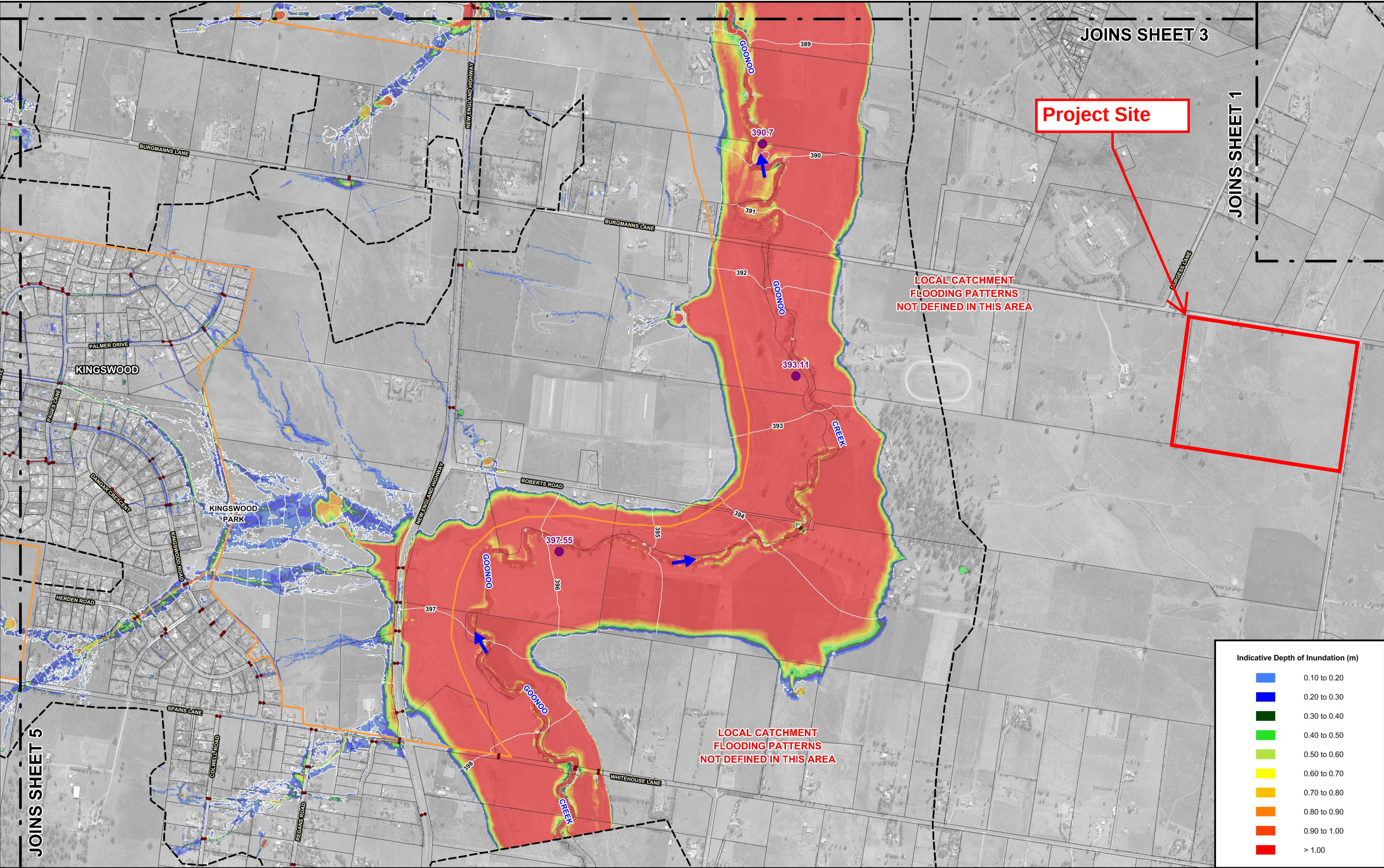
390

Water Surface Elevation Contour (m AHD)
(Main Stream Flooding Only)
- South Tamworth Rural Lands Master Plan Area

396.74

Peak Flood Level (m AHD) [L&A, 2006]
(For Comparative Purposes Only)





150 0 150 300 450 m

Scale: 1:15,000

NOTE:

The ground surface model incorporated in TUFLOW is based on LiDAR survey which has been sampled on a 2.5m (min.) grid and does not necessarily incorporate localised features which can influence flooding behaviour in individual allotments.

Flood depths are therefore approximate only and require interpretation by a suitably qualified engineer to determine flooding behaviour in individual allotments. Any assessment of flooding in individual allotments may also require a site survey.

Two-Dimensional Model Boundary

Modelled Stormwater Network

Water Surface Elevation Contour (m AHD)
(Main Stream Flooding Only)

South Tamworth Rural Lands Master Plan Area

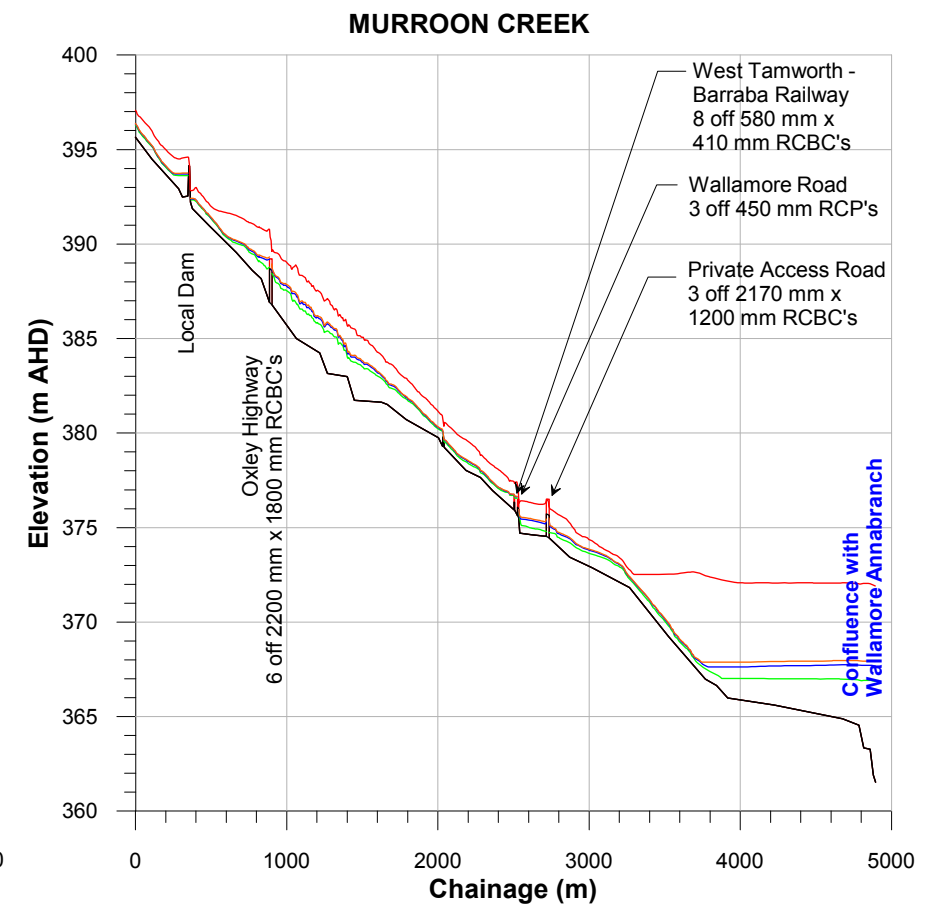
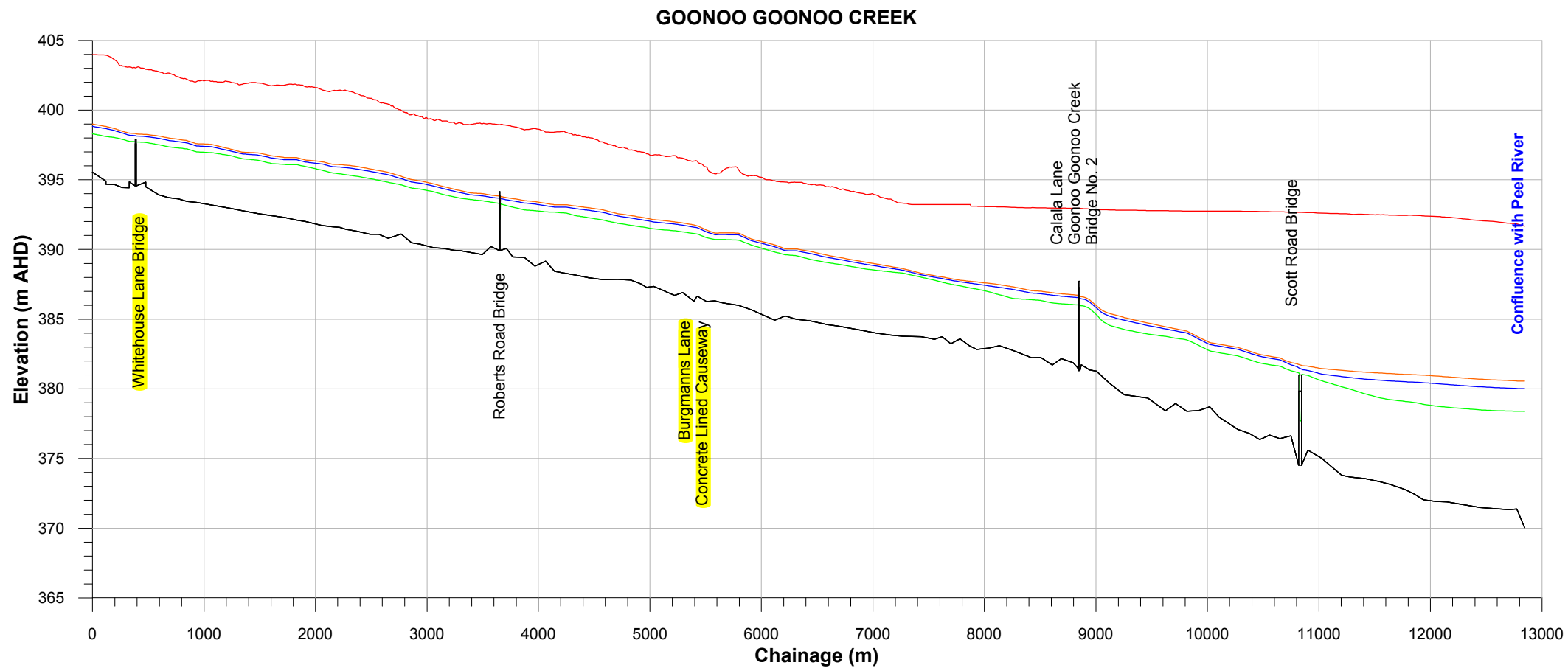
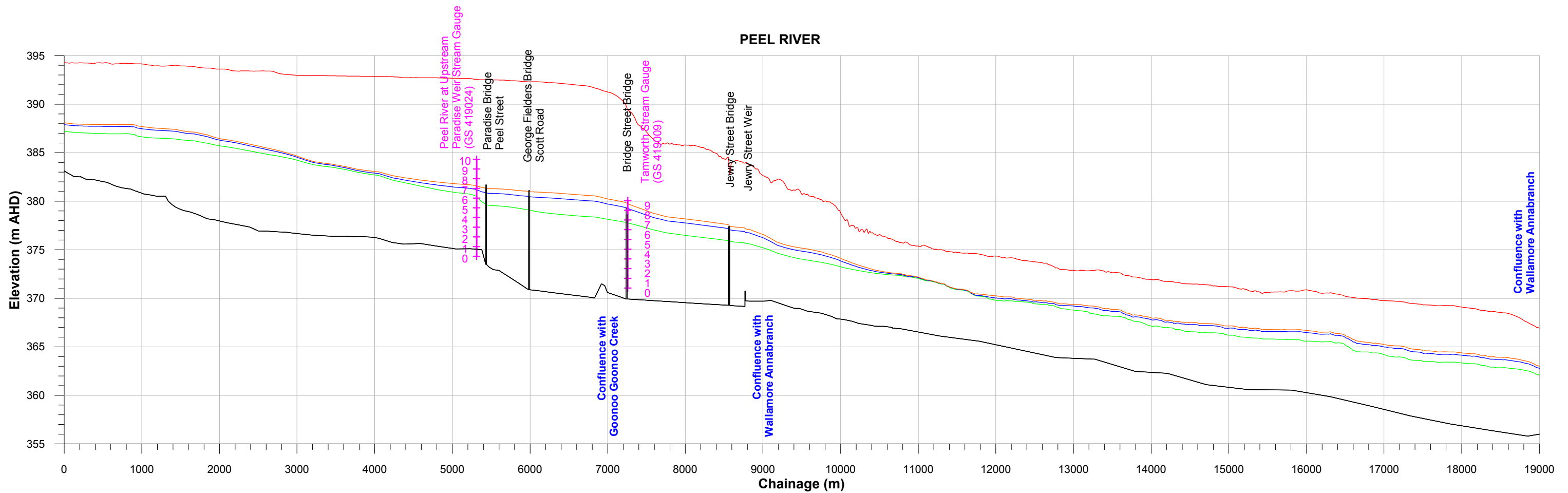
397.55 Peak Flood Level (m AHD) [L&A, 2006]
(For Comparative Purposes Only)

TAMWORTH CITY-WIDE FLOODING INVESTIGATION

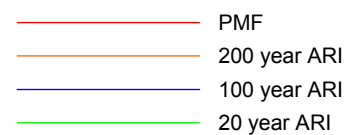
Figure 6.4
(Sheet 2 of 11)

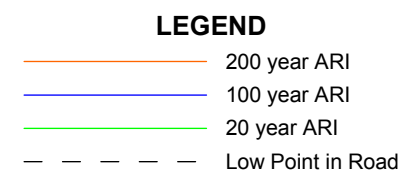
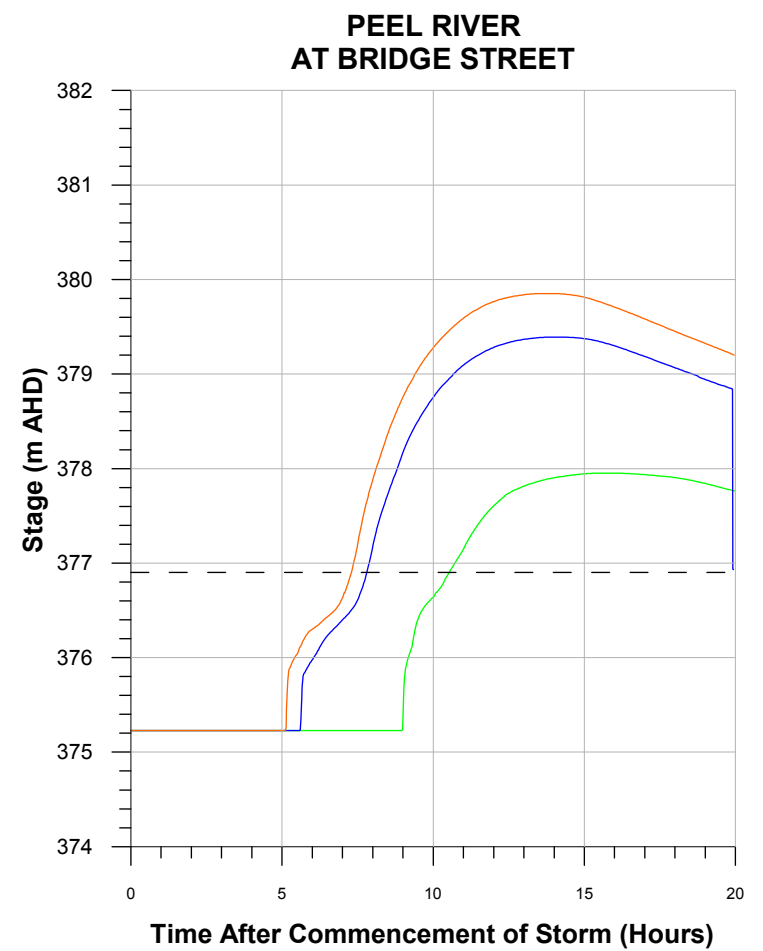
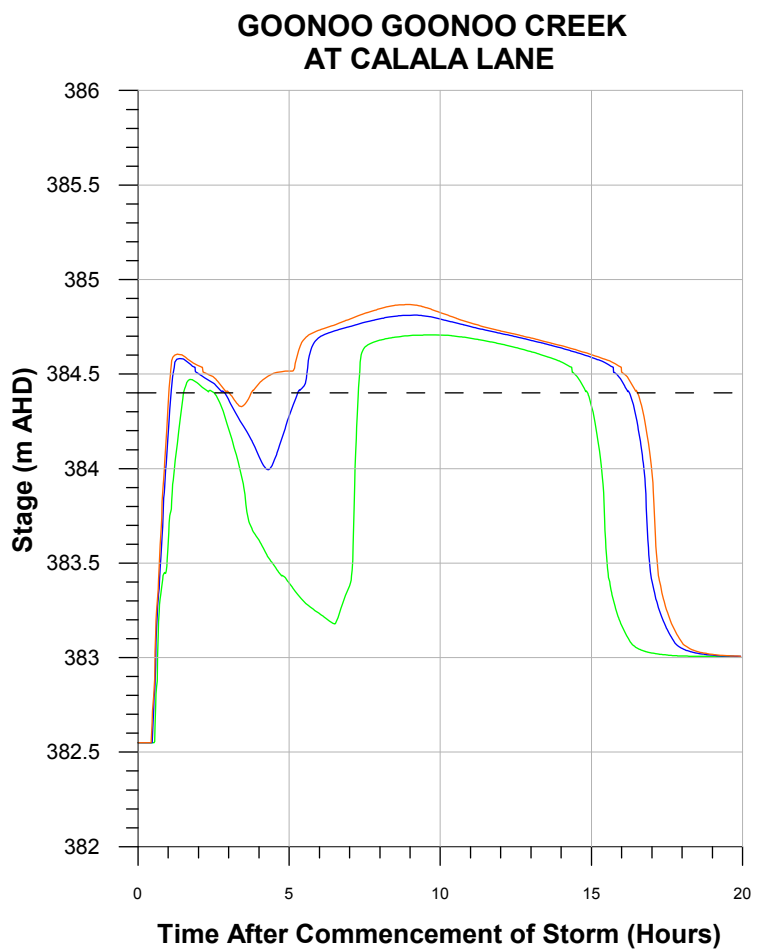
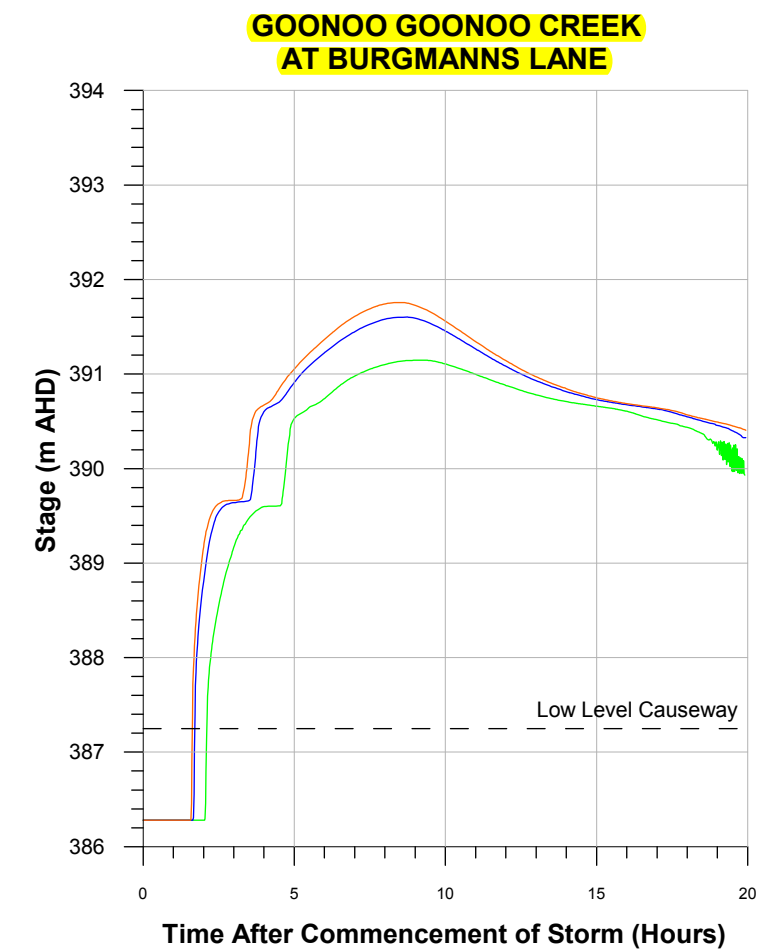
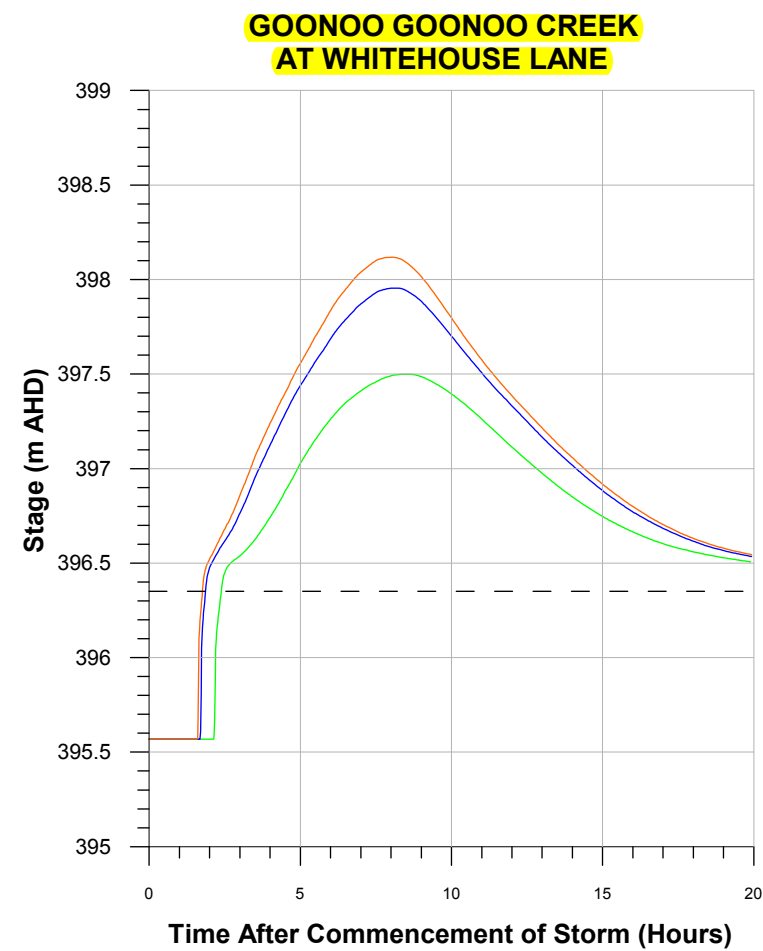
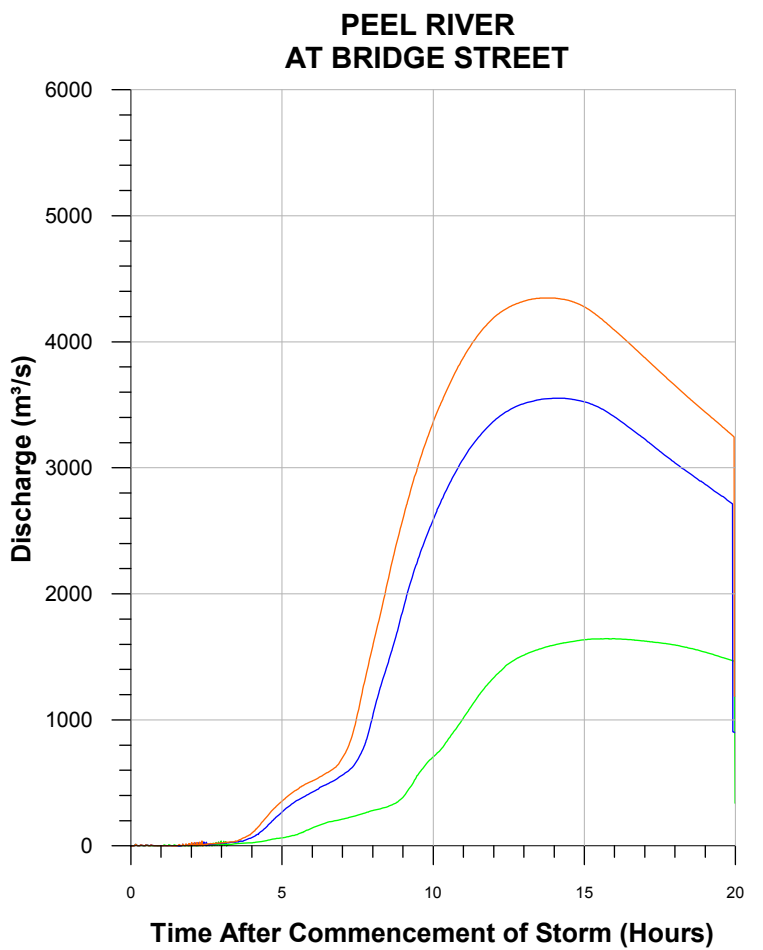
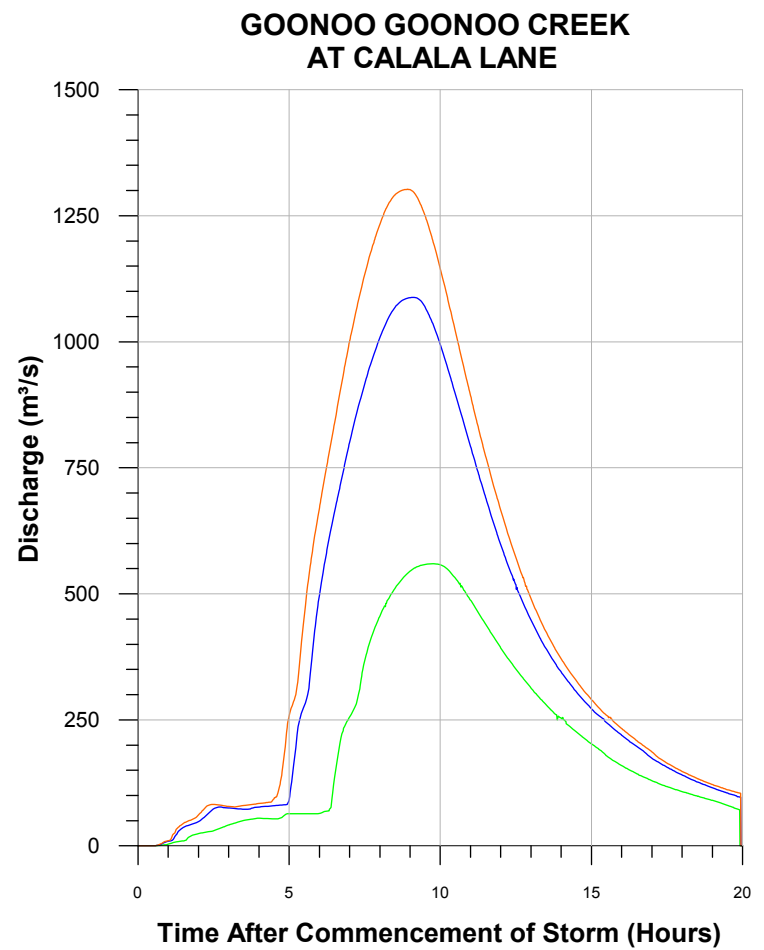
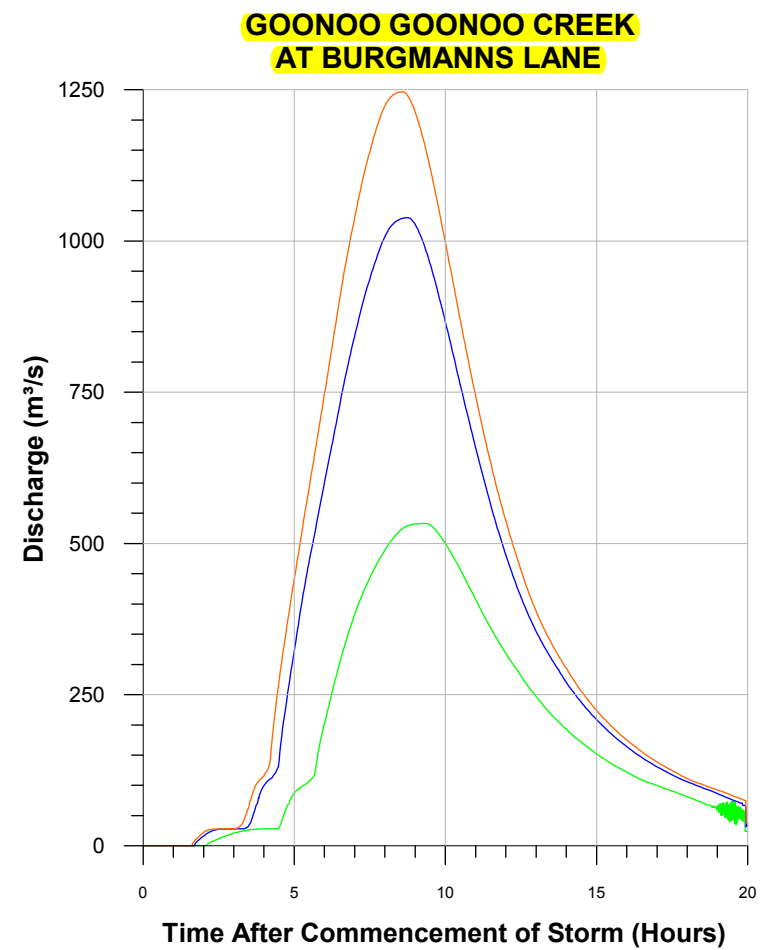
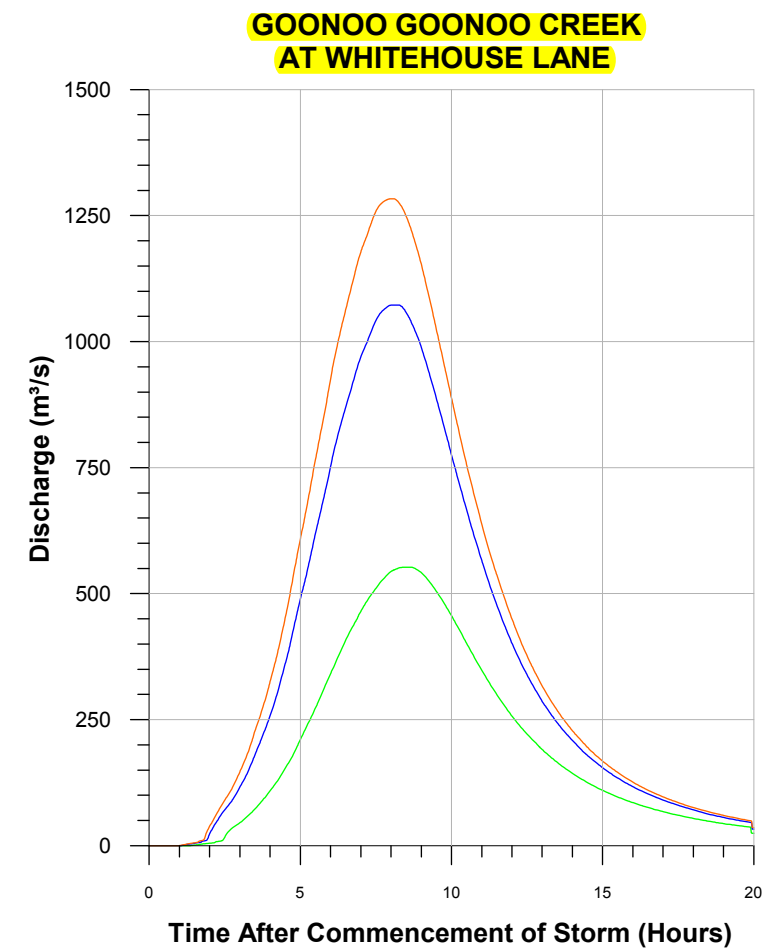
TUFLOW MODEL RESULTS
200 YEAR ARI

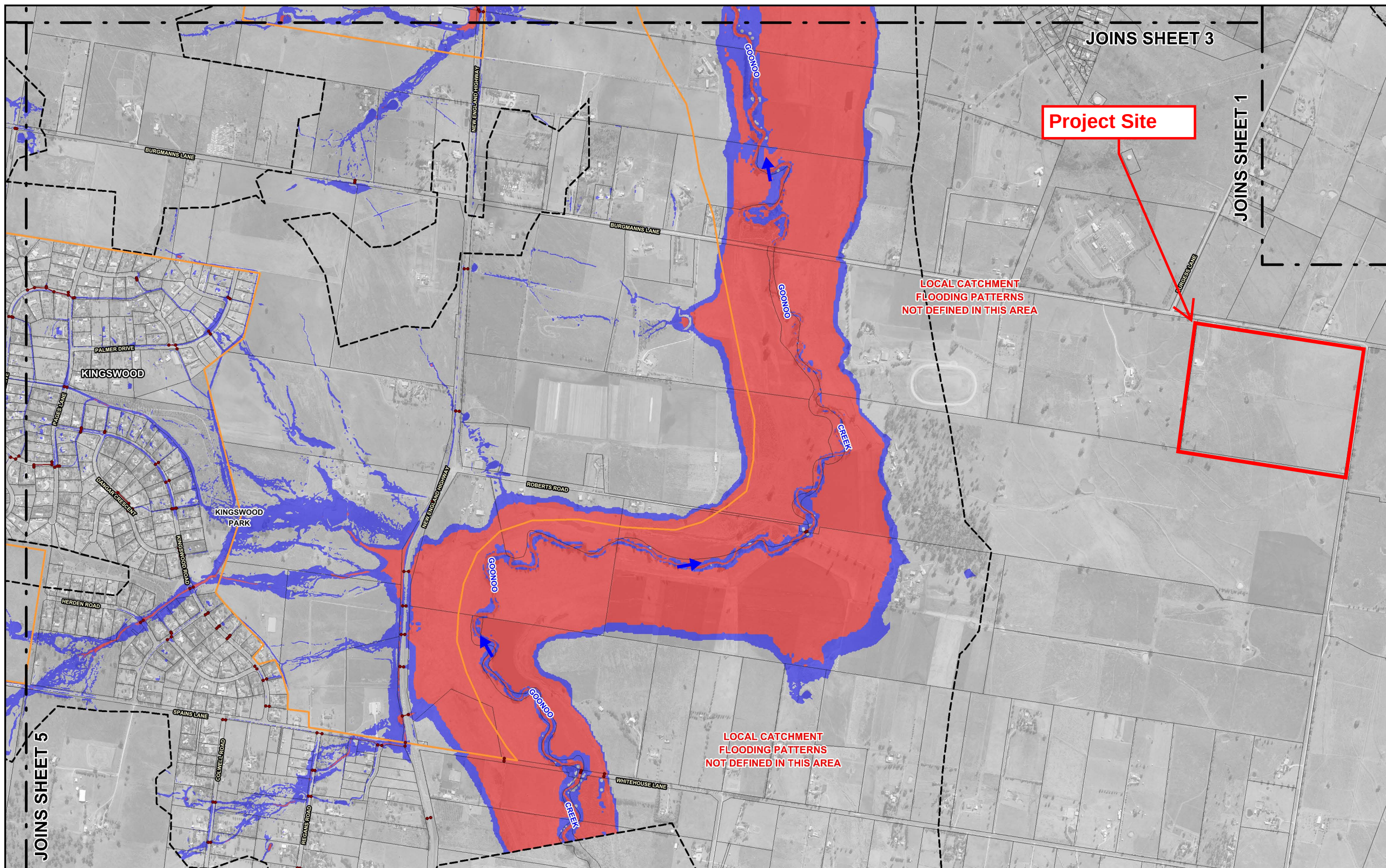
Lyll & Associates



LEGEND







Scale: 1:15,000

150 0 150 300 450 m

Lyall & Associates

NOTE:

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LEGEND

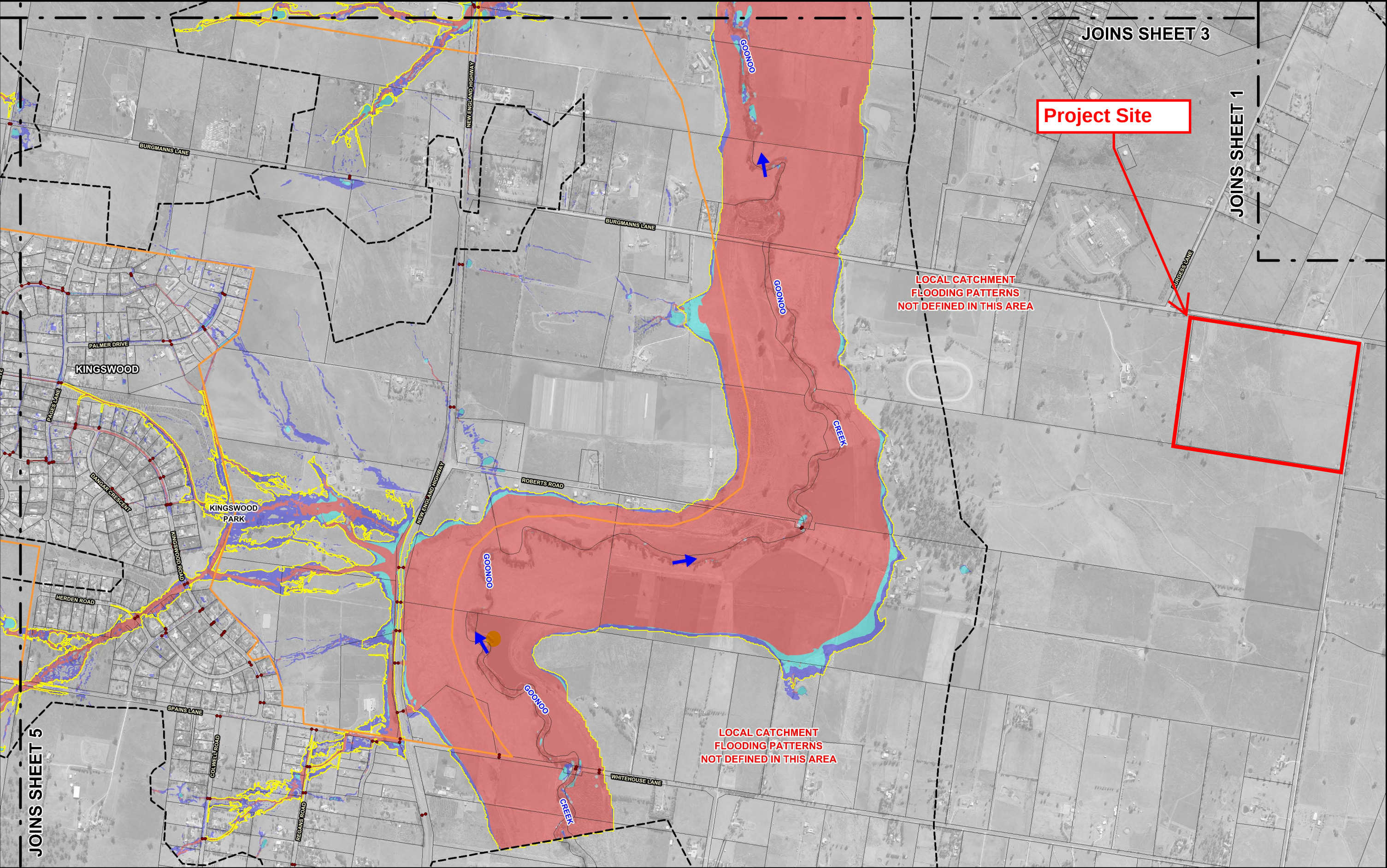
- Two-Dimensional Model Boundary
- Modelled Stormwater Network
- South Tamworth Rural Lands Master Plan Area
- High Provisional Hydraulic Hazard
- Low Provisional Hydraulic Hazard

(Categories based on Figure L2 of NSW Government's Floodplain Development Manual, 2005)

TAMWORTH CITY-WIDE FLOODING INVESTIGATION

Figure 6.10
(Sheet 2 of 11)

**PROVISIONAL FLOOD HAZARD
100 YEAR ARI**





150 0 150 300 450 m

Scale: 1:15,000

NOTE:

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Flood depths are therefore approximate only and require interpretation by a suitably qualified engineer to determine flooding behaviour in individual allotments. Any assessment of flooding in individual allotments may also require a site survey.

Two-Dimensional Model Boundary

Modelled Stormwater Network

South Tamworth Rural Lands Master Plan Area

Floodway

Flood Storage

Flood Fringe

Extent of Main Stream and Minor Tributary Flooding

TAMWORTH CITY-WIDE FLOODING INVESTIGATION

Figure 6.11
(Sheet 2 of 11)

HYDRAULIC CATEGORISATION OF FLOODPLAIN
100 YEAR ARI

Lyll & Associates

