Attexó
APEM Group

Appendix O
Flood Hazard Assessment and Stormwater Management Plan

Report

Tully BESS Stormwater Management Plan & Flood Assessment

Attexo

29 May 2026

Document Status

Version	Doc type	Reviewed by	Approved by	Date issued
V01	DRAFT	C. Wallis	A. Thompson	3 September 2025
V02	REPORT	C. Wallis	A. Thompson	15 December 2025
V03	REPORT	C. Wallis	A. Thompson	30 April 2026
V04	REPORT	C. Wallis	A. Thompson	29 May 2026

Project Details

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Document Number	25020134_TullyBESS_SMP_R01_V04.docx

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Quality ISO 9001 | Environment ISO 14001 | OHS ISO 45001

ACKNOWLEDGEMENT OF COUNTRY

The Board and employees of Water Technology acknowledge and respect the Aboriginal and Torres Strait Islander Peoples as the Traditional Custodians of Country throughout Australia. We specifically acknowledge the Traditional Custodians of the land on which our offices reside and where we undertake our work.

We respect the knowledge, skills and lived experiences of Aboriginal and Torres Strait Islander Peoples, who we continue to learn from and collaborate with. We also extend our respect to all First Nations Peoples, their cultures and to their Elders, past and present.

Artwork by Maurice Goolagong 2023. This piece was commissioned by Water Technology and visualises the important connections we have to water, and the cultural significance of journeys taken by traditional custodians of our land to meeting places, where communities connect with each other around waterways.

The symbolism in the artwork includes:

- *Seven circles representing each of the States and Territories in Australia where we do our work*
- *Blue dots between each circle representing the waterways that connect us*
- *The animals that rely on healthy waterways for their home*
- *Black and white dots representing all the different communities that we visit in our work*
- *Hands that are for the people we help on our journey*

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1 INTRODUCTION

Water Technology (WT) has been engaged by Attexo to prepare a Stormwater Management Plan (SMP) and Flood Assessment (FA) for the proposed Tully battery energy storage system (BESS), situated south of Tully in the Cassowary Coast Regional Council (CCRC) Local Government Area (LGA) in far north Queensland. The Location of the proposed site is presented in Figure 1-1.

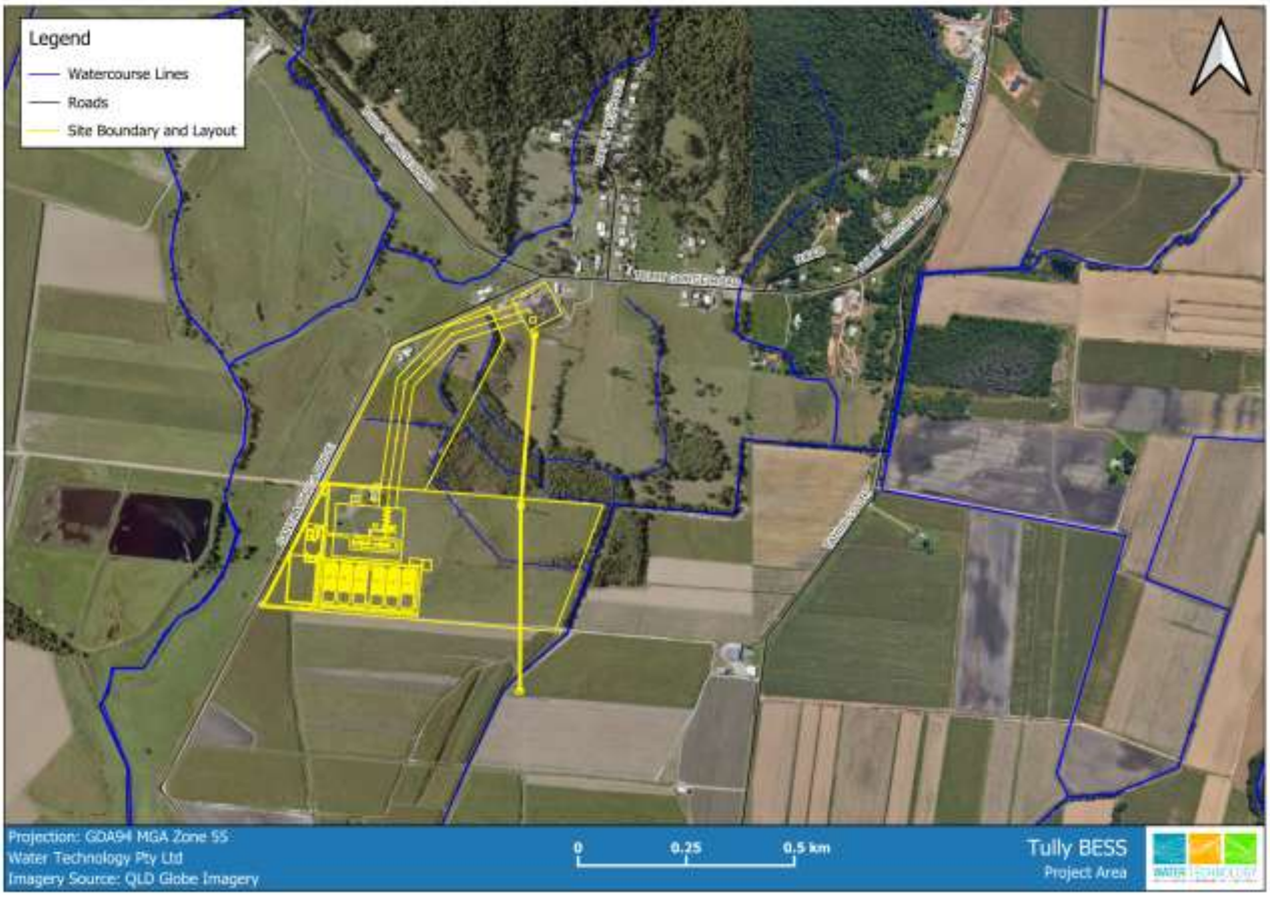

Figure 1-1 Tully BESS – Site Location

1.1 Proposed Development

Attexo are assisting RWE Tully Battery Pty. Ltd. (RWE) in submitting a development application for a proposed BESS, occupying an area of approximately 28.7 hectares (ha), that comprises of two freehold parcels, Lot 1 on RP735276 and Lot 1 on RP852238. The site is situated approximately 4 km south-west of Tully. The project is expected to have an approximate capacity of up to 200 MW / 800 MWh with grid connection proposed via the Powerlink owned 132 kV existing Tully Substation, located to the northeast on Lot 1 on RP716718. Figure 1-2 illustrates the BESS area with the layout of the batteries and supporting infrastructure. The proposal includes:

- BESS development area including earthworks, temporary construction ancillary facilities, foundations for installation of containerised battery system, drainage works, appropriate fencing, perimeter and site access road.
- An easement for an overhead electrical infrastructure connection running from the north of the BESS area to substation on the adjoining lot.
- Site access road off Sandy Creek Road.

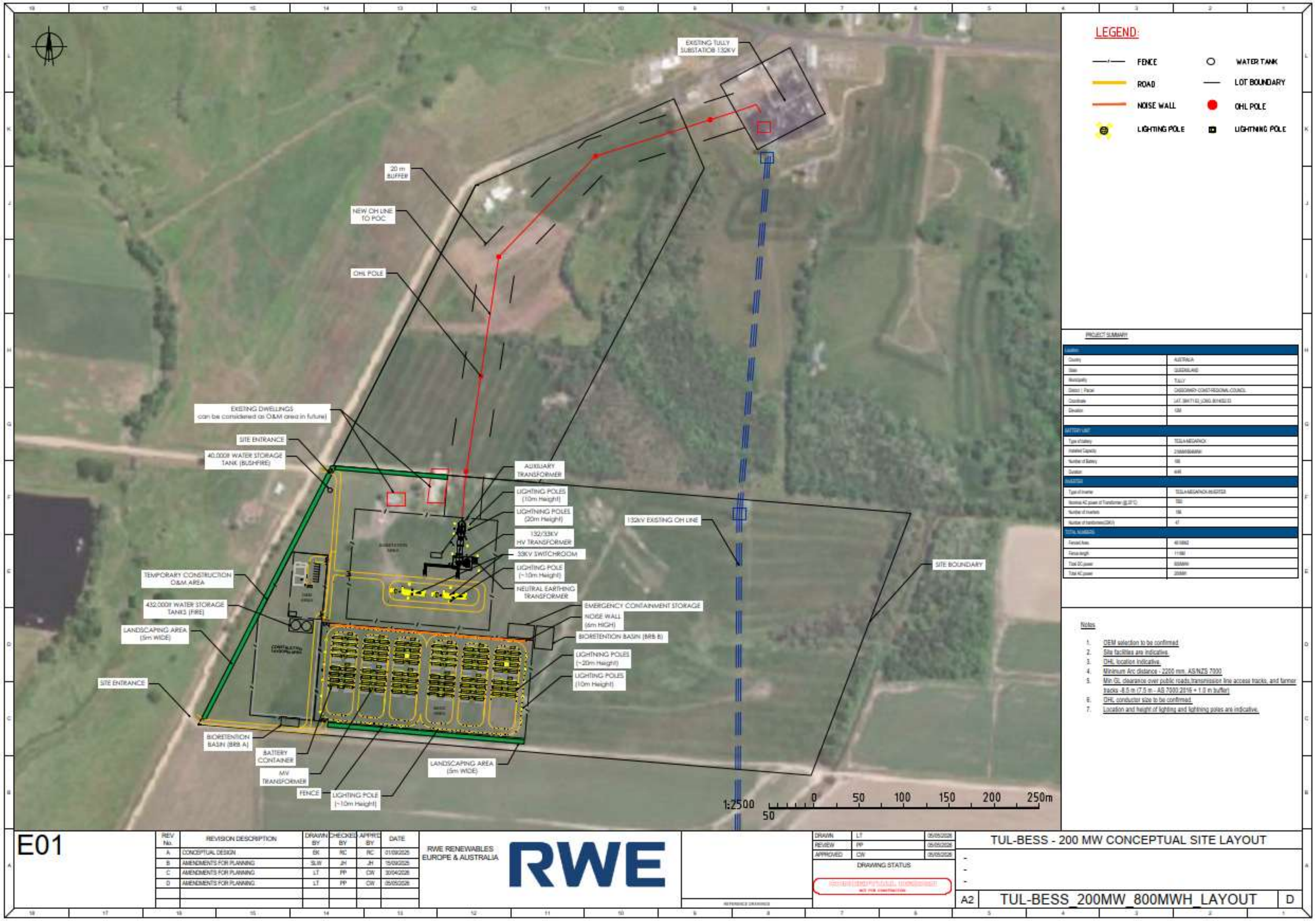

Figure 1-2 Tully BESS Site Layout

1.2 Background

WT originally completed assessments of stormwater and flooding to support the proposal. These are described in the report *'Tully BESS Stormwater Management Plan & Flood Assessment'*, prepared for Attexo by WT and dated 15 December 2025 (the SMP). The SMP was included in the Tully BESS Development Application (DA), previously submitted to Cassowary Coast Regional Council (CCRC) and an *Environment Protection and Biodiversity Conservation (EPBC) Act 1999* referral submitted to the Department of Climate Change, Energy, the Environment and Water (DCCEEW) for assessment of potential impacts on Matters of National Environmental Significance.

The Queensland State Government has recently made changes to the DA process for large-scale BESS projects. DA's for these projects are now assessed by the State Assessment and Referral Agency (SARA) against the State Development Assessment Provisions (SDAP). SDAP version 3.5 commenced on 12 December 2025 and included the introduction of the new *'State code 27: Battery storage facility development'* (SC27) as part of the changes to the Planning Regulation 2017 under the *Planning (Battery storage facilities) and Other Legislation Amendment Regulation 2025*.

For pre-existing applications relating to battery storage facilities, the legislative change means that upon commencement of SDAP v3.5 (on 12 December 2025), for any *"pre-existing development application that is a properly made application – the application is taken not to be a properly made application, and is taken not to have been accepted".* Accordingly, and the project must re-commence the DA process from the beginning under the new framework.

1.3 Assessment Objectives and Scope

This report describes a conceptual SMP and FA to support the proposal and includes:

- A review and summary of relevant planning and legislative requirements as they relate to stormwater management and flooding.
- Identification of Environmental Values (EV's) and Water Quality Objectives (WQO's) applicable to the development.
- A SMP documenting the methodology and outcomes of the assessments undertaken to demonstrate that the proposed development achieves the stormwater quality requirements of CCRC and the Queensland State Government, including:
  - Compliance with the relevant Performance Outcomes associated with The Department of State Development, Infrastructure and Planning (DSDIP):
    - State Code 27: Battery storage facility development[1].
  - Details of construction phase erosion and sediment control measures.
  - MUSIC modelling to quantify changes to stormwater runoff quality during the operational phase.
  - Conceptual sizing of stormwater quality management measures to meet the relevant WQO's.
- A FA documenting modelling undertaken to characterise existing overland flow flood behaviour within and surrounding the site and quantify potential impacts of the proposal on overland flow flooding as well as:
  - Development of a local flood model (using TUFLOW) to characterise existing overland flow behaviour.
  - High-level recommendations to minimise impacts of flooding on the development.

[1] Queensland Department of State Development, Infrastructure, Local Government and Planning, Planning guidance – State code 27: Battery storage facility development, 12/12/2025

1.3.1 State Code Performance Outcomes

State Code 27 provides performance benchmarks for battery storage facility development. Table 1-1 lists the relevant performance outcomes from these codes and identifies sections of this report where each matter is addressed.

Table 1-1 State Code Performance Outcomes

Performance Outcome (PO)	Response
State Code 27: Battery Storage Facility Development	
Protecting Water Quality and Stormwater Management	

PO16 Development:
• minimises the disturbance of high risk soils; and
• manages the release of soil based contaminants.
	■ General soil characteristics, from regional-scale mapping, are described in Section 3.5, however no field soil sampling has been completed at this stage.
	  ■ The mapping indicates presence of acidic soils (Hewitt) across the majority of the site and unknown soils (MSC) across the remaining site areas, meaning there is potential that high risk soils could be encountered at the site.
	■ Measures to manage disturbance and release of soils (and any corresponding soil-based contaminants) during the construction phase are addressed in the separate *Erosion and Sediment Control Plan* (ESCP), prepared by Attexo, The ESCP outlines soil management measures for the construction phase, which include:
	  ■ soil sampling to confirm soil types; and
	  ■ treatment of any soil limitations.

PO17 Development maintains the water quality of receiving waters, waterways and wetlands by: • avoiding locating in waterways and wetlands; • minimising crossings of and interference with natural drainage lines, farm drainage and irrigation infrastructure; • minimising erosion and sediment run off; • managing drainage control; and • preserving the bank stability of affected waterways and drainage lines avoiding non-essential hardening or unnatural modification of the waterway.	■ Waterways and wetland areas impacting the site are identified in Sections 3.4 and 3.3, respectively. ■ All site infrastructure is situated out of the mapped wetlands and waterways, with the exception of overhead lines which cross above these areas, however, all footings are situated outside them. ■ General measures to manage erosion and sediment runoff for the construction phase are addressed in the separate ESCP (prepared by Attexo). ■ Stormwater quality management measures for the operational phase have been modelling using MUSIC to demonstrate that relevant water quality targets are met. This is described in Sections 5.3 to 5.5.

Performance Outcome (PO)	Response
PO18 Development prevents the release of contaminants to surface water or groundwater in the event of an incident, including a fire or explosion.	■ Precautionary containment, testing and managed release framework has been adopted for this facility, and is detailed in Section 5.4.2. ■ Riskcon has undertaken a Fire Safety Study (FSS) for the facility and determined that a fire suppression volume of 0.432 ML is required. ■ An Emergency Containment Storage of this capacity will be provided to capture firefighting runoff for subsequent testing and appropriate management prior to release or disposal. ■ The containment storage is proposed as an open basin with a nominal depth of approximately 1.0 m, occupying an area of approximately 432 m², subject to refinement during detailed civil design.
PO19 Development minimises interference with overland flow paths.	■ The local flood modelling results, summarised in Section 6.5, identifies natural drainage paths across the site. ■ The BESS footprint and surrounding operational areas are situated on land primarily influenced by shallow overland flow and some localised ponding against an embankment along the southern site boundary. ■ The mapped inundation represents runoff from the Subject Property travelling towards downstream waterways and the works do not interfere with conveyance flowpaths for external flows through the site. ■ Future detailed design of the BESS will consider both earthworks and stormwater drainage to protect the infrastructure from flooding and to manage runoff from the developed site.

2 LEGISLATIVE CONTEXT

There are a number of legislative acts and policies in Queensland that govern development throughout the state. Those that are particularly relevant to the proposed Tully BESS in the context of the SMP and FA are detailed in the following sections.

2.1 Environmental Protection Act 1994

The stated object of the act is to protect Queensland's environment while allowing for development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends (ecologically sustainable development). Subordinate to this act is the Environmental Protection (Water and Wetland Biodiversity) Policy 2019 whose purpose is to achieve the *Environmental Protection Act (1994)* objectives in relation to waters and wetlands.

2.1.1 Environmental Protection (Water and Wetland Biodiversity) Policy 2019

The Environmental Protection (Water and Wetland Biodiversity) Policy 2019 (EPP Water) is designed to uphold the objectives of the *Environmental Protection Act 1994* concerning the protection of Queensland's water environment while permitting ecologically sustainable development. It aims to determine Environmental Values (EV's) and Water Quality Objectives (WQO's) for Queensland waters progressively. EV's define water uses by both aquatic ecosystems and humans (such as drinking water, irrigation, aquaculture, and recreation), while WQO's set objectives for the physical, chemical, and biological characteristics of water (including nitrogen content, dissolved oxygen, turbidity, toxicants, and fish health).

The policy adopts the management framework outlined in the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG, 2018) to guide its implementation.

2.2 Water Act 2000

The purpose of the act, with relevance to the project, is to provide a framework for the sustainable management of Queensland's water resources. This requires:

- Incorporating the principles of ecologically sustainable development;
- Sustaining the health of ecosystems, water quality, water-dependent ecological processes and biological diversity associated with watercourses, lakes, springs, aquifers and other natural water systems, including where practicable, reversing degradation that has occurred; and
- Recognising the interests of Aboriginal people and Torres Strait Islanders and their connection with water resources.

Subordinate to this act is the Water Plan (Wet Tropics) 2013. The Water Plan provides a framework for sustainable water management balancing human development with environmental systems including the reversal of degradation in natural ecosystems.

2.3 Planning Act 2016

The *Planning Act 2016* is the primary piece of legislation that governs land use planning and development in Queensland. It establishes a framework for the preparation and implementation of planning schemes that regulate the use of land in Queensland. The development of 'battery storage facilities' advances the purpose of the Planning Act under section 5 (c) and (h):

c. promoting the sustainable use of renewable and non-renewable natural resources, including biological, energy, extractive, land and water resources that contribute to economic development through employment creation and wealth generation

h. supplying infrastructure in a coordinated, efficient, and orderly way.

2.3.1 Planning Regulation 2017

The Planning Regulation 2017 is subordinate to the *Planning Act 2016*, detailing operational elements of the Planning Act. The Planning Regulation sets out the only land use terms that may be adopted in local planning schemes in Schedule 3. These are complemented by the use terms defined in Schedule 24 of the Planning Regulation.

2.3.1.1 State code 27: Battery storage facility development

The Planning Regulation was recently amended with introduction of the *Planning (Battery Storage Facilities) and Other Legislation Amendment Regulation 2025*, which commenced on 12 December 2025 and sets out terms for development applications for battery storage facilities. A corresponding revision of the State Development Assessment Provisions (SDAP) Version 3.5 introduced the new State Code 27 which outlines assessable benchmarks for battery storage facility development. The relevant performance outcomes, related to protecting water quality and stormwater management, are listed in Table 2-1.

Table 2-1 SC27 Performance Outcomes

Performance Outcome (PO)
PO16 Development: • minimises the disturbance of high risk soils; and manages the release of soil based contaminants.
PO17 Development maintains the water quality of receiving waters, waterways and wetlands by: • avoiding locating in waterways and wetlands; • minimising crossings of and interference with natural drainage lines, farm drainage and irrigation infrastructure; • minimising erosion and sediment run off; • managing drainage control; and • preserving the bank stability of affected waterways and drainage lines avoiding non-essential hardening or unnatural modification of the waterway.
PO18 Development prevents the release of contaminants to surface water or groundwater in the event of an incident, including a fire or explosion.
PO19 Development minimises interference with overland flow paths.

2.3.2 State Planning Policy (SPP) – Water Quality

The State Planning Policy (SPP) ensures Queensland's state interests are delivered through local planning and development assessment. The SPP identifies water quality as a state interest, and local governments must reflect it in their planning schemes; where a scheme has not fully integrated a state interest, the SPP's interim development assessment requirements apply. Development must achieve post-construction stormwater design objectives, including minimum reductions in:

- Total Suspended Solids (TSS): 80%
- Total Phosphorus (TP): 60%
- Total Nitrogen (TN): 45%
- Gross Pollutants (>5 mm): 90%

These are typically achieved through water sensitive urban design (WSUD) measures such as bioretention basins, swales, and gross pollutant traps (GPT).

2.3.3 Cassowary Coast Regional Council Planning Scheme 2015 (V4)

The Cassowary Coast Regional Council Planning Scheme advances state and regional policies through detailed local provisions. While the scheme does not specifically define Battery Energy Storage Systems (BESS), development remains subject to relevant zoning provisions and infrastructure standards, including stormwater management requirements specified in the desired standards of service. These provisions align with the State Planning Policy (SPP) – Water Quality objectives discussed in Section 2.2.

2.3.3.1 Desired Standards of Service

Section 4.4 of the Planning Scheme specifies the desired standards of service for the stormwater network:

1. Collect and convey stormwater in a system of natural and engineered channels, a piped drainage network and system of overland flow paths to a lawful point of discharge in a safe manner that minimises nuisance, damage and inundation of habitable rooms and protects life;
2. Manage the water quality within urban catchments and waterways to protect and enhance environmental values and pose no health risk to the community;
3. Adopt water-sensitive urban design principles and on-site water quality management to achieve relevant water quality objectives;
4. The design of the stormwater network is in accordance with the FNQROC Regional Development Manual – Issue 7 (2017).

2.4 Fisheries Act 1994

The primary purpose of this act as stated is to provide for the use, conservation and enhancement of the community's fisheries resources and fish habitats in a way that seeks to apply and balance the principles of and promote ecologically sustainable development. Of relevance to this project, this act manages the introduction of waterway barrier works that may impact fish movement through the project area.

2.5 Vegetation Management Act 1999

The *Vegetation Management Act 1999* provides a comprehensive framework for vegetation management in Queensland, including the protection of riparian vegetation, while the specific policies and guidelines for the protection and management of riparian vegetation in Queensland aim to ensure that this unique and important type of vegetation is protected and preserved for future generations. These include the following:

- Vegetation Management Regulation 2012: Subordinate to the Vegetation Management Act 1999 and provides accepted development vegetation clearing codes.
- Queensland Government Riparian Vegetation Management Guidelines: Provides guidance on the management of riparian vegetation and aims to ensure that riparian areas are protected and managed in an ecologically sustainable manner.
- State Planning Policy: Sets out the Queensland government's position on the protection of riparian vegetation and the requirement for local governments to include provisions for the protection of riparian areas in their planning schemes.
- Regional Ecosystems: Defined areas within Queensland that have similar vegetation types and ecological characteristics and include specific provisions for the protection and management of riparian vegetation.

2.6 Soil Conservation Act 1986

This act relates to the conservation of soil resources and mitigation of soil erosion through soil conservation measures.

2.7 Non-Statutory Water Quality Guidelines

2.7.1 Reef 2050 Water Quality Improvement Plan

The Reef 2050 Water Quality Improvement Plan is a strategic framework designed to safeguard the health of the Great Barrier Reef's marine ecosystems. It focuses on reducing sediment runoff, nutrient pollution, and pesticide contamination. Key elements include targeted actions, improved land management practices, robust monitoring, community engagement, research, and adaptive management. The plan involves stakeholders from various sectors and emphasizes the use of best management practices to minimize environmental impact.

These guidelines list specific water quality objectives for relevant catchments to achieve 2025 Great Barrier Reef water quality targets. This site is situated in the in the Tully Catchment which covers 1,683 km² (8% of the Wet Tropics region).

Table 2-2 summarises the 2025 end-of catchment anthropogenic water quality targets for the Tully Catchment and associated priorities for water quality improvement.

Table 2-2 End-of-catchment anthropogenic load reductions required from 2013 baseline

Region: Wet Tropics Region, Tully catchment water quality targets		
Parameter	**Target**	**Management Priority**
Dissolved inorganic nitrogen (DIN)	190 tonnes, 50% reduction	High
Fine sediment	17 kilo-tonnes, 20% reduction	Low
Particulate phosphorus (PP)	23 tonnes, 20% reduction	Low
Particulate nitrogen (PN)	68 tonnes, 20% reduction	Low
Pesticides	n/a	Low

2.7.2 Wet Tropics Water Quality Improvement Plan

The Wet Tropics Water Quality Improvement Plan (WQIP) was developed to establish and achieve water quality targets for the region, ensure the protection of the Great Barrier Reef. The plan identifies priority areas and outlines targeted management actions that aim to reduce pollutant loads, improve land management practises and enhance ecosystem resilience.

The short-term water quality and land management targets are in accordance with the broader Reef 2050 Water Quality Improvement Plan, reinforcing efforts to protect coastal and marine environments. The Wet Tropics region is divided into distinct catchment areas to facilitate localised and strategic interventions. Key pollutants of concern include fine sediment, nutrients and pesticides, which originate mainly from agriculture activities. While some catchments have been identified as priority areas for investment, the plan promotes a proactive and preventative approach to managing water quality risks across the region, ensuring long-term sustainability.

2.7.3 Application to the Project

While the Reef 2050 WQIP and the Wet Tropics WQIP are not statutory instruments, adopting their catchment-specific targets and best-practice measures supports compliance against State Code 9 by:

(a) maintaining or improving site hydrology (PO3),

(b) preventing unacceptable water quality impacts to wetlands and their buffers (PO4), and

(c) ensuring wetlands are not used as part of the stormwater treatment system (PO5).

2.8 Other Relevant Guidelines

In addition to relevant legislation, several surface water and stormwater management guidelines have been considered to ensure best practice methods and design outcomes are utilised at Tully BESS. These include:

- Australian and New Zealand Governments (ANZG) 2018, Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Australian and New Zealand Governments and Australian state and territory governments, Canberra ACT, Australia.
- Australian Drinking Water Guidelines, 2011 (Updated August 2018).
- Queensland Urban Drainage Manual, 2017.
- Australian Rainfall and Runoff: A Guide to Flood Estimation, Commonwealth of Australia - Geoscience Australia, 2019.
- Best Practice Erosion and Sediment Control, IECA, 2025.

3 CATCHMENT HYDROLOGY AND SITE CHARACTERISTICS

3.1 Topography and Catchments

3.1.1 Regional Context - Tully River Drainage Basin

The Tully River Drainage Basin is located in the south of the Wet Tropics region and which occupies an area of approximately 1,675 km² extending south from Innisfail, as shown in Figure 3-1. The Tully River Basin drains primarily to the Pacific Ocean, with additional contributions from the Hull River and smaller tributaries. Given the region's high rainfall and complex topography, the site is subject to dynamic hydrodynamic processes, including floodplain inundation, overland flow, and potential backwater effects from downstream constraints.

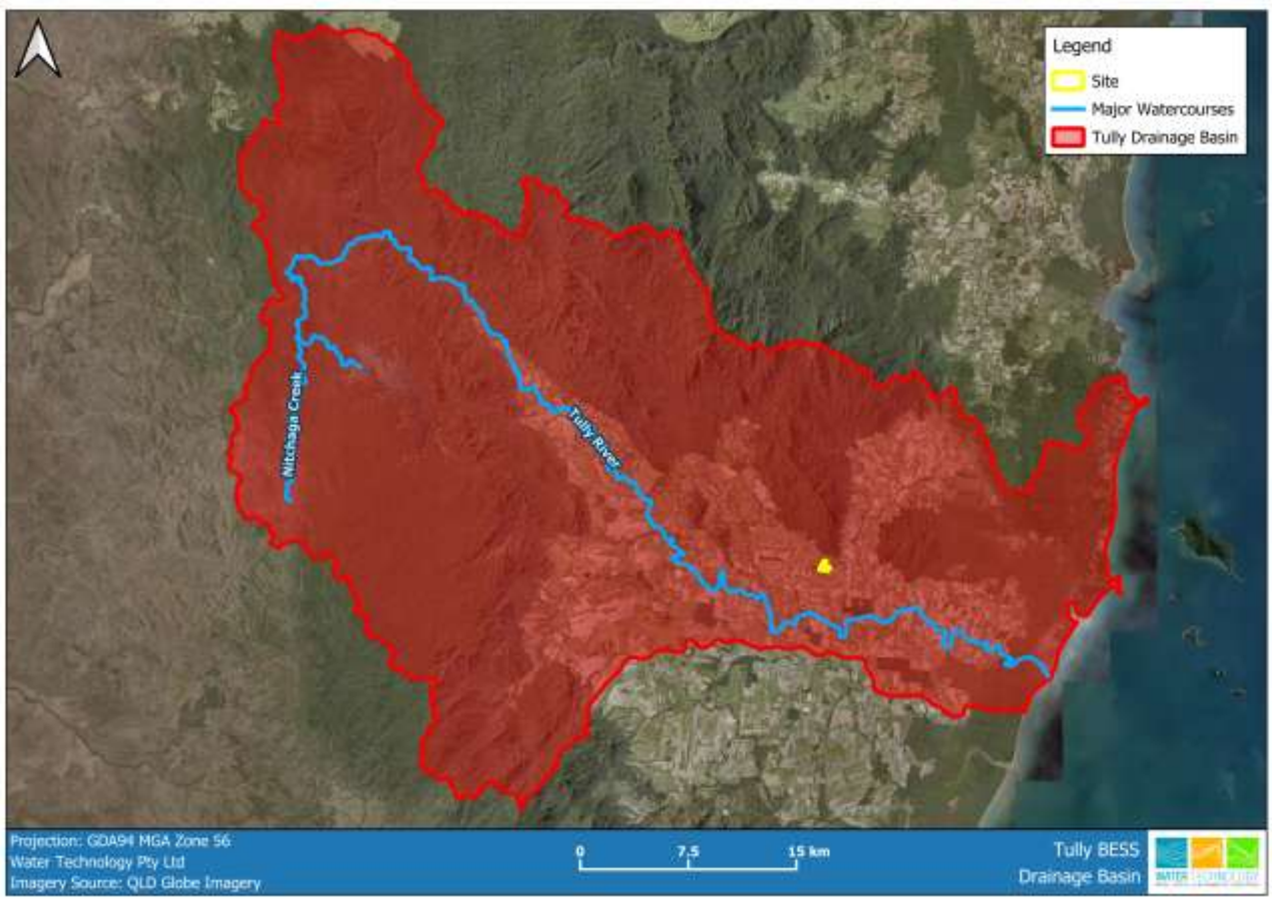

Figure 3-1 Tully Drainage Basin

3.1.2 Site and Local Catchment

The landform of the floodplain surrounding the site to the west, south and east is characterised by gentle low-grade slopes and drained by a combination of natural ephemeral flowpaths and constructed agricultural drains. To the north of the site, the land is much steeper, with ranges of Mount Tyson rising to an elevation above 300m AHD approximately 2.5km north of the site. The mountain range forms the headwaters of the local catchment for the unnamed tributaries flowing around the site.

The site is situated on the fringe of the floodplain in the lower part of the Tully River Drainage Basin. The land is relatively flat, with elevations within the site ranging from approximately 8 mAHD (in the east) to 18 mAHD (in the northwest). The site topography is shown in Figure 3-1.

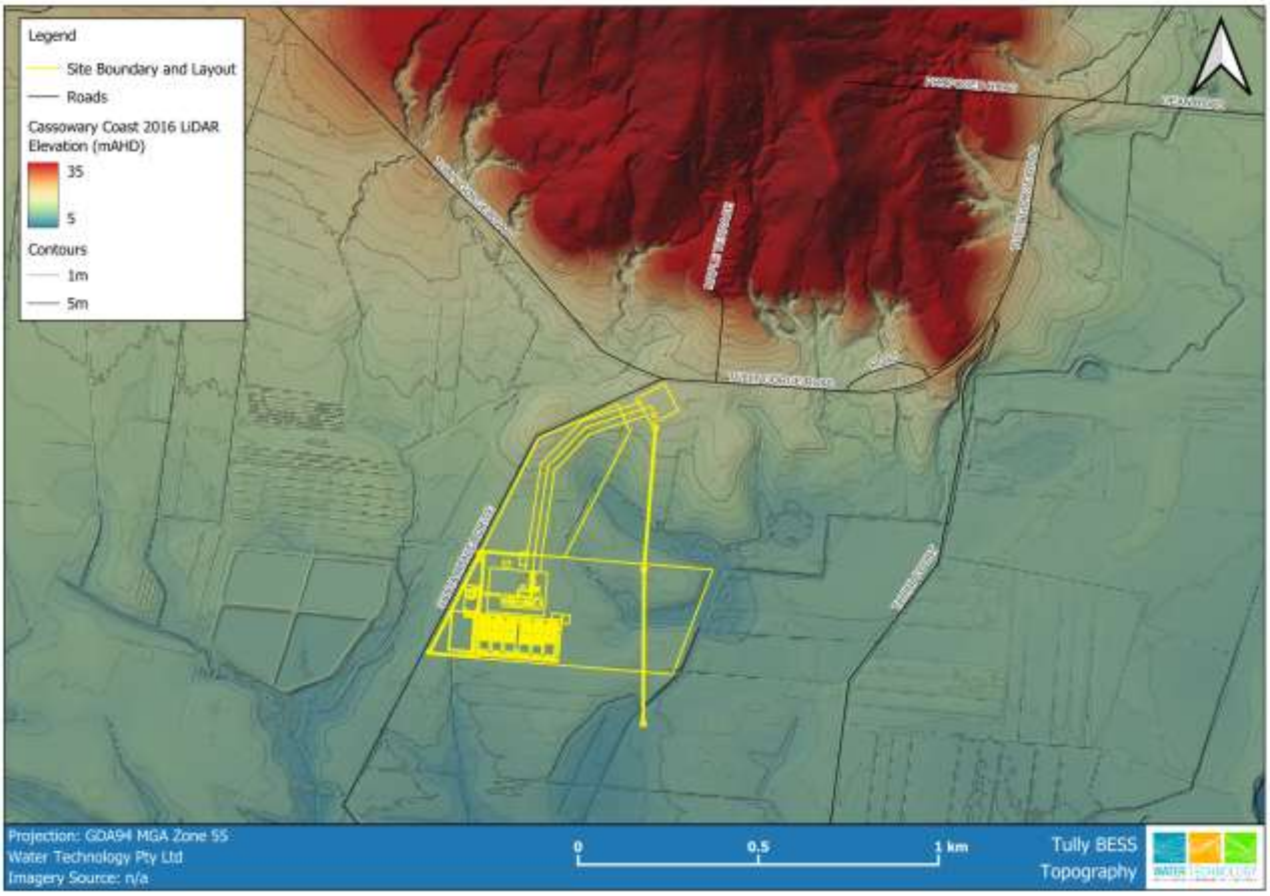

Figure 3-2 Site Topography and Local Catchment

3.2 Land Use

The project area is predominantly used for grazing native vegetation, as identified by the Queensland Land Use Mapping Program. The surrounding catchment features also include areas of Environmental Significance according to Cassowary Coast Regional Council online planning scheme mapping, as shown in Figure 3-3.

3.3 Great Barrier Reef Wetland Protection Areas

Figure 3-4 shows the location of the mapped Great Barrier Reef Wetland Protection Areas in the vicinity of the project. The areas of high ecological significance identified in this dataset closely correlate with the areas of Environmental Significance shown in the Cassowary Coast Regional Council online planning scheme mapping, which includes mapped wetlands near the site. The proposed infrastructure has been designed to be located wholly outside these mapped high ecological significance areas.

However, the site is within the mapped Great Barrier Reef Wetland Protection Area trigger area, which means the development must be assessed against the provisions of State Code 9: Great Barrier Reef Wetland Protection Areas under the State Development Assessment Provisions (SDAP). Compliance with State Code 9 performance outcomes is addressed in Section 1.3.1.

Figure 3-3 Areas of Environmental Significance (Cassowary Coast Regional Council Online Planning Scheme)

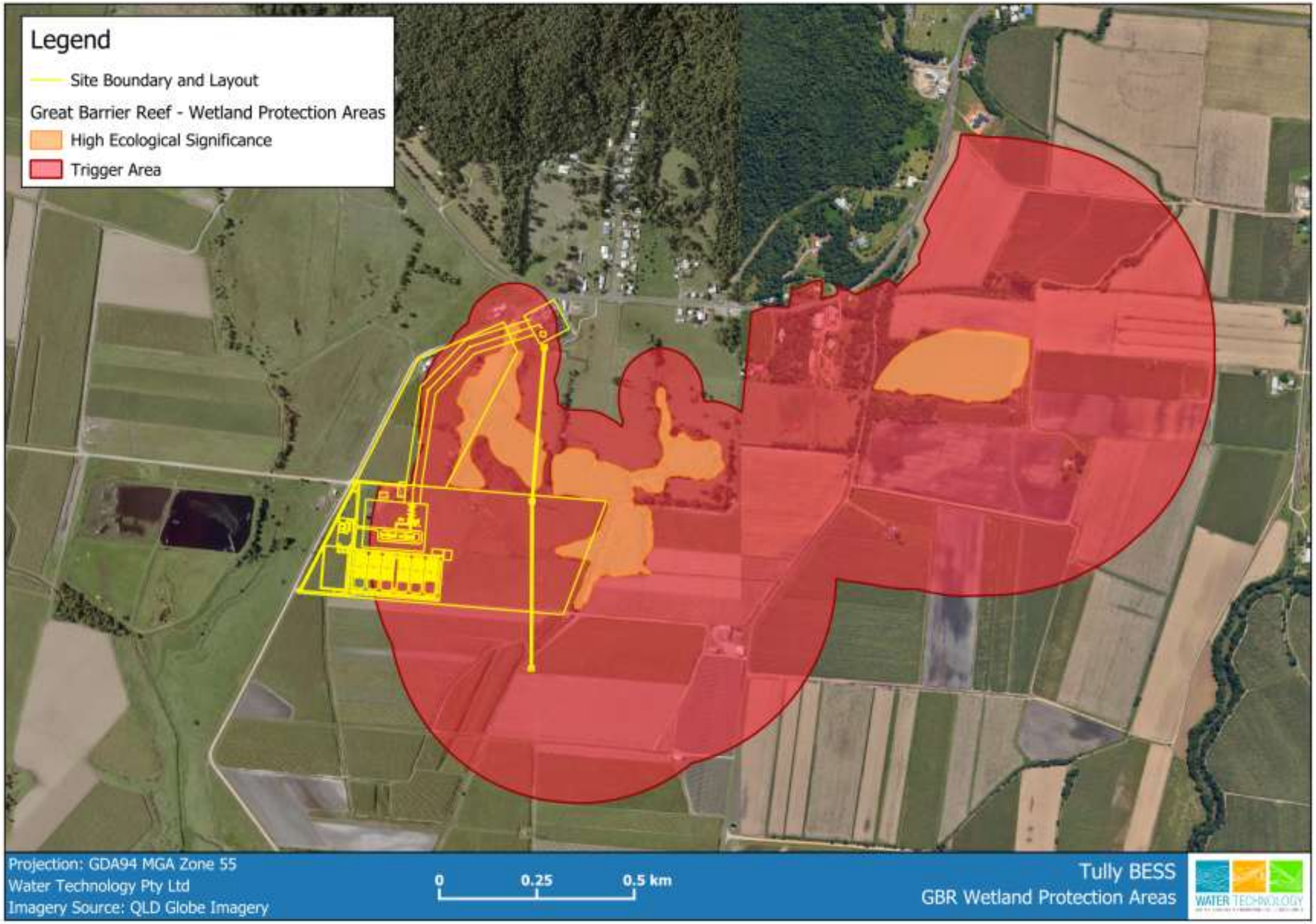

Figure 3-4 Great Barrier Reef Wetland Protection Areas

3.4 Waterways and Fish Passage

Figure 3-6 illustrates the proposed development layout against the Department of Agriculture and Fisheries *Queensland waterways for waterway barrier works* spatial layer. This spatial layer classifies waterways defined by the *Fisheries Act* to assist in determining whether proposed barrier works are assessable or accepted (DAF, 2021). Waterways receive a fish passage attribute, a number between 1 and 5 which is additionally colour coded for easy reference. The classification does not indicate the relative importance of the fish habitat, rather it has been determined by several characteristics including stream order, stream slope and tidal influence.

- Waterways classified as 1 (low) (green) or 2 (medium) (amber) are typically in the upper reaches of a catchment where fish are typically smaller with stronger swimming abilities.
- Waterways classified as 3 (high) (red), 4 (major) (purple), or 5 (tidal) (grey) typically are host to a wider range of fish sizes and swimming abilities.

Figure 3-5 illustrates the assessment process matrix provided by DAF (2021) in the *Queensland waterways for waterway barrier works* spatial data layer: Guide to determining waterways Version 2.0 (April 2021). There were no waterway crossings identified for this project.

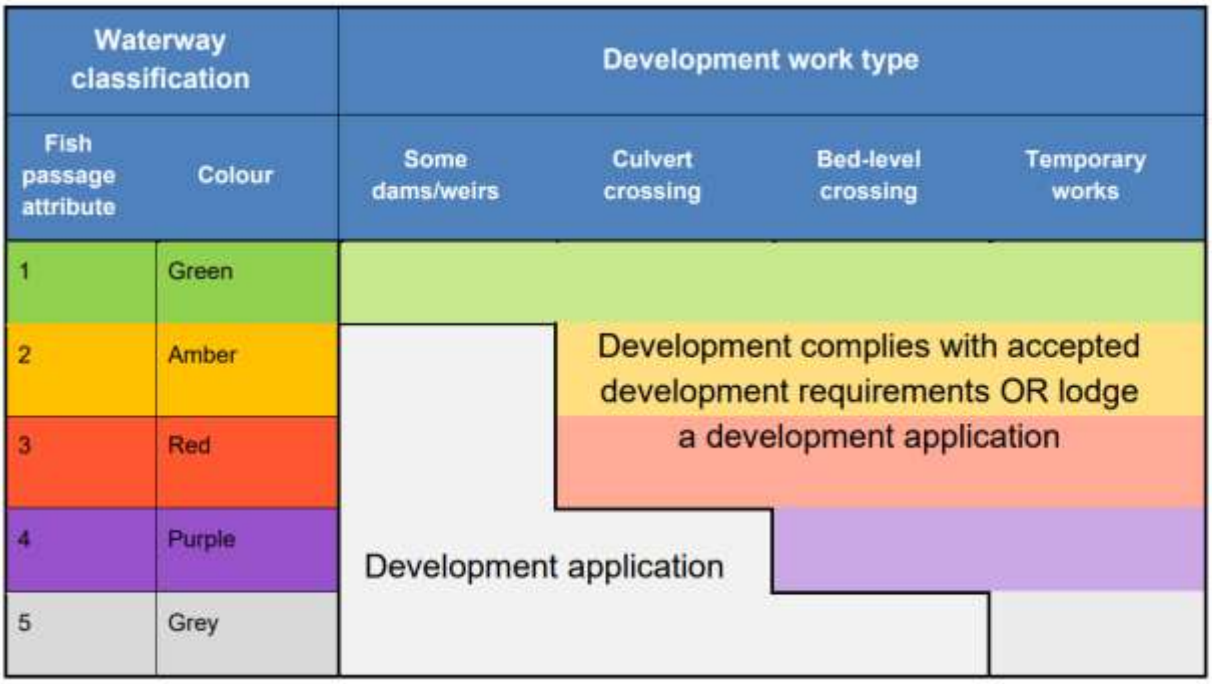

Figure 3-5 Assessment process matrix regarding waterway classification and proposed development work

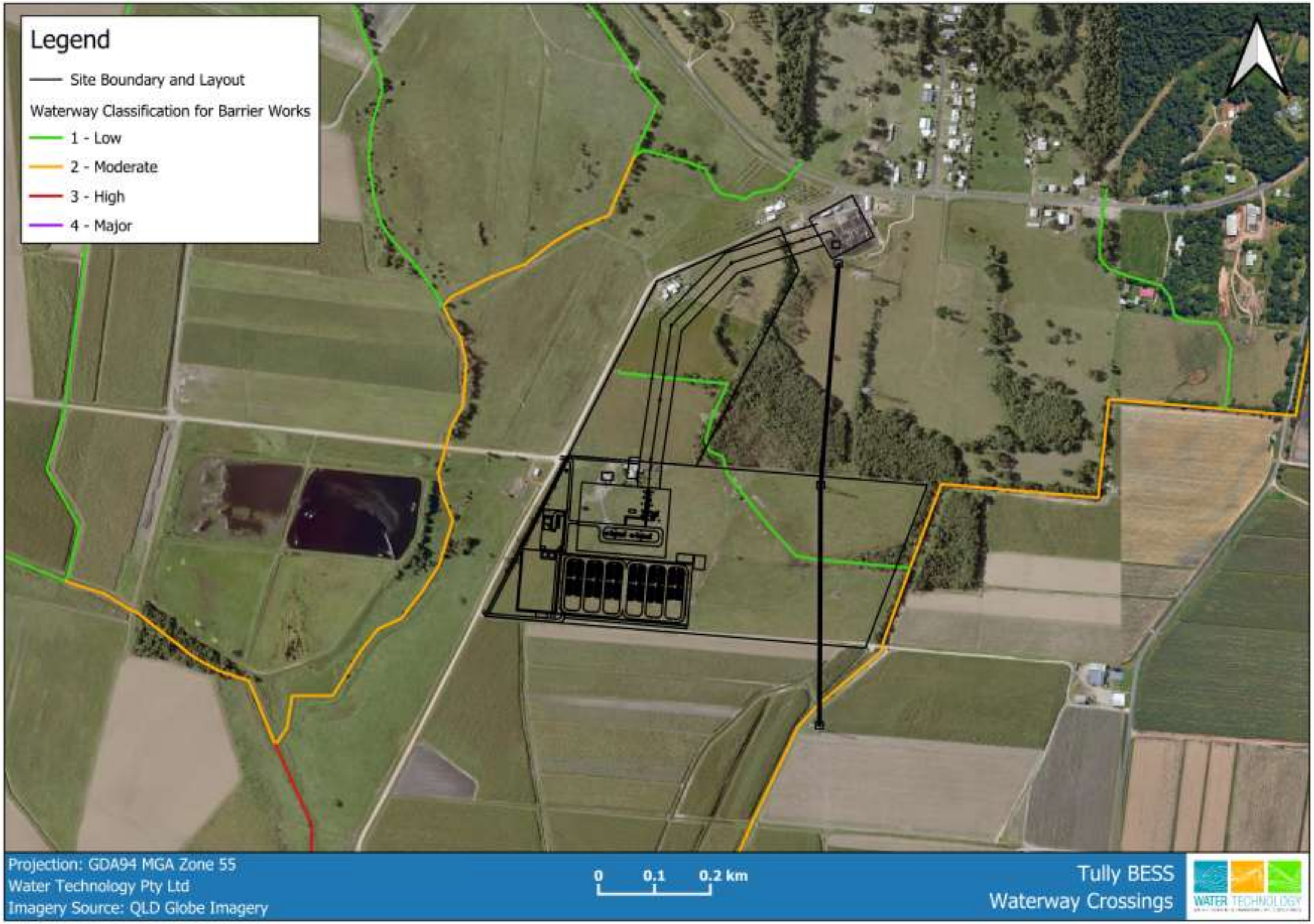

Figure 3-6 Crossing Locations

3.5 Soils

3.5.1 Soil Type and Description

Soil mapping at a scale of 1:50,000 was accessed via Queensland Globe and is illustrated on Figure 3-7. The map data was derived from a soil and land suitability survey of the Cardwell-Tully-Innisfail area undertaken between 1982 and 1996 and described in CSIRO's *'Division of Soils, Divisional Report No. 115, Soils of the Cardwell-Tully Area, North Queensland'* (1992).

The Hewitt soil series dominates the site and belongs to a broader group described as poorly drained soils formed on alluvial deposits. Conceptually, soils in this series are described as:

> *Moderately thick to thick (= 0.4m), very dark grey to black sapric peat with strong granular structure. Peat texture is silty clay loam or clay loam, though small amounts of sand and a few fine gravels may be present in areas adjoining the alluvial fans. Peaty horizons overlay grey; light to medium-heavy clay. Clay subsoils are typically mottled and structured. Coarse prismatic or columnar structure was also observed in drain batters.*

The soils in this series are hydrosols The development footprint for the proposed BESS facility is entirely within this mapped area, and the soil properties may influence infiltration capacity and foundation design.

A portion of the site is mapped as MSC (Miscellaneous Soils Complex), a classification used for areas where detailed soil assessment is limited or where heterogeneous soil conditions occur. This designation indicates that site-specific geotechnical investigations will be important to confirm soil properties for earthworks and stormwater management design. Works within the MSC area are limited to a short length of a proposed site entry road (adjacent to an existing driveway entry), and a corridor for linear overhead infrastructure. Soil disturbance will be limited to construction of footings for towers supporting the overhead infrastructure and the areas will be stabilised once construction is complete.

3.5.2 Acid Sulfate Soils (ASS)

The site is located towards the fringe of the National Scale (1:2,000,000) acid sulfate soils mapping accessible through Queensland Globe. The land lies within the Bm(p4) map classification, which is defined as having a *'low probability of occurrence (6-70%)'* of ASS. There is no more detailed mapping of ASS covering the site.

Although the mapping indicates a low probability, the potential presence of ASS cannot be ruled out. Accordingly, for any site areas where excavation is required or soil will be disturbed during construction works, soil sampling should be undertaken and soil treatment provided as required. The ESCP (prepared by Attexo) should be referenced for further details on construction phase management of site soils.

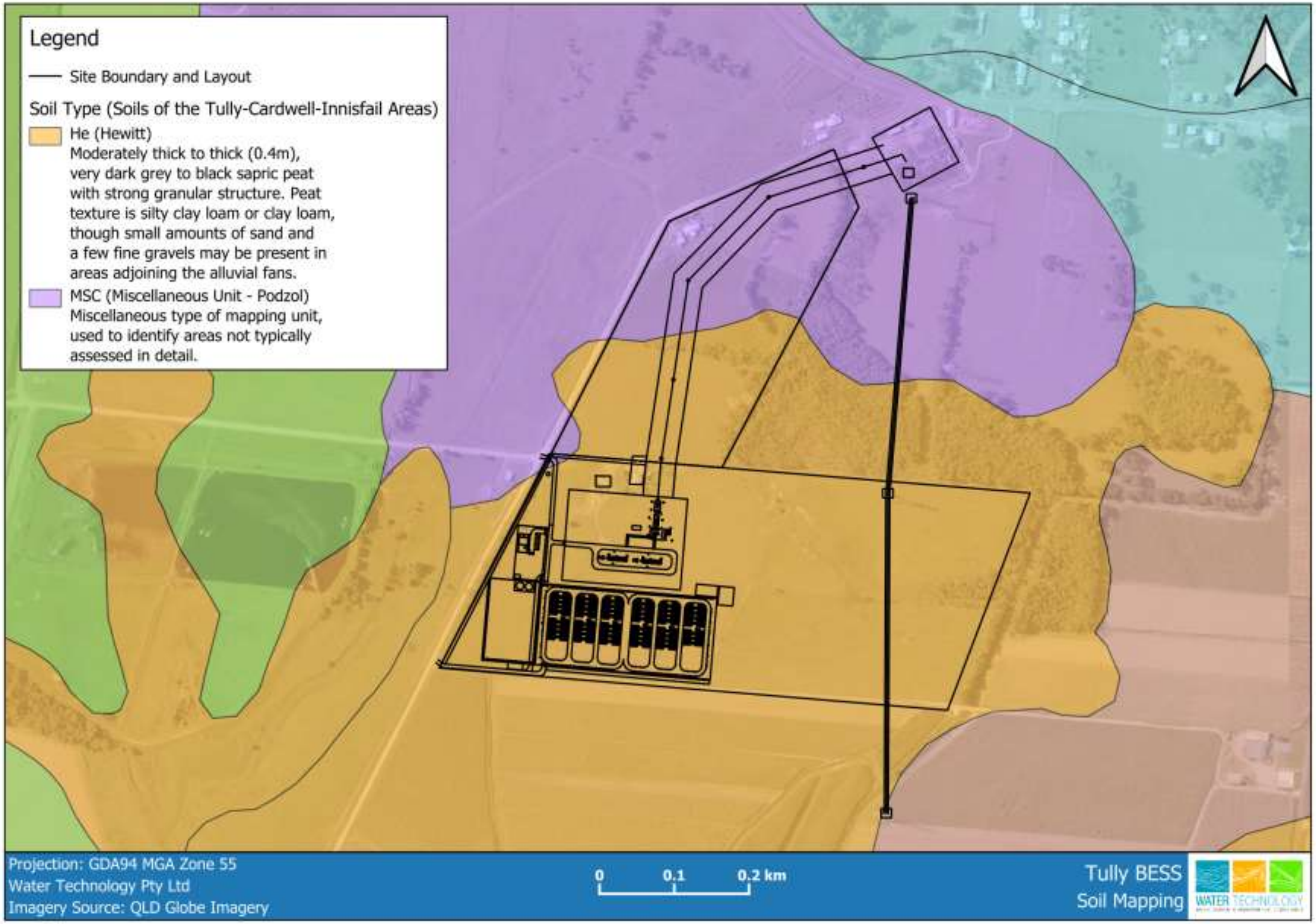

Figure 3-7 Site Soil Mapping

3.6 Geomorphology

A high-level desktop geomorphic assessment was undertaken to characterise the waterways assessed in this Study Area. The Study Area is located on the floodplain of the Tully River, at the southern foothills of Tully Gorge National Park. The geology of the area consists of alluvium materials underlain by granites. The area receives high rainfall and high intensity rainfall often leads to the River overtopping its bank and inundating the floodplains. Flat topography, regular inundation of the floodplain and poor infiltration of granitic geologies supported the development of extensive wetlands in the area historically.

To support the development of agriculture on the alluvial floodplains, many of these wetlands were drained and infilled. Channels were also constructed to divert flows. Consequently, most of the waterways in the Study Area are artificial or highly modified channels of Stream Order 1 and 2. The construction of this extensive channel network has greatly increased the drainage density of the landscape. Many of these drains have been constructed as straight channels, resulting in an increase in the efficiency of flow and sediment transfer downstream. The increase in flow rate also increases the risk of channel bank and/or bed erosion.

Extensive clearing of vegetation from the floodplain also contributed to the increased rate and volume of run-off. This further reduced the resilience of channel banks and bed. While lower order streams such as those bordering the Study Area are less likely to be affected by the cumulative effects of these erosive processes, localised disturbances may trigger changes such as channel deepening or widening.

3.7 Climate

Tully Station is the nearest open station providing climate statistics and is located approximately 3 km northeast of the centroid of the project area. Annual rainfall statistics are provided in Table 3-1 with gauge locations presented in Figure 3-9.

Table 3-1 Annual Rainfall Statistics

Parameter	Units	Tully Sugar Mill	Bingil Bay
Station number		032042	32009
Rainfall record		1956-present	1925-present
Distance from project area centroid	km	3 km NE	24.5 km NE
Mean rainfall	mm/year	3,921	3,127
10th percentile rainfall	mm/year	2,881	2,339
Median rainfall	mm/year	3,825	3,002
90th percentile rainfall	mm/year	5,103	4,225
Maximum rainfall	mm/year	6,211	5,165

Figure 3-8 shows the mean monthly rainfall and pan-evaporation derived from the SILO point data for the Tully gauging station. Mean annual rainfall and evaporation at Tully are 3,921 mm and 1,833 mm, respectively. The wet season tends to occur from December - May, with lesser rainfall throughout the remainder of the year.

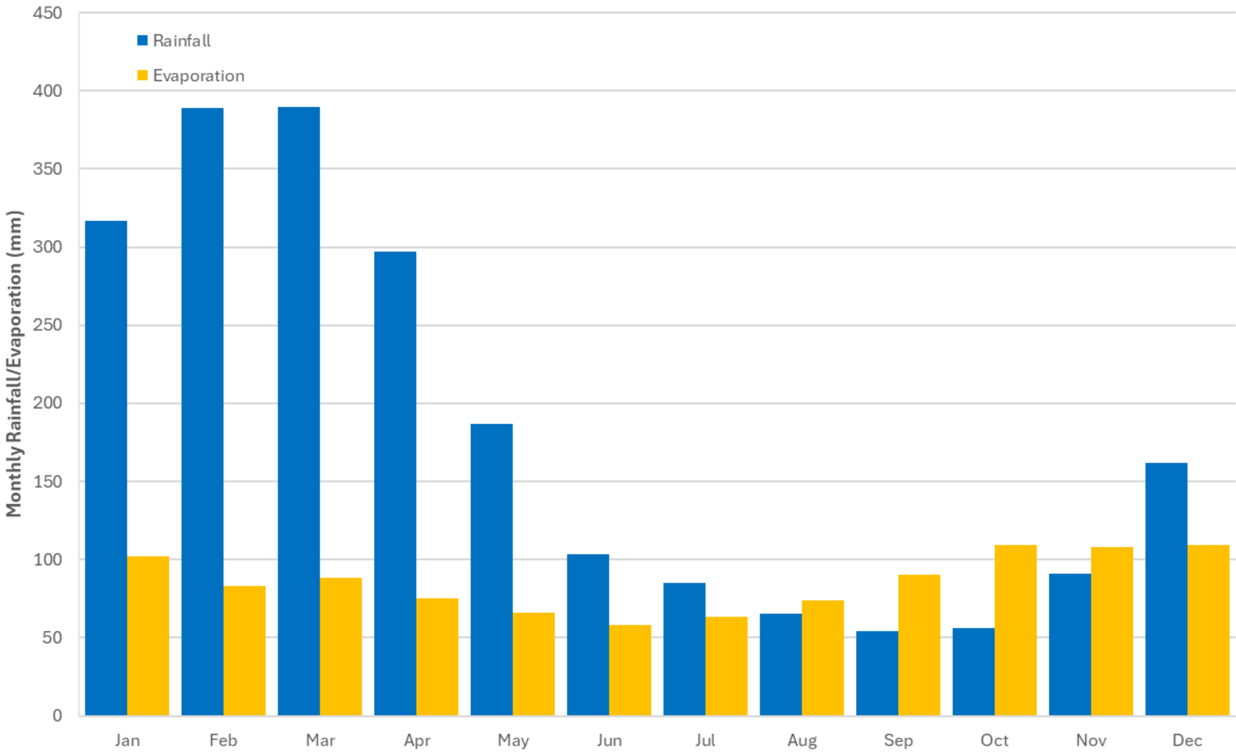

Figure 3-8 Mean Monthly Rainfall and Evaporation at Tully Sugar Mill (032042)

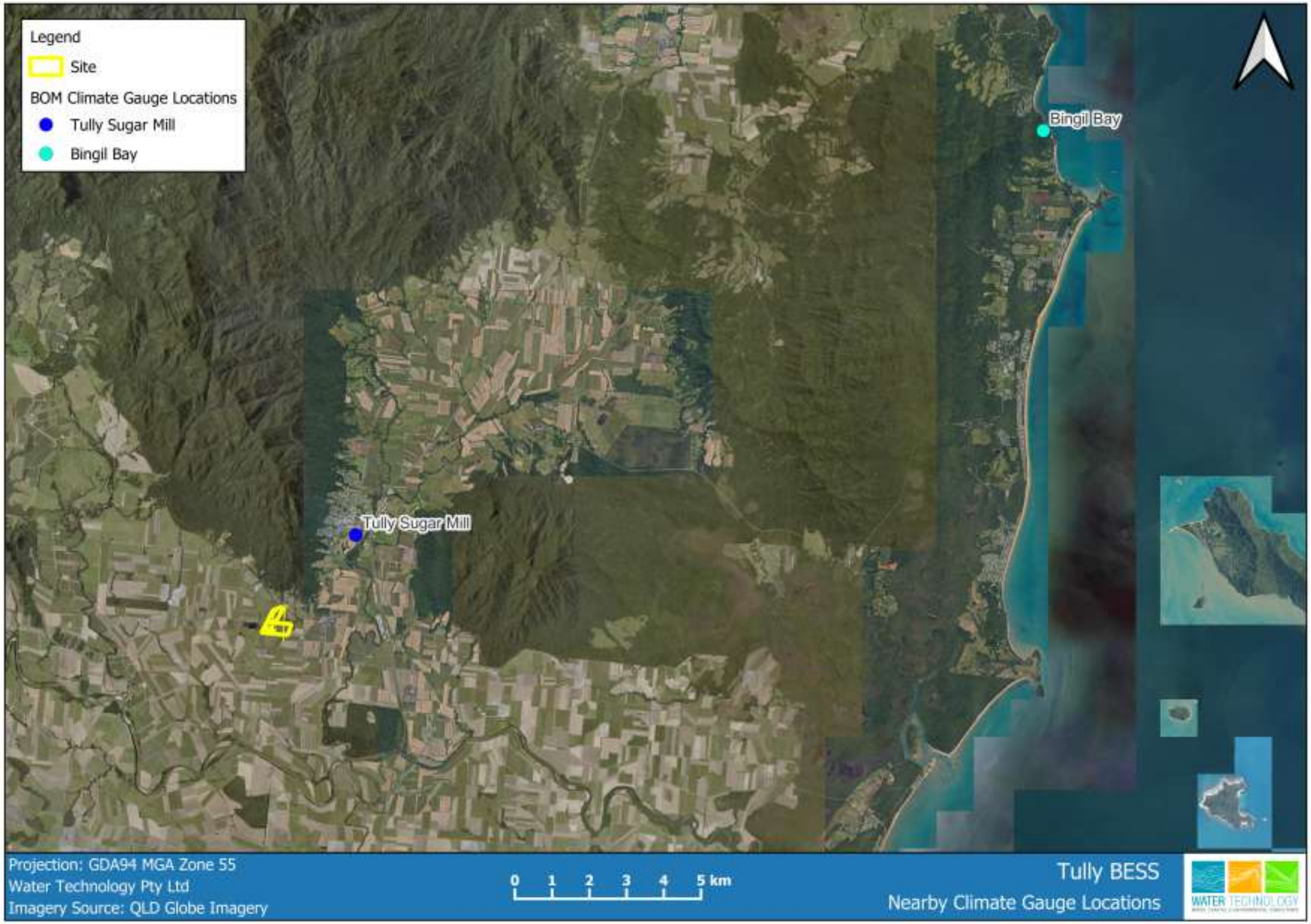

Figure 3-9 Gauge Locations

4 SURFACE WATER QUALITY

4.1 Environmental Values

The Environmental Protection (Water and Wetland Biodiversity) Policy 2019, which is subordinate legislation to the Environmental Protection Act 1994, provides a framework for identifying environmental values (EV) for a waterway and deciding water quality objectives (WQO) to protect or enhance those EV's. EV's for water are the qualities of water that make it suitable for supporting aquatic ecosystems and human water uses. These EVs need to be protected from the effects of habitat alteration, waste releases, contaminated runoff and changed flow to ensure healthy aquatic ecosystems and waterways that are safe for community use.

The site is located in the Tully River (WQ1131 – Tully River, Murray River and Hinchinbrook Island Basins) and is mapped in the Environmental Protection (Water) Policy 2009, Wet Tropics Map Series. The site is located within the Tully River Basin lowland fresh waters environmental values zone. The EVs specified for protection are as follows:

- Aquatic Ecosystems
- Irrigation
- Farm Supply
- Stock Water
- Human consumer
- Primary Recreation
- Secondary Recreation
- Visual Recreation
- Drinking Water
- Industrial Use
- Cultural and Spiritual Values

4.2 Water Quality Objectives

Water Quality Objectives are intended to protect the EV's of receiving waters and as such set out parameters for biological, chemical and other measures to be met in the receiving waters. The site is located in the Tully River Basin lowland fresh waters zone and a management intent of 'moderately disturbed for the protection of aquatic ecosystems. Water quality should be maintained or improved in line with the WQOs. The relevant aquatic ecosystem WQOs for the Tully River catchment waters are outlined in Table 4-1 to Table 4-4.

The management of riparian vegetation related to WQOs shall be conducted with reference to regional vegetation management codes under the Vegetation Management Act 1999. This is aimed at maintaining water quality, bank stability and aquatic a terrestrial habitat. Clearing control varies according to stream order.

Table 4-1 Water quality objectives for nutrients and suspended soils to protect aquatic ecosystems EVs during high flow periods- 50th percentile

Parameter	Value*
Ammonia N	8 µg/L
Oxidised N	66 µg/L
Particulate N	153 µg/L
Dissolved organic nitrogen	106 µg/L
Total nitrogen	370 µg/L
Filterable reactive phosphorous	3 µg/L
Particulate P	10 µg/L
Dissolved organic phosphorous	5 µg/L
Total phosphorus	20 µg/L
Total suspended solids	20 mg/L

*High flow WQOs are based on measured data from high flow periods at a reference site on the Tully River in Tully Gorge National Park (gauging station 113015A).

Table 4-2 Water quality objectives for specific pesticides and biocides to protect aquatic ecosystem EVs for moderately disturbed developed fresh water

Parameter	Value
Atrazine	13 µg/l
Chlorpyrifos	0.01 µg/l
Endosulfan	0.03 µg/l
Simazine	3.2 µg/l
Hexazinone	75 µg/l
2,4-D	280 µg/l
Tebuthiuron	2.2 µg/l
Diazinon	0.01 µg/l

Table 4-3 Water quality objectives for ions, metals and chemical indicators in surface waters for general data across the Wet Tropics- 50th percentile

Parameter	Value
Na	7 mg/l
Ca	3 mg/l
Mg	2 mg/l
HCO_3	25 mg/l
Cl	9 mg/l
SO_4	1 mg/l
Electrical conductivity (EC)	72 µS/cm
Hardness	17 mg/l
Alkalinity	20 mg/l
Sodium adsorption ratio (SAR)	0.70

Table 4-4 Water quality objectives to protect human use environmental values (Source: DES 2020)

Environmental Value	Water quality objectives to protect EV
Suitability for drinking water supply	Local WQOs for drinking water supply are provided in Table 4 of DES (2020). Note: For water quality after treatment or at point of use refer to legislation and guidelines, including: ■ Public Health Act 2005 and Regulations ■ Water Supply (Safety and Reliability) Act 2008, including any approved drinking water management plan under the Act ■ Australian Drinking Water Guidelines.
Protection of the human consumer	Objectives as per AWQG and Australia New Zealand Food Standards Code, Food Standards Australia New Zealand, 2007 and updates.
Protection of cultural and spiritual values	Protect or restore indigenous and non-indigenous cultural heritage consistent with relevant policies and plans.
Suitability for industrial use	No WQOs are provided in this scheduling document for industrial uses. Water quality requirements for industry vary within and between industries. The AWQG do not provide guidelines to protect industries and indicate that industrial water quality requirements need to be considered on a case-by-case basis. This EV is usually protected by other values, such as the aquatic ecosystem EV.
Suitability for irrigation	ANZECC objectives for pathogens and metals are provided in Tables 8 and 9 of DES 2020. For other indicators, such as salinity, sodicity and herbicides, see AWQG.
Suitability for stock watering	Objectives as per AWQG, including median faecal coliforms <100 organisms per 100 mL. WQOs for total dissolved solids and metals are provided in Tables 10 and 11 of DES 2020, based on AWQG. For other objectives, such as cyanobacteria and pathogens, see AWQG.
Suitability for farm supply/use	Objectives as per AWQG.

Suitability for primary contact recreation	Objectives as per NHMRC (2008), including:
	■ water free of physical (floating and submerged) hazards
	■ temperature range: 16–34°C
	■ pH range: 6.5–8.5
	■ DO: >80%
	■ faecal contamination: designated recreational waters are protected against direct contamination with fresh faecal material, particularly of human or domesticated animal origin. Two principal components are required for assessing faecal contamination:
	  ■ assessment of evidence for the likely influence of faecal material.
	  ■ counts of suitable faecal indicator bacteria (usually enterococci).
	  ■ These two components are combined to produce an overall microbial classification of the recreational water body
	■ intestinal enterococci: 95th percentile ≤ 40 organisms per 100mL (for healthy adults) (NHMRC, 2008; Table 5.7).

Environmental Value	Water quality objectives to protect EV

Suitability for primary contact recreation	■ direct contact with venomous or dangerous aquatic organisms should be avoided. Recreational water bodies should be reasonably free of, or protected from, venomous organisms
	■ waters contaminated with chemicals that are either toxic or irritating to the skin or mucous membranes are unsuitable for recreational purposes.
	■ cyanobacteria/algae: Recreational water bodies should not contain:
	    ■ Level 1: ≥ 10 µg/L total microcystins; or ≥ 50 000 cells/mL toxic Microcystis aeruginosa; or biovolume equivalent of ≥ 4 mm3 /L for the combined total of all cyanobacteria where a known toxin producer is dominant in the total biovolume; or
	    ■ Level 2: ≥ 10 mm3 /L for total biovolume of all cyanobacterial material where known toxins are not present; OR cyanobacterial scums consistently present. Further details are contained in NHMRC (2008) and Table 12 of DES 2020.

Suitability for secondary contact recreation	Objectives as per NHMRC (2008), including: ■ intestinal enterococci: 95th percentile ≤ 40 organisms per 100 mL (for healthy adults) (NHMRC, 2008; Table 5.7). ■ cyanobacteria/algae—refer objectives for primary recreation, NHMRC (2008) and Table 12 of DES 2020.
Suitability for visual recreation	Objectives as per NHMRC (2008), including: ■ Recreational water bodies should be aesthetically acceptable to recreational users. The water should be free from visible materials that may settle to form objectionable deposits; floating debris, oil, scum and other matter; substances producing objectionable colour, odour, taste or turbidity; and substances and conditions that produce undesirable aquatic life. ■ cyanobacteria/algae—refer objectives for primary recreation, NHMRC (2008) and Table 12 of DES 2020.

5 STORMWATER MANAGEMENT PLAN

5.1 Construction Phase

Management of water quality during the construction phase is necessary to minimise environmental harm to downstream receiving waters. Construction phase stormwater quality management will occur in accordance with current industry standards including the requirements of the *State Planning Policy (SPP)* and *Best Practice Erosion and Sediment Control (International Erosion Control Association (IECA) 2008)*.

Further details of the management approach are provided in the Erosion and Sediment Control Plan (ESCP) developed for the site by Attexo. Construction phase water quality management approaches are highly-site specific. Therefore, the management approach will be refined as more details of the construction timeline are known.

5.2 Operational Phase

An assessment of stormwater quality at the site, including Water Sensitive Urban Design (WSUD) measures adopted to mitigate impacts to the quality of stormwater runoff from the developed site, has been undertaken using the Model for Urban Stormwater Conceptualisation (MUSIC).

The following section documents the conceptual sizing of a treatment train, consisting of bioretention basins and vegetated swales, to inform site layout and civil design. These WSUD measures are proposed for the operational phase of the development and are, therefore, long-term water quality management measures following the post-construction phase of the proposed development. Potential pollutants from this development are listed in Table 5-1 below.

Table 5-1 Potential Pollutants from Site (Post-Construction Phase)

Pollutant Type	Pollutant sources
Sediment	Sediment brought in by vehicles, erosion, atmospheric deposition, organic matter, spills and accidents.
Nutrients	Fertiliser, decaying organic matter, animal faeces, detergents, atmospheric deposition.
Gross Pollutants	Litter such as food, drink and materials packaging and wrappers, leaf matter and grass clippings.
Hydrocarbons	Fuel and oil spills from cars and trucks, asphalt pavements.

5.3 MUSIC Model Schematisation

Water quality modelling of the proposed development has been undertaken using the Model for Urban Stormwater Conceptualisation (MUSIC). The MUSIC model allows the user to estimate the pollutant loads generated within and exported from the proposed BESS area within the site and quantify the relative effectiveness of the proposed stormwater quality treatment train. MUSIC provides quantitative modelling for Total Suspended Solids (TSS), Total Phosphorous (TP), Total Nitrogen (TN), and Gross Pollutants (GP).

In consideration of the Reef 2050 WQIP, which specifies Water Quality Objectives (WQO's) relative to existing site runoff, rather than in terms of treatment train effectiveness for development site runoff, modelling for both existing and proposed developed site conditions has been undertaken.

The MUSIC model was set up in accordance with the *Water by Design MUSIC Modelling Guidelines (2018)* (WBD, 2018) which has been published under the Water by Design Program by the South-East Queensland Healthy Waterways Partnership. In addition, Healthy Waterways recommends using the latest version of MUSIC to ensure compliance with stormwater pollutant load reduction objectives.

5.3.1 Catchment Areas

The existing landform and proposed BESS layout were used to estimate catchment areas for input to the MUSIC model. The same overall catchment area has been represented in the MUSIC model for both existing proposed developed site conditions to enable direct comparison of existing and developed pollutant loads leaving the site. However, the sub-catchment areas are modified by the proposed development.

The existing landform is characterised by a gentle ridge running north-south through the proposed development footprint. The overall catchment has been divided into two sub-catchments, as shown on Figure 5-1, which also depicts indicative flow directions for site runoff. Sub-catchment A falls to the southwest and discharges via an existing culvert under the embankment bounding the southern side of the site. Sub-catchment B falls eastwards, draining to an ephemeral flowpath that traverses the eastern part of the site (and lies entirely outside the proposed development footprint). A lumped landuse approach has been used to represent each existing sub-catchment in the model.

Figure 5-1 Existing Case MUSIC Sub-catchments

For the proposed developed site, detailed design of earthworks will direct runoff from the entire BESS footprint to the east (sub-catchment B). It has been assumed that, where practicable, runoff from the remaining developed site areas will be diverted westwards (sub-catchment A) to minimise changes to the total sub-catchment contributing runoff to each discharge point. A split catchment land use approach was adopted for modelling pollutant loads from the proposed development footprint within the site. The developed case sub-catchments, modelled landuse areas and indicative post-development flow directions are shown on Figure 5-2.

The modelled sub-catchment characteristics for both existing and developed site conditions are summarised in Table 5-2.

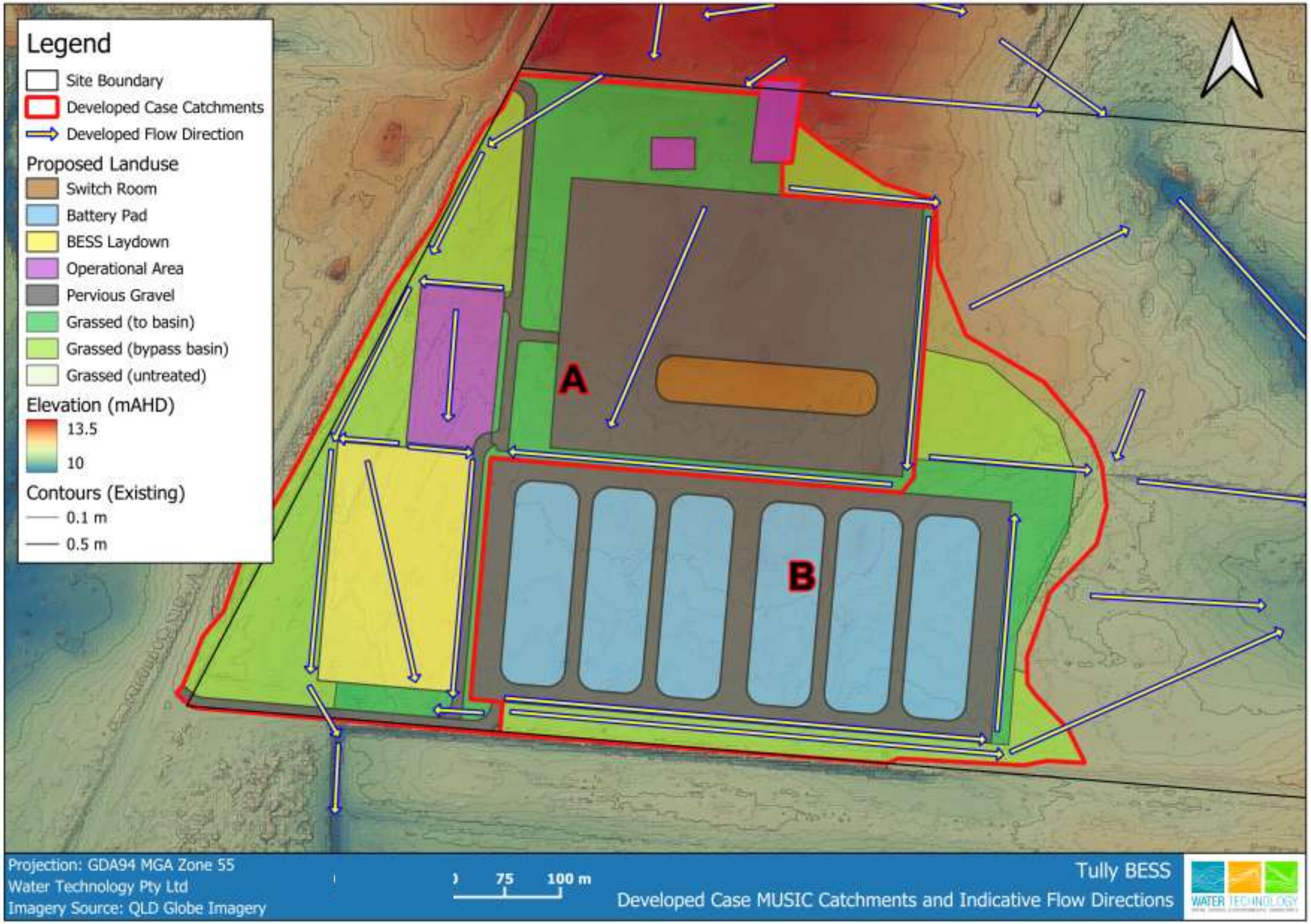

Figure 5-2 Developed Case MUSIC Sub-catchment Areas and Indicative Flow Directions

Table 5-2 Modelled BESS Sub-catchment Breakdown

Catchment	Total Area (ha)	Fraction Impervious (%)	Rainfall Threshold (mm)	Landuse Type
Pre-developed Case Catchment A				
Existing	5.58	0	1.0	Rural residential
Post-Developed Catchment A				
Pervious Gravel	1.99	35%	1.5	Unsealed road
Operational Area	0.37	75%	1.0	Industrial
Battery Pad	0.00	75%	1.0	Industrial
Switch Room	0.20	75%	1.0	Industrial
Grassed (to basin)	0.96	0%	1.0	Rural residential
Grassed (bypass basin)	0.94	0%	1.0	Rural residential
BESS Laydown	0.66	35%	1.0	Industrial
Total	**5.11**	**26%**	**n/a**	**n/a**
Pre-developed Case Catchment B				
Existing	3.31	0	1.0	Rural residential
Post-Developed Catchment B				
Pervious Gravel	1.00	35%	1.5	Unsealed Road
Operational Area	0.00	75%	1.0	Industrial
Battery Pad	1.57	75%	1.0	Industrial
Switch Room	0.00	75%	1.0	Industrial
Grassed (to basin)	0.26	0%	1.0	Rural residential
Grassed (bypass basin)	0.73	0%	1.0	Rural residential
Grassed (untreated)	0.22	0%	1.0	Rural residential
Total	**3.78**	**40%**	**n/a**	**n/a**

5.3.2 Rainfall Runoff Parameters

WBD (2018) does not include any region-specific rainfall runoff parameters. However, the values recommended for the Whitsunday Region, Queensland have been adopted for this study as they are the closest region with available data (see Table 5-3).

Table 5-3 Rainfall Runoff Parameters Adopted in MUSIC Modelling

Parameter	MUSIC Parameter
Rainfall threshold (mm)	1
Soil storage capacity (mm)	100
Initial storage (% capacity)	30
Field capacity (mm)	100
Infiltration capacity coefficient a	200
Infiltration capacity coefficient b	1
Initial depth (mm)	10
Daily recharge rate (%)	4
Daily baseflow rate (%)	2
Daily deep seepage rate (%)	0.4

5.3.3 Pollutant Export Parameters

In the absence of any site-specific water quality or pollutant data, and in keeping with industry best practice the modelling adopted pollutant load export parameters from WBD (2018). The landuse types adopted in the model for the various site areas are displayed in Table 5-2 and the pollutant export parameters for each land use type are provided in Table 5-4.

As the Water by Design MUSIC Guideline does not provide pollutant generation parameters for unsealed roads, parameters for this land use were adopted from *Using MUSIC in the Sydney Drinking Water Catchment* (WaterNSW, 2023). This document provides the most relevant Australian, regulator-endorsed dataset for unsealed road sources and has been widely applied nationally, including in Queensland, where no equivalent state-specific MUSIC parameters exist. The adopted parameters are consistent with Queensland-based research identifying unsealed roads as sediment-dominated pollutant sources.

Table 5-4 Pollutant Export Parameters

Landuse	Flow Type	TSS log^{10} values		TP log^{10} values		TN log^{10} values	
		Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
Rural Residential	Baseflow Parameters	0.53	0.24	-1.54	0.38	-0.52	0.39
	Stormflow parameters	2.26	0.51	-0.56	0.28	0.32	0.30
Industrial	Baseflow Parameters	0.78	0.45	-1.11	0.48	0.14	0.20
	Stormflow parameters	1.92	0.44	-0.59	0.36	0.25	0.32
Unsealed Road	Baseflow Parameters	1.2	0.17	-0.85	0.19	0.11	0.12
	Stormflow parameters	3.0	0.32	-0.3	0.25	0.34	0.19

5.3.4 Rainfall and Evapotranspiration Data

As per the recommendations in WBD (2018), climate datasets were adopted from MUSIC's included data, with rainfall data sourced from the Tully Sugar Mill Radar 6-minute gauge, and monthly average areal potential evapotranspiration (PET) taken for the Tully Sugar Mill SILO dataset.

Rainfall, in the form of a 6-minute pluviometer data, was available from November 1972 to May 2010. From this, a ten-year period from 1 June 1999 to 31 May 2009 was selected for modelling purposes. The mean annual rainfall over the selected MUSIC dataset is 3,782 mm, which is slightly lower than the long-term mean of 3,921 mm for the full Tully Sugar Mill record. This difference is minor, and the selected period is considered representative of local climatic conditions and suitable for modelling purposes.

5.3.5 Treatment Nodes

The site has been split into two sub-catchments for the purposes of treating and directing clean and dirty water run-off. It is proposed to treat run off from the developed site and surrounding post-development catchment using grassed swales which channel flow into two (2) bioretention basins (BRB) located in each sub-catchment. BRB A will be located along the southern boundary of Subcatchment A and adjacent to the BESS laydown area at the down-slope end of the site. BRB B will be located to the east of Subcatchment B, adjacent to the right corner of battery pad laydown.

The MUSIC model schematisation is shown below in Figure 5-3. The modelling considered a range of BRB sizes to determine the most suitable options within respect to achieving the required load reduction targets. The adopted model parameters for the proposed treatment devices is shown in Table 5-5 and Table 5-6. Indicative locations of the proposed treatment devices are shown in Figure 5-4.

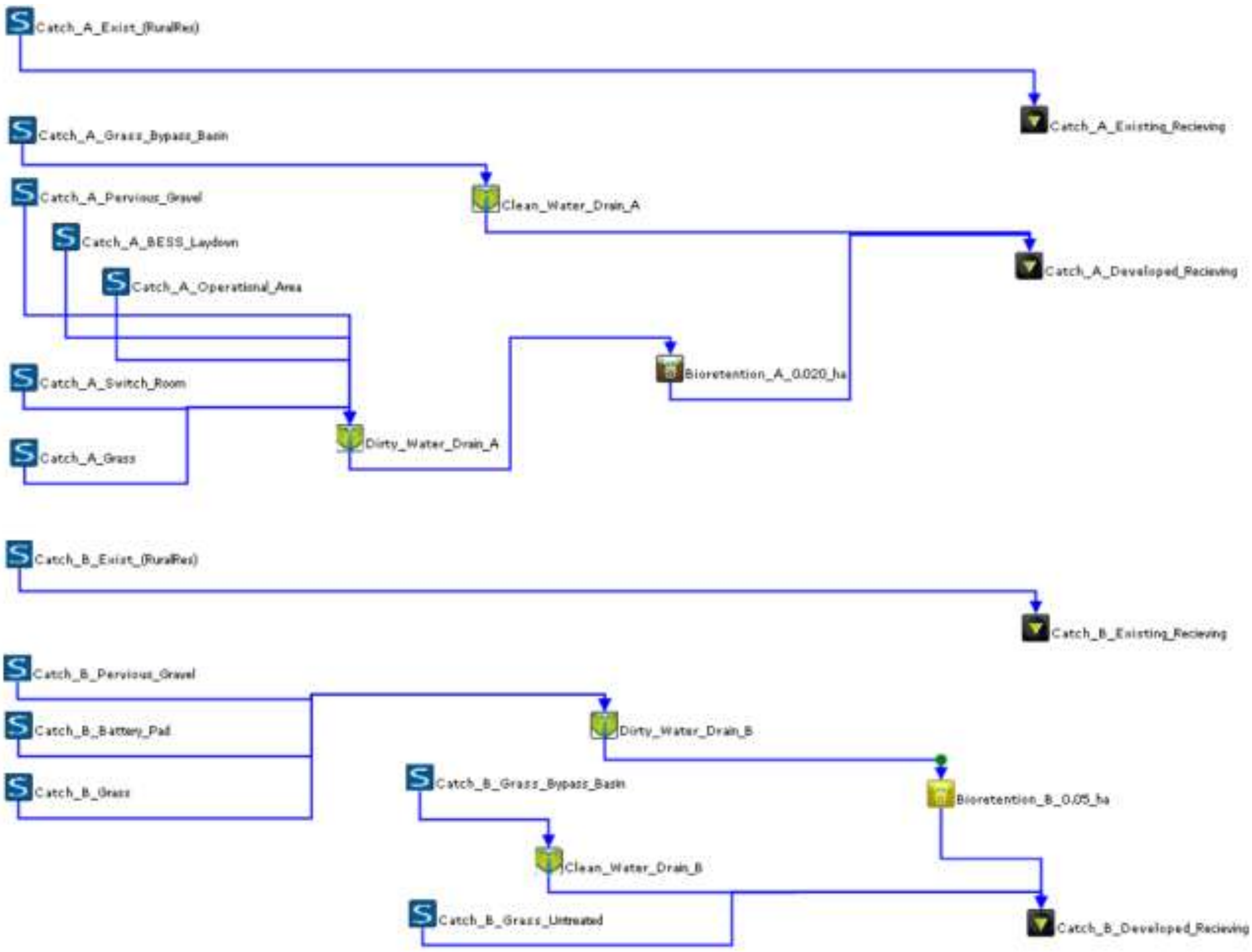

Figure 5-3 MUSIC Model Schematisation

Table 5-5 MUSIC Swale Properties

Parameter	Clean Water A	Dirty Water A	Clean Water B	Dirty Water B
Low Flow By-pass (m^3/s)	0	0	0	0
Total Length (m)	250	415	395	325
Bed Slope %	1	1	1	1
Base Width (m)	1.0	1.5	1.5	1.0
Top Width (m)	4	4	4	4
Depth (m)	0.5	0.5	0.5	0.5
Vegetation Height (m)	0.25	0.25	0.25	0.25

Figure 5-4 Developed Case Treatment Measures

Table 5-6 MUSIC Bioretention Basin Properties

Parameter	Bioretention Basin A Properties	Bioretention Basin B Properties
Low Flow By-pass (m³/s)	0	0
High Flow By-pass (m³/s)	1.5	1.5
Surface Area (m²)	200	500
Extended Detention Depth (m)	0.30	0.30
Filter Area (m²)	200	500
Unlined Filter Media Perimeter (m)	57	89
Filter Depth (m)	0.50	0.50
Saturated Hydraulic Conductivity (mm/hr)	200	200
TN Content of Filter Media (mg/kg)	400	400
Orthophosphate Content of Filter Media (mg/kg)	30	30

5.4 MUSIC Results and Discussion

Pollutant load reduction targets for the Tully Catchment have been set by the Great Barrier Reef Discharge Standards as described in the Reef 2050 Water Quality Improvement Plan (WQIP) 2017-2022 (State of Queensland, 2018). The relevant load reduction targets were described in Section 2.7. The performance of the proposed water quality treatment train must be compared to the pre-developed condition of the site, as required by the Reef WQIP's stipulation of achieving reductions compared to the 2013 baseline.

The results for BRB A, which are summarised in Table 5-7 show that the pollutant load reduction targets are met for all pollutants using a treatment train with a BRB with a filter area of 200 m² and vegetated swales with a combined length of at least 665 m long. The clean water vegetated swale diverts clean water along the western boundary of the development, offsite into a preexisting waterway suitable for discharge.

Table 5-7 MUSIC Model Results Bioretention Basin A

Parameter	Pre-Developed Source Load (kg/yr)[1]	Developed Source Load (kg/yr)	Residual Load (kg/yr)	Required Load Reduction	Pollutant Reduction from developed source	Pollutant Reduction from pre-developed source	Target Achieved from pre-developed source
Total Suspended Solids (TSS)	49,677	99,452	1,401	20%	99%	97%	**YES**
Total Phosphorus (TP)	42	63	10	20%	84%	76%	**YES**
Total Nitrogen (TN)	357	334	171	Nil	49%	52%	*Nil*
Particulate Nitrogen (PN)[2]	107	100	51	20%	49%	52%	**YES**
Dissolved Inorganic Nitrogen (DIN)[3]	250	234	119	50%	49%	52%	**YES**
Gross Pollutants (GP)	0	940	0	Nil	100%	100%	*Nil*

The results for BRB B, which are summarised in Table 5-8 show that the pollutant load reduction targets are met for TSS and TP but are not quite met for PN and DIN. The Catchment B treatment train has a BRB filter area of 200 m² and vegetated swales with a combined length of at least 720 m long. The clean water vegetated swales divert clean water in an easterly direction, offsite into a preexisting waterway suitable for discharge.

Table 5-8 MUSIC Model Results Bioretention Basin B

Parameter	Pre-Developed Source Load (kg/yr)[1]	Developed Source Load (kg/yr)	Residual Load (kg/yr)	Required Load Reduction	Pollutant Reduction from developed source	Pollutant Reduction from pre-developed source	Target Achieved from pre-developed source
Total Suspended Solids (TSS)	27,156	61,076	2,526	20%	96%	91%	**YES**
Total Phosphorus (TP)	26	50	7	20%	86%	74%	**YES**
Total Nitrogen (TN)	209	304	112	Nil	63%	46%	*Nil*
Particulate Nitrogen (PN)[4]	63	91	34	20%	63%	46%	**No**
Dissolved Inorganic Nitrogen (DIN)[5]	146	213	79	50%	63%	46%	**No**
Gross Pollutants (GP)	0	963	0	Nil	100%	100%	*Nil*

[2] Particulate Nitrogen is calculated as 30% of TN
[3] Dissolved Inorganic Nitrogen (DIN) is calculated as 70% of TN
[4] Particulate Nitrogen is calculated as 30% of TN
[5] Dissolved Inorganic Nitrogen (DIN) is calculated as 70% of TN

Stormwater quality modelling indicates that the proposed treatment system achieves substantial reductions in TSS, TP and TN, consistent with best practice stormwater outcomes for infrastructure development. Reductions in dissolved inorganic nitrogen (DIN) are achieved to the maximum practicable extent using passive bioretention and vegetated treatment measures. However, modelling demonstrates that achieving a numerical 50% reduction in DIN relative to pre development conditions for Catchment B would require disproportionately large treatment areas, resulting in significant over treatment of other pollutants and land take that is not commensurate with the scale and nature of the development.

The limited DIN reduction achievable reflects inherent process constraints rather than deficiencies in design. DIN is highly soluble and not effectively removed through sedimentation or filtration based systems, relying instead on biological uptake and denitrification processes that require extended detention times and sustained anoxic conditions.

5.4.1 Hazardous Materials

The introduction of contaminants to the project area for the construction, maintenance, operation and decommissioning of the project infrastructure poses a risk of these contaminants ending up in the receiving environment. Local storage of chemicals and fuels within the project area will increase this risk along with concrete batching and associated materials. Therefore, relevant guidelines and standards governing the storage and use of hazardous materials and waste removal will be followed to reduce this risk. Appropriate measures will be incorporated in the Final SMP, Construction Management Plan and Emergency Response Plan, which will be prepared in accordance with relevant conditions of the development approval.

5.4.2 Emergency Containment Storage for Firefighting Runoff

A specific risk associated with Battery Energy Storage System (BESS) facilities is the potential contamination of site runoff generated during firefighting activities in the event of a battery thermal runaway, fire, or explosion. Firefighting runoff from BESS facilities has the potential to contain elevated concentrations of contaminants relative to normal stormwater runoff, including suspended solids, dissolved metals, electrolyte residues and other by-products associated with battery materials, fire suppressants and combustion processes. While the specific composition and concentrations are incident-dependent, such runoff is generally considered unsuitable for uncontrolled discharge without prior assessment. Accordingly, a precautionary containment, testing and managed release framework has been adopted for this facility.

Riskcon has undertaken a Fire Safety Study (FSS) for the facility and determined that a fire suppression volume of 0.432 ML is required. An Emergency Containment Storage of this capacity will be provided to capture firefighting runoff for subsequent testing and appropriate management prior to release or disposal.

No additional storage volume is proposed to capture rainfall runoff coincident with a BESS fire event. This approach reflects the very low likelihood of such coincidence, noting that BESS fire incidents in Australia to date have been rare and have not occurred during rainfall events. The emergency containment storage has therefore been conservatively sized to address the highest-risk component of the scenario, being contaminated firefighting water, while avoiding unnecessary oversizing of infrastructure.

The containment storage is proposed as an open basin with a nominal depth of approximately 1.0 m, occupying an area of approximately 432 m², subject to refinement during detailed civil design. The storage will be located offline and upstream of the bioretention basin, and separate from operational-phase WSUD measures to ensure that potentially contaminated firefighting water does not enter or compromise routine treatment systems.

Under normal operating conditions, site runoff will bypass the emergency containment storage and drain to the operational stormwater treatment system. During firefighting activities, runoff will be diverted to the containment storage via a dedicated diversion system. The physical diversion infrastructure will be incorporated into the detailed civil design.

Operational control of the diversion system will be managed by trained emergency response personnel and documented separately within a site-specific Emergency Response Plan or Emergency Operations Manual, to be prepared prior to commissioning. This documentation will define activation triggers, responsibilities, and procedures for diverting and isolating firefighting runoff.

Water captured within the emergency containment storage will be retained pending water quality assessment. If testing confirms compliance with relevant discharge criteria, controlled release may be undertaken. Where water quality does not meet discharge requirements, or where uncertainty exists, captured water will be removed from the site and treated or disposed of at a licensed facility by an appropriately licensed contractor. Detailed post-incident management procedures will be included in the site emergency documentation.

5.4.3 Water Supply

5.4.3.1 Construction Phase

Water will be required during the construction phase for:

- Construction works
- Dust suppression
- Vegetation establishment

There is a CCRC bulk water supply point near the intersection of Tully Mission Beach Road and the Bruce Highway. During the construction phase, water will be transported to the site by water tankers and stored appropriately at the site where required. Potable water will be supplied by contractors for their workforce during construction.

5.4.3.2 Operational Phase

During the operational phase of the project there will be minimal demand for water. A reticulated water line supplied by council water supply will be connected to the O&M building that will be utilised predominately for potable water. Any non-potable water requirements like short term dust suppression, cleaning or maintenance of vegetation will come from the council run bulk water supply point standpipe as stated in the section above. On-site water storage tanks will also be used to store water for firefighting.

5.5 Stormwater Quality Summary

An assessment of the proposed development has identified potential impacts on the environmental values of the surface waters in the receiving environment. However, these risks can be managed through proper design and the implementation of appropriate mitigation measures during the construction and operation of the BESS. The following provides details of the proposed mitigation measures.

5.5.1 Construction Phase

Any disturbance that involves the clearing of vegetation or earthworks should be carefully considered to ensure the project does not result in increased sediment loads and associated pollutants from entering the downstream receiving environment.

Construction of the proposed BESS represents the highest risk of erosion as there will be active disturbance occurring during this phase including earthworks. However, the construction period will be relatively short compared to the life of the project with construction expected to be completed within 18 months. All construction works should be completed in association with a detailed construction phase ESCP.

Once construction is complete, the risk of erosion will be greatly reduced as there will be no ongoing disturbance of soils. Further it is expected that disturbed areas not required for operations (including cut and fill batter slopes) will be revegetated.

5.5.2 Operational Phase

The surface water assessment showed that the proposed development has the potential to increase the quantity of pollutants discharging to the receiving environment. The MUSIC modelling outcomes demonstrate that the proposed BRB's and vegetated swales will benefit the receiving environment through pollutant load reduction and thus comply with the objectives of the Reef 2050 Water Quality Improvement Plan.

In addition to the WSUD measures, a separate containment storage is to be provided for the purpose of capturing, and treating, potentially contaminated fire water runoff from the BESS area. Detailed civil design will address emergency diversion of runoff to this storage in the event of a battery fire.

Appropriate measures for the safe handling and storage of chemicals and hazardous materials at the project site during the construction and operational phases should be included in the Final Stormwater Management Plan, Construction Management Plan and/or Emergency Response Plan as required.

An emergency containment storage with a minimum capacity of 0.432 ML will be provided to capture potentially contaminated runoff generated during firefighting activities at the BESS facility. The storage is sized in accordance with the project Fire Safety Study and is intended to temporarily contain firefighting water, which may include contaminants associated with battery materials, fire suppressants and combustion by-products. The containment storage will be located offline from the operational stormwater system and activated via a dedicated diversion during emergency response, with captured water retained for testing and either released in a controlled manner if suitable or removed from site for treatment or disposal at a licensed facility.

5.6 Legal Point of Discharge

Stormwater runoff from the proposed development will be conveyed via bioretention basins and swale drains to existing drainage lines and watercourses within the subject site. These drainage features discharge downstream to existing flow paths. The proposed works do not involve diversion of flows to new discharge locations or third-party land, and no re-direction of catchment boundaries is proposed. As such, runoff will continue to discharge to established receiving environments consistent with existing conditions.

A high-level assessment indicates that the development footprint intersects only a minor portion of the mapped floodplain, with shallow inundation depths (generally <0.1 m) and limited earthworks within these areas. On this basis, the proposed works are not expected to cause measurable increases in peak discharge, flow velocity, or flood levels within receiving downstream areas.

Accordingly, the proposed discharge arrangement is considered to satisfy the intent of the lawful point of discharge principles outlined in QUDM (4th Edition), subject to detailed design and confirmation of any specific requirements of Council or relevant referral agencies.

5.6.1 Conceptual Bioretention Basin Outlet Design

Stormwater from the proposed bioretention basins will be discharged via controlled outlet structures. The outlet structures will be configured to mimic existing runoff conditions and limit potential increases in peak discharge. At a conceptual level, each bioretention basin will incorporate a low-flow outlet system consisting of a perforated underdrain and/or outlet pipe connected to a downstream control pit or headwall. The outlet will be set at or near the base of the filter media to allow extended detention of runoff within the basin and promote infiltration and treatment prior to discharge.

A secondary overflow structure (e.g. weir or surcharge pit) will be provided to safely convey flows during larger storm events, preventing overtopping or uncontrolled release. Overflow levels will be set to maintain hydraulic continuity with the adjacent swale and ensure that flow paths remain consistent with existing drainage patterns.

Detailed sizing and hydraulic design of outlet structures will be undertaken at the detailed design stage, including confirmation of discharge capacity, tailwater conditions, and erosion protection requirements.

6 FLOOD ASSESSMENT

6.1 Overview

The proposed site is partially inundated during regional flood events within the Tully River catchment. Additionally, multiple defined watercourses traverse the site, requiring a detailed assessment of existing flood constraints.

To support the local flood assessment for the development, a rain-on-grid hydraulic model has been developed using TUFLOW. The model is configured to simulate direct rainfall-runoff interactions across the terrain and incorporates hydrodynamic processes to assess flood behaviour. The hydrologic analysis was conducted in accordance with Australian Rainfall and Runoff 2019 (ARR2019) guidelines, utilising the TUFLOW ARR tool. Key design rainfall parameters include:

- Design Rainfall Data sourced from ARR2019 and BOM 2016 IFD, incorporating all ten (10) ARR2019 temporal patterns to evaluate peak discharge variability.
- Rainfall losses adopted from ARR2019 Data Hub, with an Initial Loss of 43 mm and a Continuing Loss of 4.9 mm/hr.
- Design rainfall was implemented as a direct rainfall boundary in the hydraulic model, enabling a rain-on-grid approach.

In the absence of stream gauge data, estimated peak flows were validated using the Rational Method. A range of design storms including the 10%, 1%, 0.2% and 0.5% AEP events were assessed hydraulically in the TUFLOW model to quantify the local flood extent to inform the proposed development. The subsequent sections of this report provide detailed insights into the catchment modelling undertaken as part of this site-specific study.

6.1.1 Model Extent and Topography

As outlined in Section 3.1, the site is located within the Tully River Drainage Basin, a hydrologically active region of the Wet Tropics. The topography generally slopes south toward the Tully River, which plays a key role in local drainage and flood dynamics, and southeast toward Babinda Creek, a tributary of the Tully River. To the north, the terrain rises steeply beyond 100 mAHD, forming part of the mountain ranges adjacent to Mount Bartle Frere. These mountains receive high rainfall and generate significant runoff, contributing to floodplain inundation during extreme events. Major roads, including Tully Gorge Road and the proposed road network, traverse these elevated areas and may influence surface water flow and drainage patterns.

The Tully River catchment, covering approximately 1,675 km², drains primarily to the Pacific Ocean, with additional contributions from the Hull River and smaller tributaries. Given the region's high rainfall and complex topography, the site is subject to dynamic hydrodynamic processes, including floodplain inundation, overland flow, and potential backwater effects from downstream constraints. These factors will be critical in assessing site-specific flooding constraints.

6.2 Hydraulic Model Setup

The model was developed using two TUFLOW methods to accurately simulate the catchment dynamics. A rain-on-grid approach was applied to represent the catchment. To support the local flood assessment for the development, a TUFLOW hydraulic model (build 2023-01-AE) utilising the HPC (Highly Parallelized Computations) solution scheme was adopted. TUFLOW is a 1D-2D linked hydraulic model that solves the depth-averaged shallow water equations. A range of design storms including the 10%, 5%, 2%, 1%, 0.2% and 0.5% AEP events were assessed hydraulically in the TUFLOW model to quantify the local flood extent to inform the proposed development.

6.2.1 Base Case Model

The following represents a summary of the setup of the TUFLOW hydraulic model, with the hydraulic model setup illustrated in Figure 6-1.

- Detailed grid resolution of 2m to adequately reflect the topography surrounding the site.
- Model topography is based on LiDAR collected in 2014.
- Two large HQ downstream boundaries with relatively flat slope of 0.001% for the hydraulic model was positioned approximately 1km downstream of the investigation area to ensure boundary conditions did not affect the model results at the area.
- Topography modifiers were applied to the model to represent channels through Tully George Road, Sandy Creek Road and Syndicate Road at culvert locations. This approach was adopted as the culverts are non-critical structures for the investigation area. However, satellite imagery confirms their existence, indicating they were constructed to facilitate the free movement of flow.

6.2.2 Surface Roughness

Floodplain roughness was represented using a Manning's "n" roughness coefficient assigned to various land uses and spatial areas throughout the model based on aerial imagery. These are presented in Table 6-1. A depth-varying Manning's n over a building footprint has been used to realistically represent the effects of buildings on overland flow during flooding. The waterways identified as waterway barrier works under the *Fisheries Act 1994* have been adopted in the model to represent Manning's roughness for waterways, as shown in Figure 6-1.

Table 6-1 Manning's "n" roughness coefficient used in model

Land Use	Manning's "n" roughness coefficient
Grass	0.04
Medium Vegetation	0.07
Road	0.02
Watercourse	0.05
Bare Soil	0.03
Buildings	0.02 at shallow depths (< 0.03 m) 0.3 at significant depths, (> 0.1 m)

6.2.3 Catchment Hydrology

The hydrological analysis was conducted using the ARR&R (2019) Datahub and BOM 2016 IFD data. The hydrological model simulated all ten (10) temporal patterns for each duration to ensure comprehensive analysis. Rainfall hydrographs for the specific area were extracted using the ARR TUFLOW tool, enabling accurate representation of local rainfall-runoff dynamics. Key design rainfall parameters include:

- Design Rainfall Data sourced from ARR2019 and BOM 2016 IFD, incorporating all ten (10) ARR2019 temporal patterns to evaluate peak discharge variability.
- Rainfall losses adopted from ARR2019 Data Hub, with an Initial Loss of 43 mm and a Continuing Loss of 4.9 mm/hr.
- Design rainfall was implemented as a direct rainfall boundary in the hydraulic model, enabling a rain-on-grid approach.

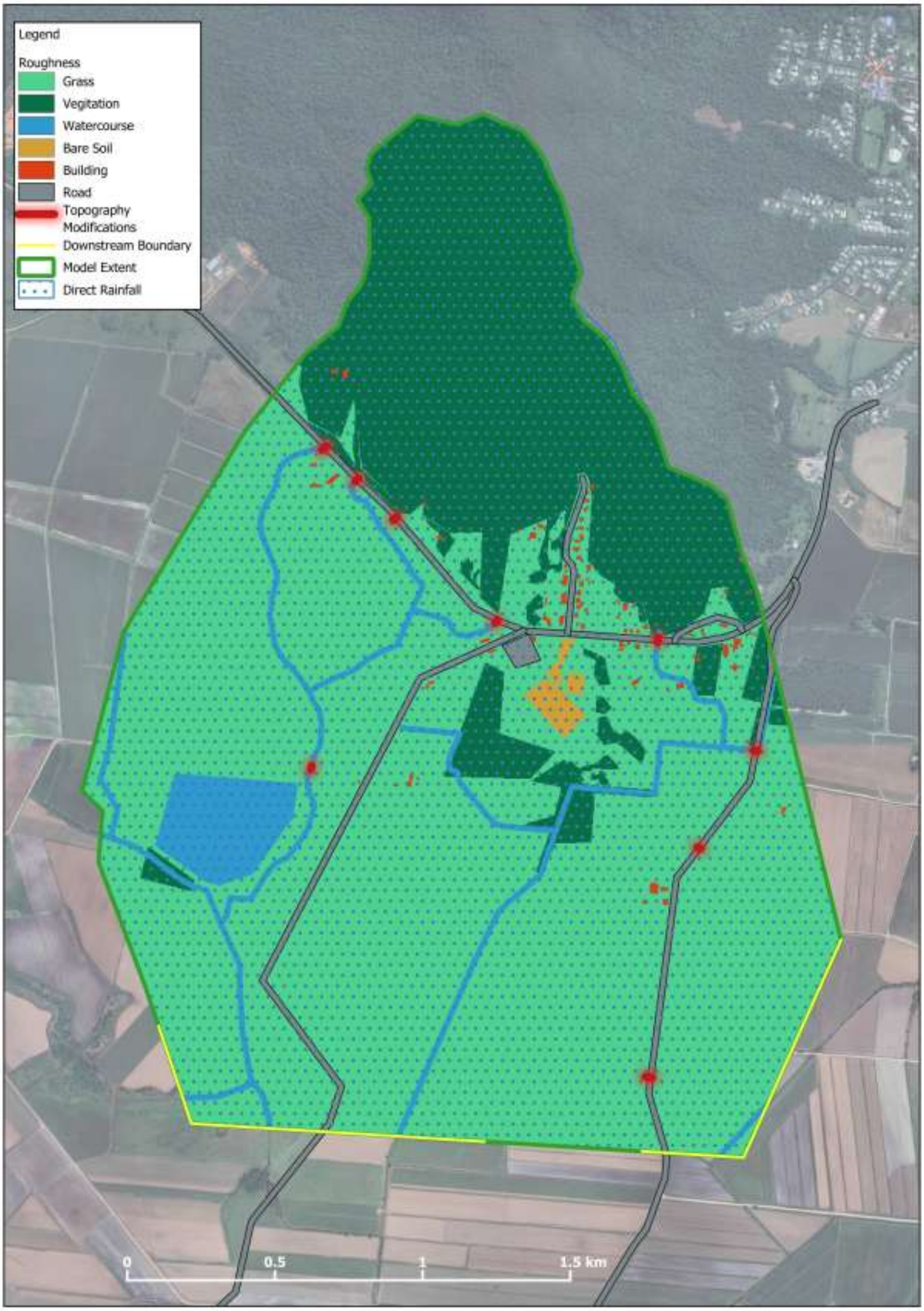

Figure 6-1 TUFLOW Model Layout

6.2.4 Hydrology Validation - RFFE

This site-specific investigation involves an ungauged local catchment, and as such, no site-based data is available for calibrating runoff. Consequently, the TUFLOW direct rainfall modelling has been validated using the Regional Flood Frequency Estimation (RFFE) tool.

The RFFE method applies statistical analysis of streamflow records from gauged catchments across Australia to estimate design flood discharges at ungauged locations. By inputting key catchment descriptors, including catchment area and geographic location, the tool provides peak flow estimates for a range of annual exceedance probabilities (AEPs), together with associated uncertainty bounds.

The following parameters were utilised with the RFFE tool:

- Catchment area: 0.523 km^2.
- Catchment outlet: Lon 145.9031 Lat -17.9484
- Catchment centroid: Lon 145.9068 Lat -17.9425

RFFE-derived peak flow estimates are summarised in Table 6-2 and compared against the corresponding peak discharges extracted from the TUFLOW direct rainfall model at the catchment outlet.

Table 6-2 Design Discharge Estimates – RFFE Comparison

Design Event	Discharge (m3/s)			
	TUFLOW Peak	RFFE Estimate	RFFE Lower (5%) Estimate	RFFE Upper (95%) Estimate
10% AEP (1 in 10 year)	13.33	10.50	7.99	14.71
5% AEP (1 in 20 year)	15.45	13.34	9.91	20.47
2% AEP (1 in 50 year)	18.07	17.41	12.25	31.44
1% AEP (1 in 100 year)	19.86	20.76	13.86	42.86

The TUFLOW-derived peak discharges for the 1% and 2% AEP events are within approximately 4% of the corresponding RFFE central estimates, indicating very close agreement for the more critical design events. For the 5% and 10% AEP events, the TUFLOW results exceed the RFFE central estimates but remain within the RFFE 90% confidence interval (bounded by the 5th and 95th percentile estimates).

Overall, the level of agreement between the TUFLOW modelled peak flows and the RFFE estimates is considered appropriate for an ungauged catchment of this scale, particularly given the inherent uncertainty associated with regional flood estimation methods. On this basis, the direct rainfall model is assessed as providing a reasonable representation of catchment hydrologic response and is considered fit for purpose for the objectives of this study.

6.3 Result Processing

For the direct rainfall modelling of the investigation area, the median grid for each duration was generated, followed by calculation of a max–max envelope in accordance with ARR2019 Guidelines. This process was applied across all flood events and all hydraulic variables, including peak water level, velocity, and depth. Within the infrastructure area of the site, the median temporal pattern analysis indicated notable variability. Critical storm durations ranged from 15–45 minutes for rare events and 30–45 minutes for more frequent events, confirming that shorter duration events generally represent the most critical scenarios for local flooding at the site.

Table 6-3 Critical Depth Durations

Scenario	Critical Duration
0.2% AEP	30-45 Minutes
0.5% AEP	30-45 Minutes
1% AEP	15-45 Minutes
2% AEP	15-45 Minutes
5% AEP	15-45 Minutes
10% AEP	15-45 Minutes

6.4 GIS Mapping

Appendix B provides the GIS mapping of the peak flood depth and velocity for the 10%, 5%, 2%, 1%. 0.5% and 0.2% AEP events. The flood inundation extents based on the TUFLOW model results for the 1% AEP event is presented in Figure 6-2. A 50mm depth cutoff has been applied to the depth mapping to filter out artifacts from the direct rainfall modelling approach.

6.5 Local Flood Assessment Results

The results of the assessment are summarised as follows:

- Overland flow approaching the site from the north (originating near Mount Tyson) is conveyed via culverts beneath Tully George Road. Downstream of the culverts, the flow diverges, with a portion directed east of the site and another portion flows west of the site toward Sandy Creek Road. Western flows are guided through natural topographic depressions, bypassing an agricultural dam located on a neighbouring lot. The water continues through agricultural land southeast of the site and ultimately discharges into the Tully River. These flows do not break out east of Sandy Creek Road and are not considered to pose a flood risk to the Subject Property.
- Flows travelling along the eastern side of the site traverse the site itself. A portion of this flow is intercepted by an irrigation channel running westward from Syndicate Road. This channel appears to break out just northeast of the proposed site, redirecting flows into a wetland area located immediately south of the developed section.
- The wetland functions as an ephemeral watercourse and is considered an ecologically significant feature in the context of the site. It receives not only redirected flow from the irrigation channel but also overland sheet flow from the north.
- The wetland system drains via the irrigation channel located east of the site. A secondary flow path branches into the site lot and discharges into a smaller additional downstream wetland area before continuing south. This path intersects with another smaller irrigation channel approximately 0.57 km south of the site, which also captures minor sheet flow from the western portion of the site.
- Flood modelling indicates the presence of shallow overland sheet flow across portions of the proposed BESS site. Flow depths are generally less than 0.15 m, with some areas of localised ponding evident along the southern boundary adjacent to the irrigation channel. These conditions are anticipated to be mitigated through site development works, including filling, grading, and re-leveling of the affected areas during construction.
  - This shallow sheet flow can be managed by appropriate site stormwater infrastructure which can be addressed during detailed design.
- Flow velocities across the proposed infrastructure areas of the site are generally low, remaining below 0.5 m/s.

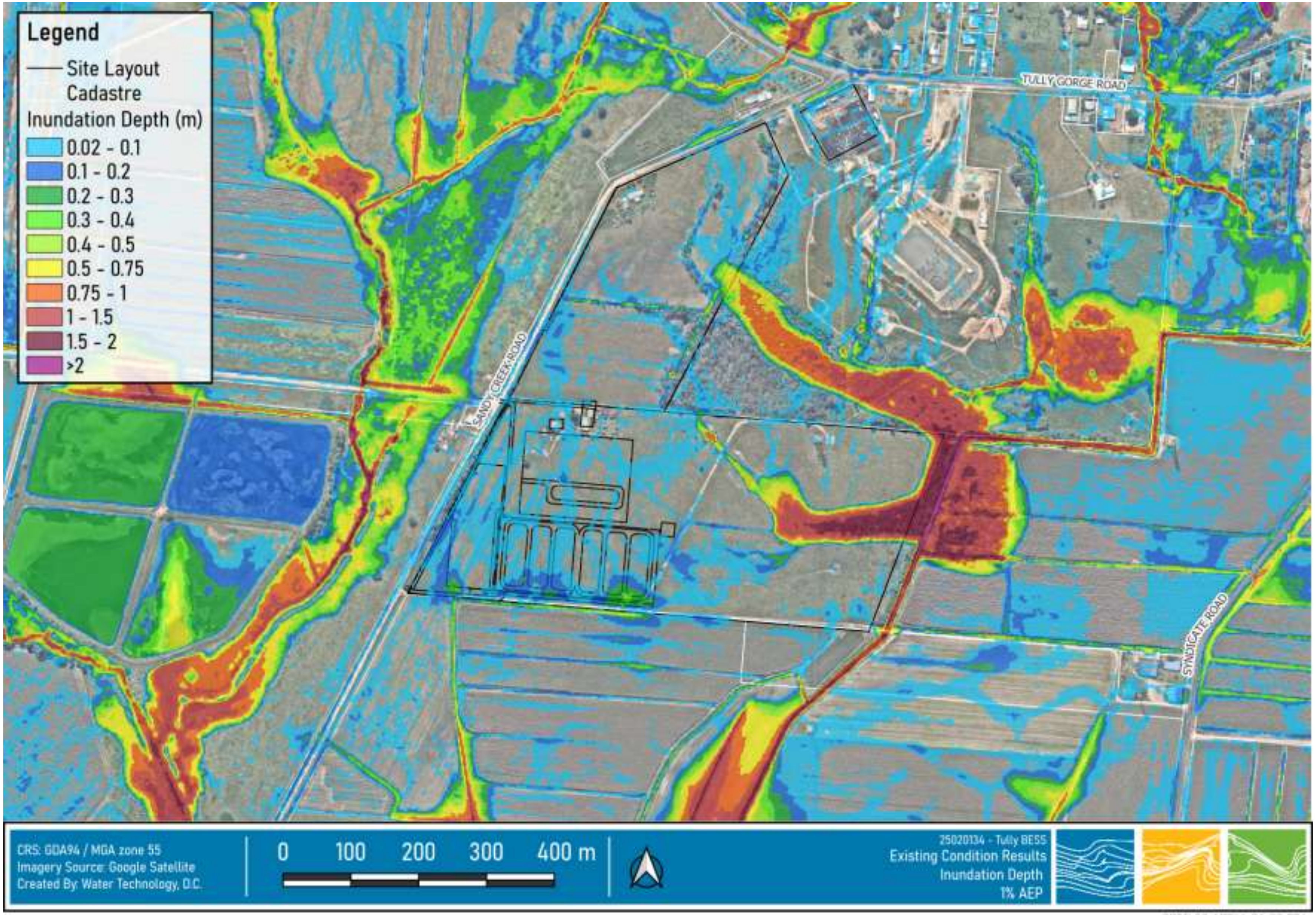

Figure 6-2 1% AEP Inundation Depth

6.6 Regional Flood Results

The regional flood model result grids were obtained from Cassowary Coast Regional Council and analysed to assess the potential impacts of regional flooding on the proposed site. The regional model is critical as it represents large-scale flood behaviour associated with the Tully River and its interaction with the site. Figure 6-4, Figure 6-5 and Figure 6-6 present the Q100 (1% AEP), Q200 (0.5% AEP), and Q500 (0.2% AEP) peak flood depths.

The results indicate that the site is only minimally affected in the 1% AEP event, with minor flood fringe inundation observed along the southern boundary. This inundation is consistent with localised pooling of water identified in the local model. Maximum flood depths in this event were recorded at 0.30 m in the southwest corner and 0.23 m in the southeast corner of the site.

Table 6-4 summarises the water levels and depths for these reference points (locations shown in Figure 6-3). It should be noted that ground levels at the reference points are approximately 11.23 m AHD at the western corner and 11.49 m AHD at the eastern corner.

More significant inundation occurs under the 0.5% AEP and 0.2% AEP events, which extend further across the site and have greater potential to impact the planned infrastructure. These peak water levels should be considered when designing earthworks levels to site sensitive infrastructure (i.e. substations) to ensure they meet local planning requirements.

Table 6-4 Regional Flood Depths at Key Reporting Locations

Event	Reporting Point	Water Level (m AHD)	Depth (m)
Q100	A	11.75	0.40
	B	11.74	0.23
Q200	A	12.16	0.81
	B	12.11	0.60
Q500	A	12.71	1.36
	B	12.63	1.12

The site is located on the outer edge of the Tully River floodplain, and only a small portion of the development footprint—approximately 5,000 m²—overlaps the 1% AEP (Q100) flood extent, representing a minor fraction of the overall site area. Within this overlap, modelled flood depths are generally less than 0.1 m, indicating shallow, low-velocity inundation.

Given the limited encroachment, minimal fill requirements, and the fact that the majority of infrastructure is located outside the Q100 extent, the proposed works are not expected to cause any measurable change to flood storage or conveyance. The shallow inundation depth combined with the absence of significant earthworks in the flood-affected zone means flood behaviour will remain effectively unchanged.

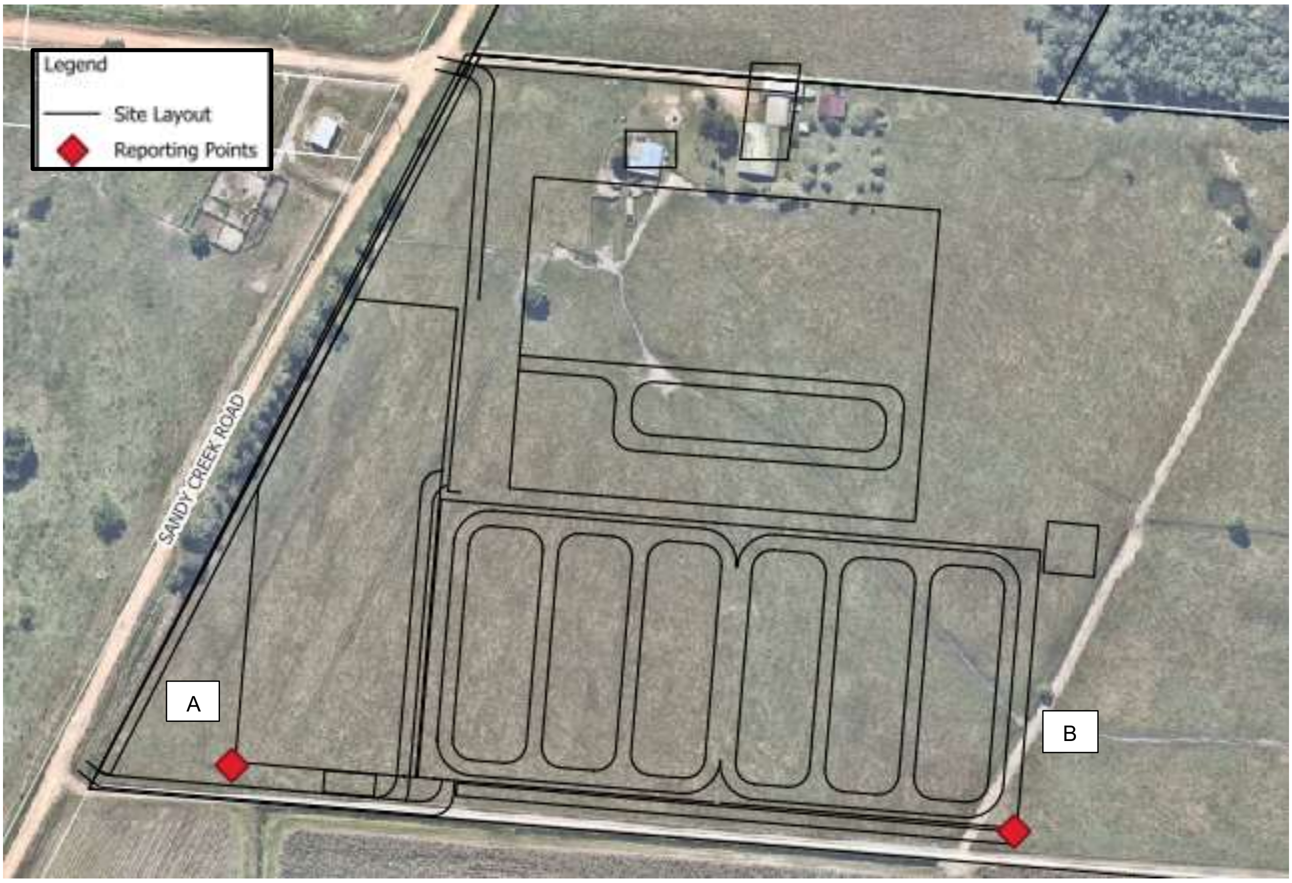

Figure 6-3 Key Reporting Locations

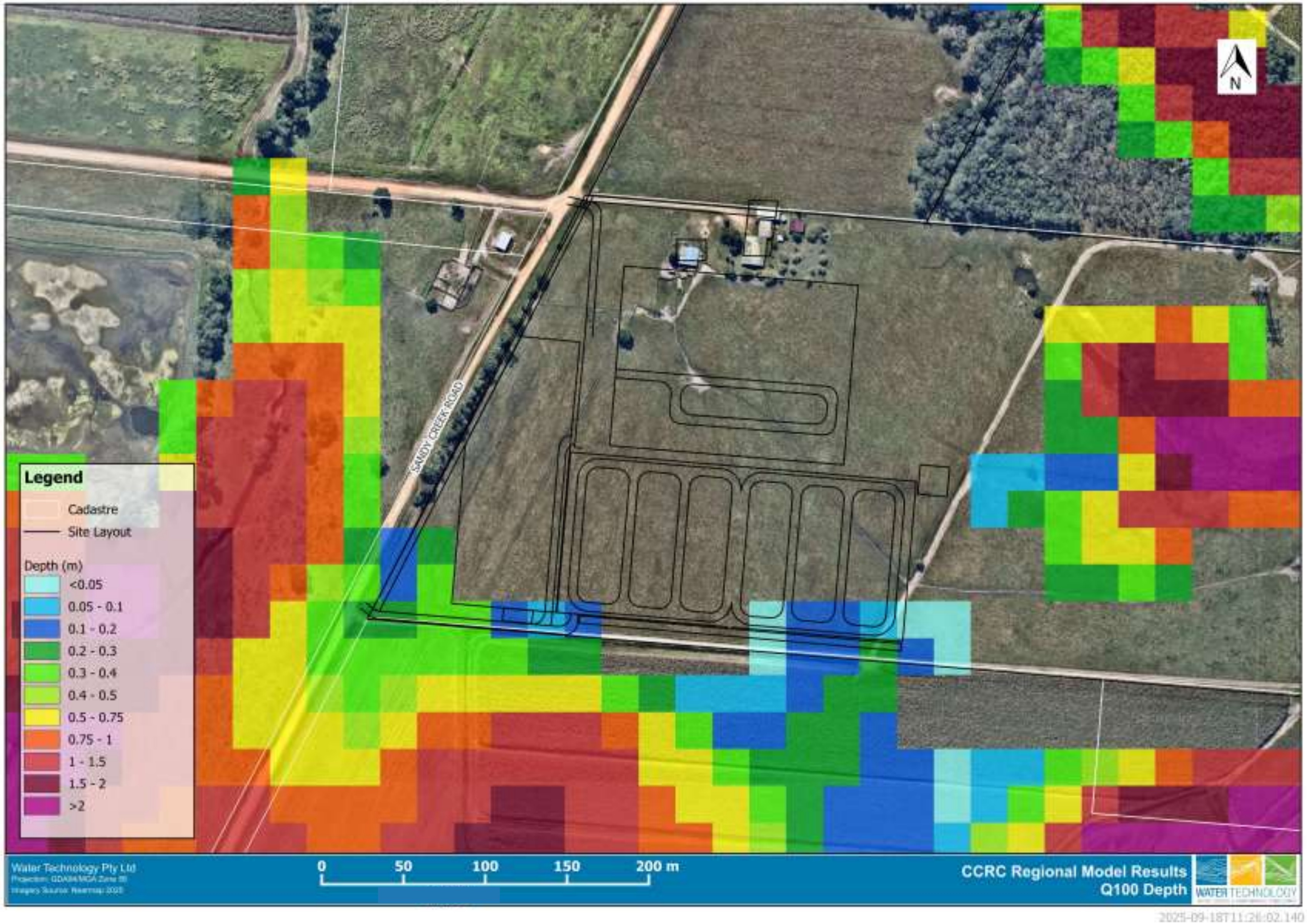

Figure 6-4 Q100 Regional Flood Results

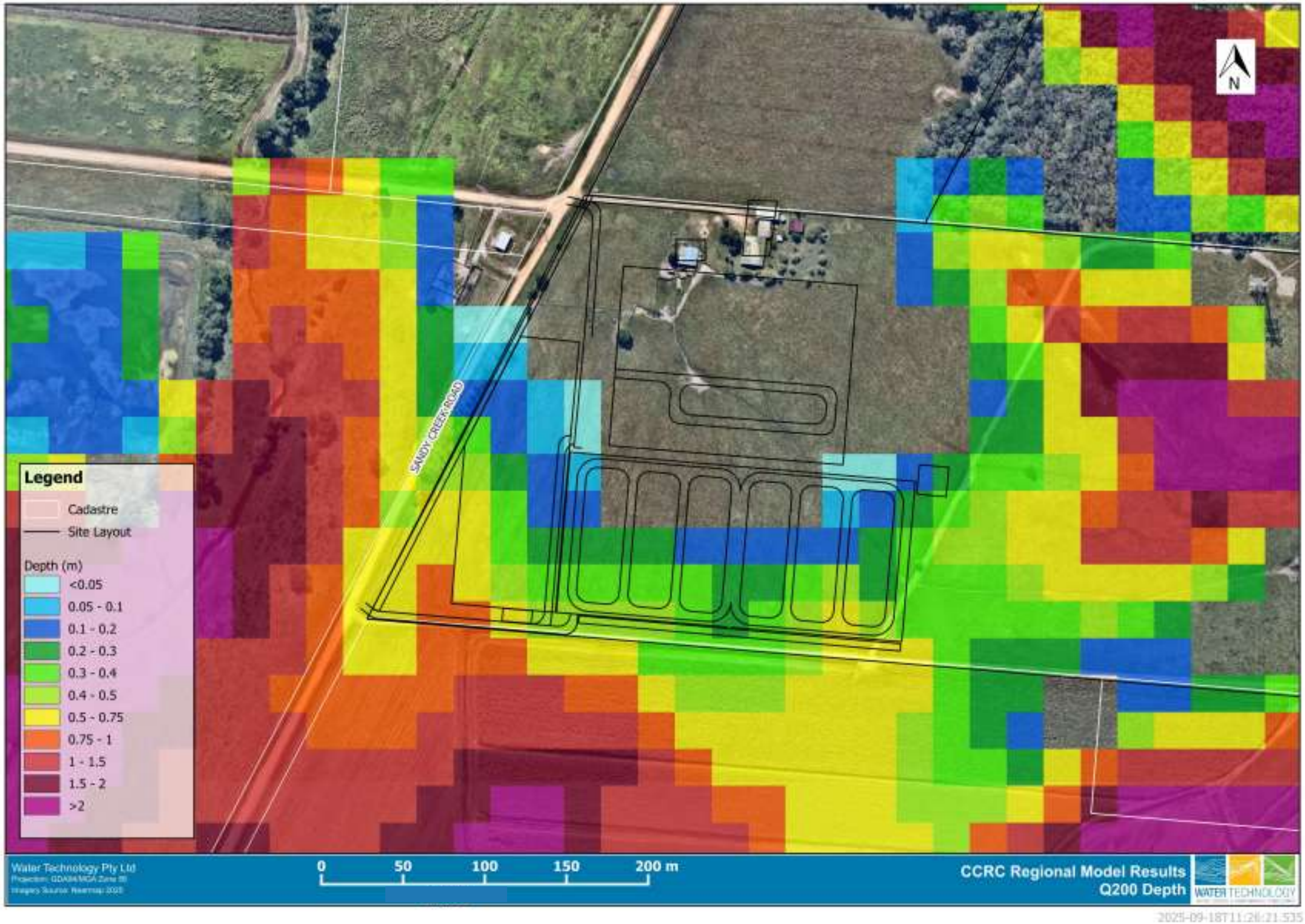

Figure 6-5 Q200 Regional Flood Results

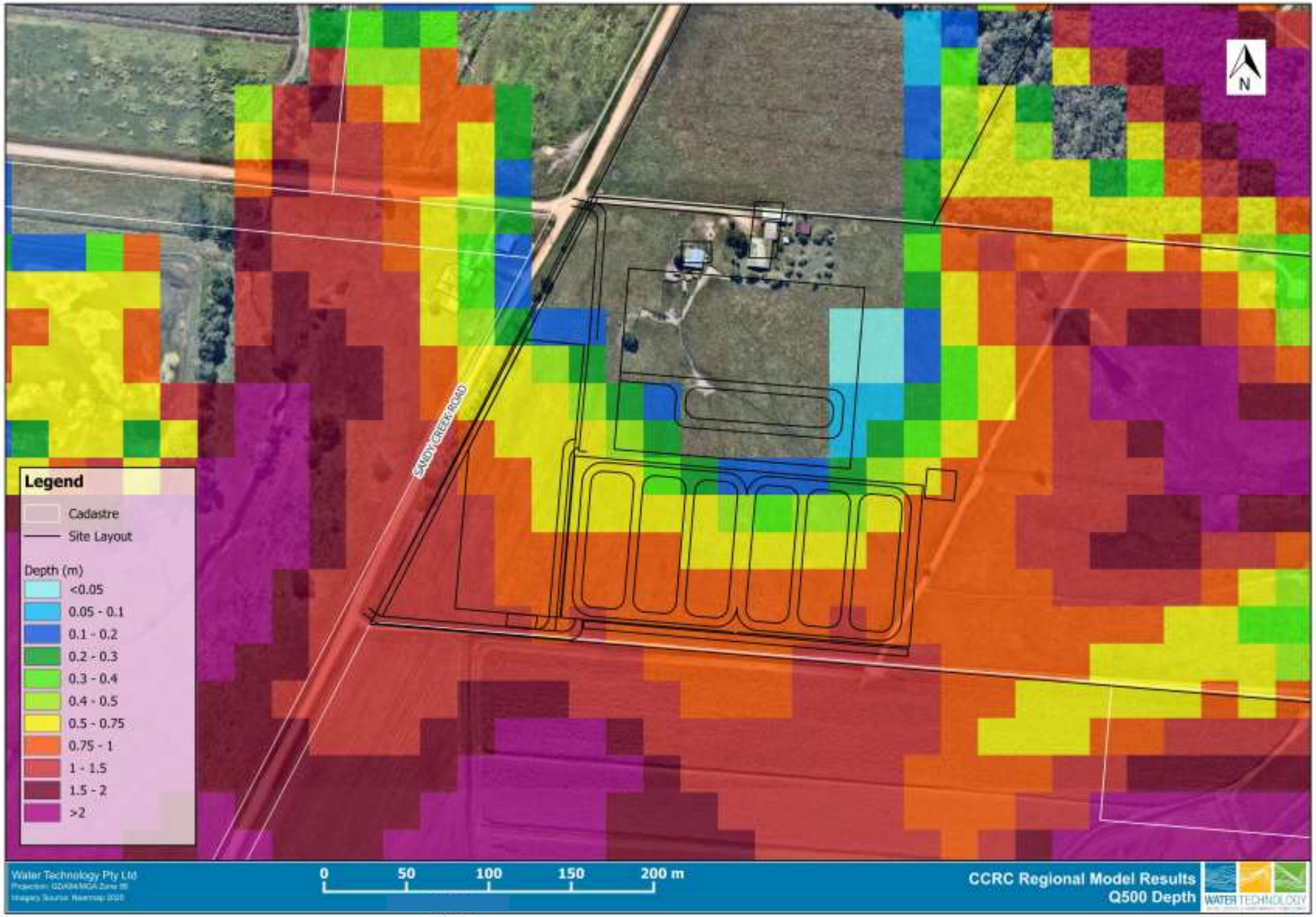

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Figure 6-6 Q500 Regional Flood Results

7 SUMMARY

Water Technology was engaged by Attexo to prepare a Stormwater Management Plan (SMP) and Flood Assessment (FA) for the proposed Tully BESS facility located at Tully, Queensland. The SMP described modelling to quantity potential changes to runoff quality from the BESS and to undertake conceptual sizing of mitigation measures to meet relevant Water Quality Objectives (WQO's) for the development in respect of pollutant load reductions relative to the undeveloped site. Based on the modelling outcomes, the following measures are recommended to mitigate the potential impacts on stormwater quality:

- In Catchment A, vegetated swales at least 415 m long to convey stormwater runoff from the developed site area to the end-of line treatment device and an end-of-line BRB with a minimum filter area of 200 m². It is proposed that the BRB will be located at the downslope end of the southern boundary, adjacent to the proposed location of the temporary construction area. A 250 m long vegetated swale will also be required to divert clean water runoff along the western boundary of the site.
- In Catchment B, vegetated swales with a combined length of 325 m in to convey stormwater runoff from the developed site area to the end-of line treatment device and end end-of-line BRB with a minimum filter area of 200 m². It is proposed that the BRB will be located to the east of the subcatchment, adjacent to the battery container. Vegetated swales with a combined length of 395 m will also be required to divert clean water runoff along the western boundary of the site.

Modelling demonstrated that the proposed stormwater quality management measures generally achieved the WQO's and provide an overall net improvement relative to baseline conditions. That is, the development returns a net improvement in the runoff water quality discharging from site. Overall, the stormwater management system delivers the maximum practicable reduction in DIN while achieving strong reductions in particulate and total nutrient loads. The inability to achieve a strict numerical 50% DIN reduction is driven by fundamental treatment limitations and conservative baseline assumptions, rather than an absence of appropriate mitigation, and is considered reasonable and consistent with the intent of Queensland water quality requirements for development within Great Barrier Reef catchments.

The proposed stormwater treatment infrastructure ensures the proposed development complies with the requirements of PO3 to PO5 of State Code 9 Great Barrier Reef wetland protection areas by:

- **PO3** (Hydrology): Minimising earthworks, using pervious surfaces, and incorporating vegetated swales and bioretention basins to maintain natural flow paths and support infiltration, helping preserve surface and groundwater hydrology.
- **PO4** (Water quality): Implementing a WSUD treatment train designed to meet SPP and Reef 2050 water quality objectives, supported by MUSIC modelling and robust ESC measures during construction.
- **PO5** (Wetlands): Locating all stormwater treatment devices outside mapped wetlands and buffers, ensuring wetlands are not used for detention or treatment.

Appropriate measures for the safe handling and storage of chemical and hazardous materials at the project site during the construction and operational phases should be included in the Final Stormwater Management Plan, Construction Management Plan and/ or Emergency Response Plan as required.

An emergency containment storage with a minimum capacity of 0.432 ML will be provided to capture potentially contaminated runoff generated during firefighting activities at the BESS facility. The storage is sized in accordance with the project Fire Safety Study and is intended to temporarily contain firefighting water, which may include contaminants associated with battery materials, fire suppressants and combustion by-products. The containment storage will be located offline from the operational stormwater system and activated via a dedicated diversion during emergency response, with captured water retained for testing and either released in a controlled manner if suitable or removed from site for treatment or disposal at a licensed facility.

The FA described modelling to characterise existing local flood behaviour at the site. The assessment found:

- Overland flow from the north is conveyed via culverts beneath Tully George Road before diverging east and west of the site, ultimately draining to the Tully River without posing a flood risk to the Subject Property.
- Flows along the eastern boundary interact with an irrigation channel and an adjacent wetland system, which functions as an ephemeral watercourse and receives both channel breakout and minor sheet flow from the north.
- Within the proposed BESS site, modelling indicates shallow sheet flow (<0.15 m) and localised ponding near the southern boundary, which is expected to be mitigated through construction earthworks and site grading. Flow velocities are generally low, remaining below 0.5 m/s.

The regional flood model results indicate that the site is only minimally affected in the 1% AEP event, with minor flood fringe inundation observed along the southern boundary. These impacts are consistent with localised pooling identified in the local model. More significant inundation occurs under the 0.5% AEP and 0.2% AEP events, which extend further across the site and have greater potential to impact the planned infrastructure. The regional flood levels should be considered when designing earthworks levels to site sensitive infrastructure (i.e. substations) to ensure they meet local planning requirements.

The site is located on the outer edge of the Tully River floodplain, and only a small portion of the development footprint—approximately 5,000 m²—overlaps the 1% AEP (Q100) flood extent, representing a minor fraction of the overall site area. Within this overlap, modelled flood depths are generally less than 0.1 m, indicating shallow, low-velocity inundation.

Given the limited encroachment, minimal fill requirements, and the fact that the majority of infrastructure is located outside the Q100 extent, the proposed works are not expected to cause any measurable change to flood storage or conveyance. The shallow inundation depth combined with the absence of significant earthworks in the flood-affected zone means flood behaviour will remain effectively unchanged.

Overall, the assessments described in this SMP and FA demonstrate that the proposed development, including the mitigation measures described above, returns a no-worsening of existing conditions with respect to flood as well as providing an improvement in stormwater runoff quality. Detailed design of the management and mitigation measures described conceptually within this report will be required to ensure the final design provides the intended outcomes.

APPENDIX A
WET TROPICS REGION: TULLY CATCHMENT WATER QUALITY TARGETS

WET TROPICS REGION

Tully catchment water quality targets

Catchment profile

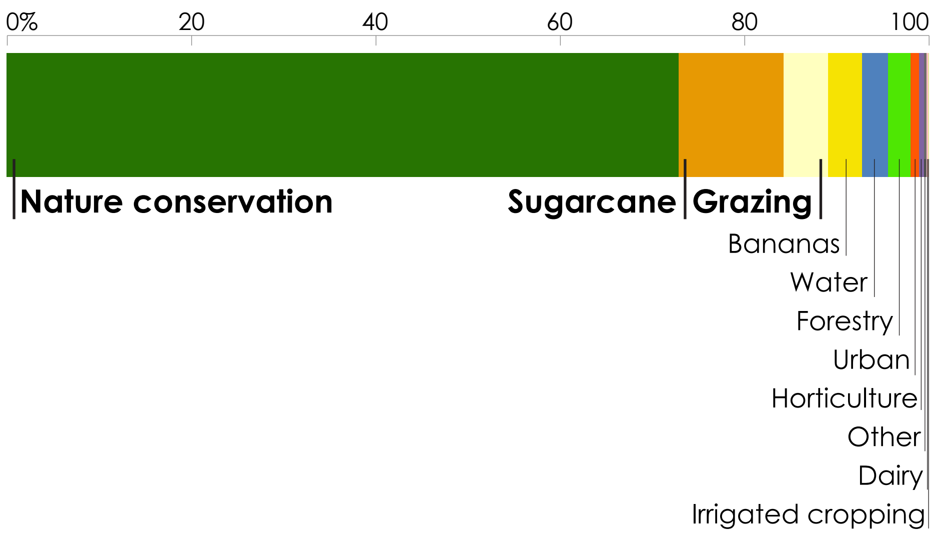
Under the Reef 2050 Water Quality Improvement Plan, water quality targets have been set for each catchment that drains to the Great Barrier Reef. These targets (given over the page) consider land use and pollutant loads from each catchment.

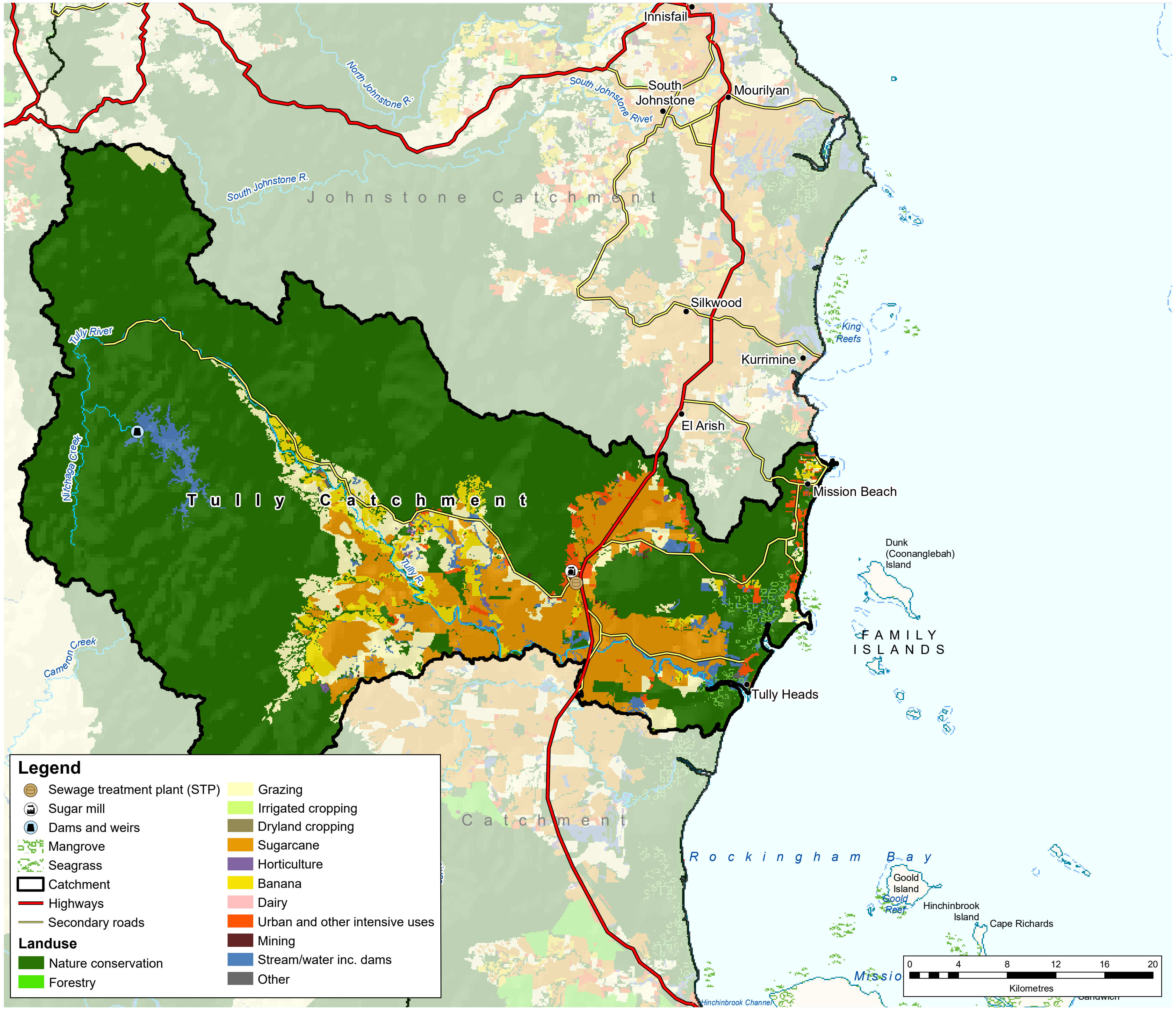
The Tully catchment covers 1683 km^2 (8% of the Wet Tropics region). Rainfall averages 2763 mm a year, which results in river discharges to the coast of about 3527 GL each year.

The Tully catchment is located in the southern section of the Wet Tropics region. The majority of the catchment is drained by the Tully River, with the remaining area captured by the Hull River and a number of smaller coastal creeks. The upper reaches of the Tully River are fed by streams emerging from rainforests of the Wet Tropics World Heritage Area in the coastal mountain ranges. The Koombooloomba Dam is also located in the upper catchment area. The lowland floodplains of the Tully catchment have intensive agricultural land use, principally of sugarcane, grazing and banana crops. Small pockets of urban areas are present, which include the township of Tully at the foot of the mountain range and several smaller coastal localities, including Hull Heads, Tully Heads and Mission Beach.

Land uses in the Tully catchment

The main land uses are nature conservation (73%), sugarcane (11%), and grazing (5%).





2025 water quality targets and priorities

End-of-catchment anthropogenic load reductions required from 2013 baseline				Pesticides
Dissolved inorganic nitrogen (DIN)	Fine sediment	Particulate phosphorus (PP)	Particulate nitrogen (PN)	
50% 190 tonnes	**20%** 17 kilotonnes	**20%** 23 tonnes	**20%** 68 tonnes	To protect at least **99%** of aquatic species at the end of catchment

The 2025 targets aim to reduce the amounts of fine sediments, nutrients (nitrogen and phosphorus) and pesticides flowing to the reef. Each target for sediment and nutrients is expressed as: (a) the percentage load reduction required compared with the 2013 estimated load of each pollutant from the catchment; and (b) the load reductions required in tonnes. Progress made since 2013 will count towards these targets. Previously reported progress between 2009 and 2013 has already been accounted for when setting the targets. The pesticide target aims to ensure that concentrations of pesticides at the end of each catchment are low enough that 99% of aquatic species are protected. The targets are ecologically relevant for the Great Barrier Reef, and are necessary to ensure that broadscale land uses have no detrimental effect on the reef's health and resilience.

A high percentage reduction target may not necessarily mean it is the highest priority. The priorities (ranked by colour) reflect the relative risk assessment priorities for water quality improvement, based on an independent report, the 2017 Scientific Consensus Statement. The priorities reflect scientific assessment of the likely risks of pollutants damaging coastal and marine ecosystems.

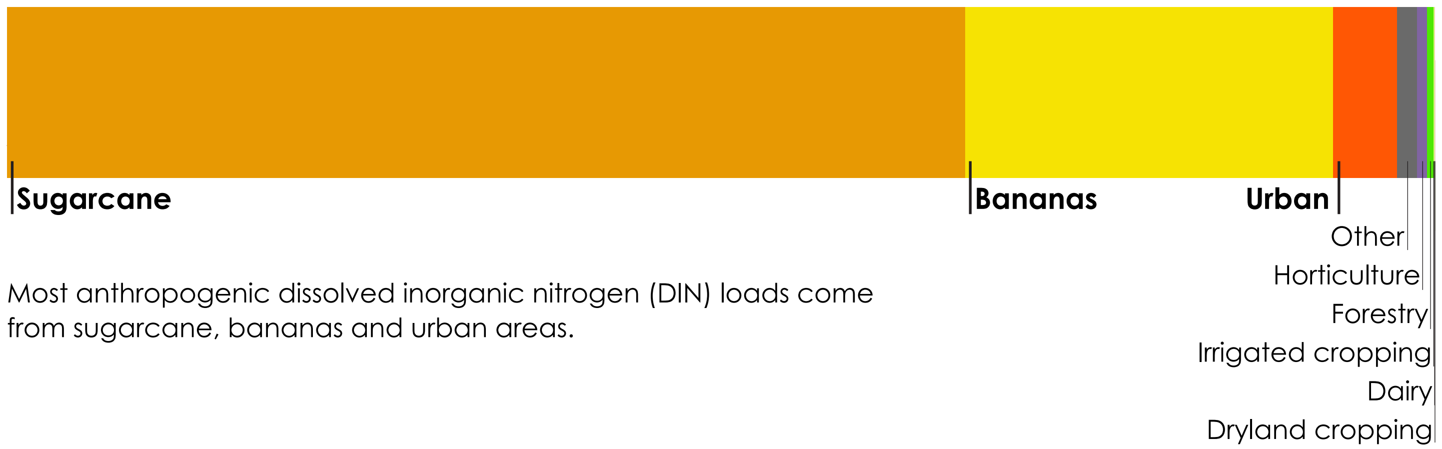
Water quality relative priority

- Very high
- High
- Moderate
- Low
- Minimal
- Not assessed

Modelled water quality pollutant loads

The Tully catchment contributes high loads of anthropogenic dissolved inorganic nitrogen, mostly from sugarcane. There are also small loads of fine sediment.

Dissolved inorganic nitrogen



Most anthropogenic dissolved inorganic nitrogen (DIN) loads come from sugarcane, bananas and urban areas.

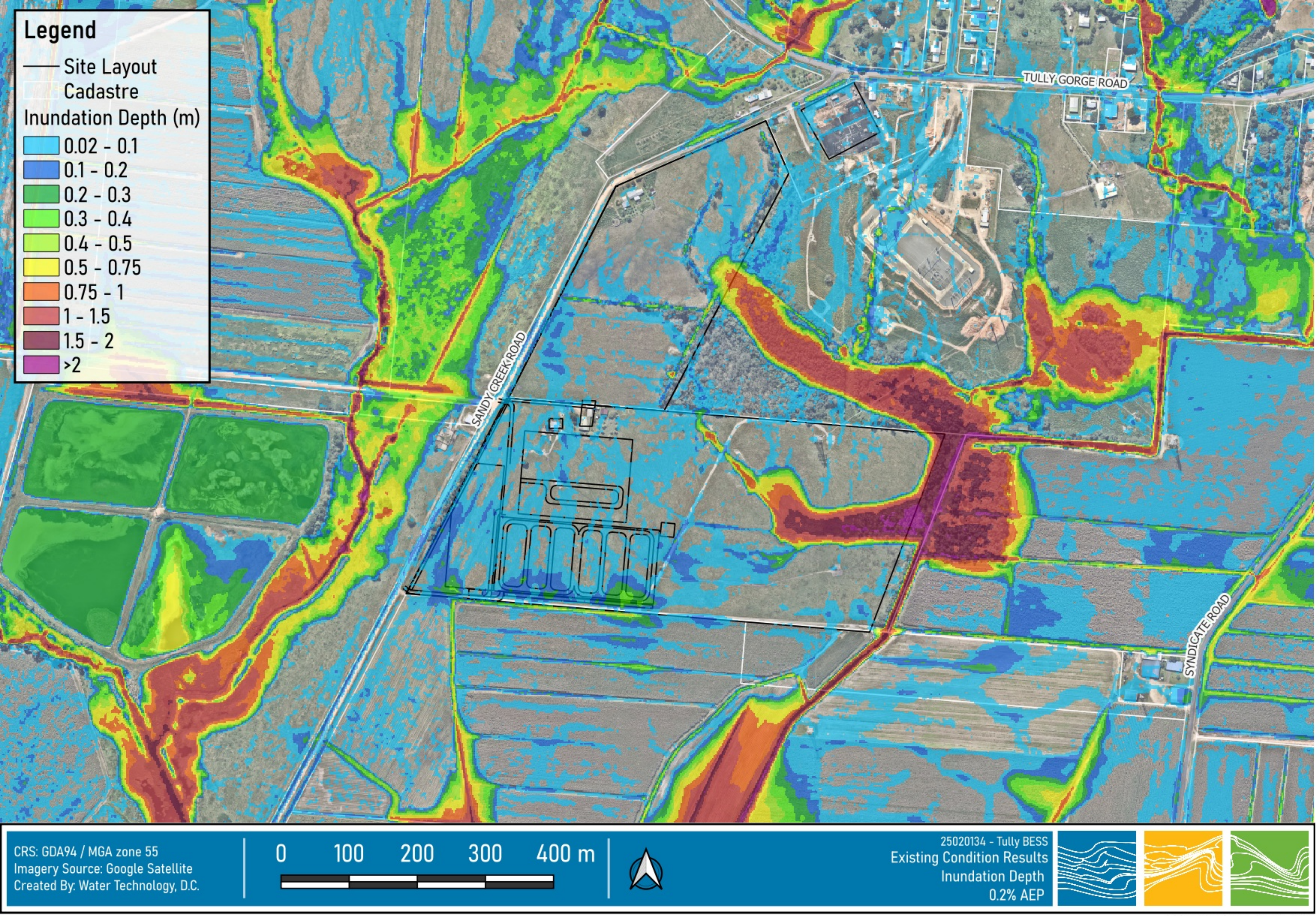
Fine sediment

Most anthropogenic fine sediment loads come from sugarcane, streambank erosion, grazing and bananas.

Types of sediment erosion

Most sediment erosion comes from hillslopes and streambanks in the Tully catchment.

APPENDIX B
FLOOD DEPTH AND VELOCITY MAPS



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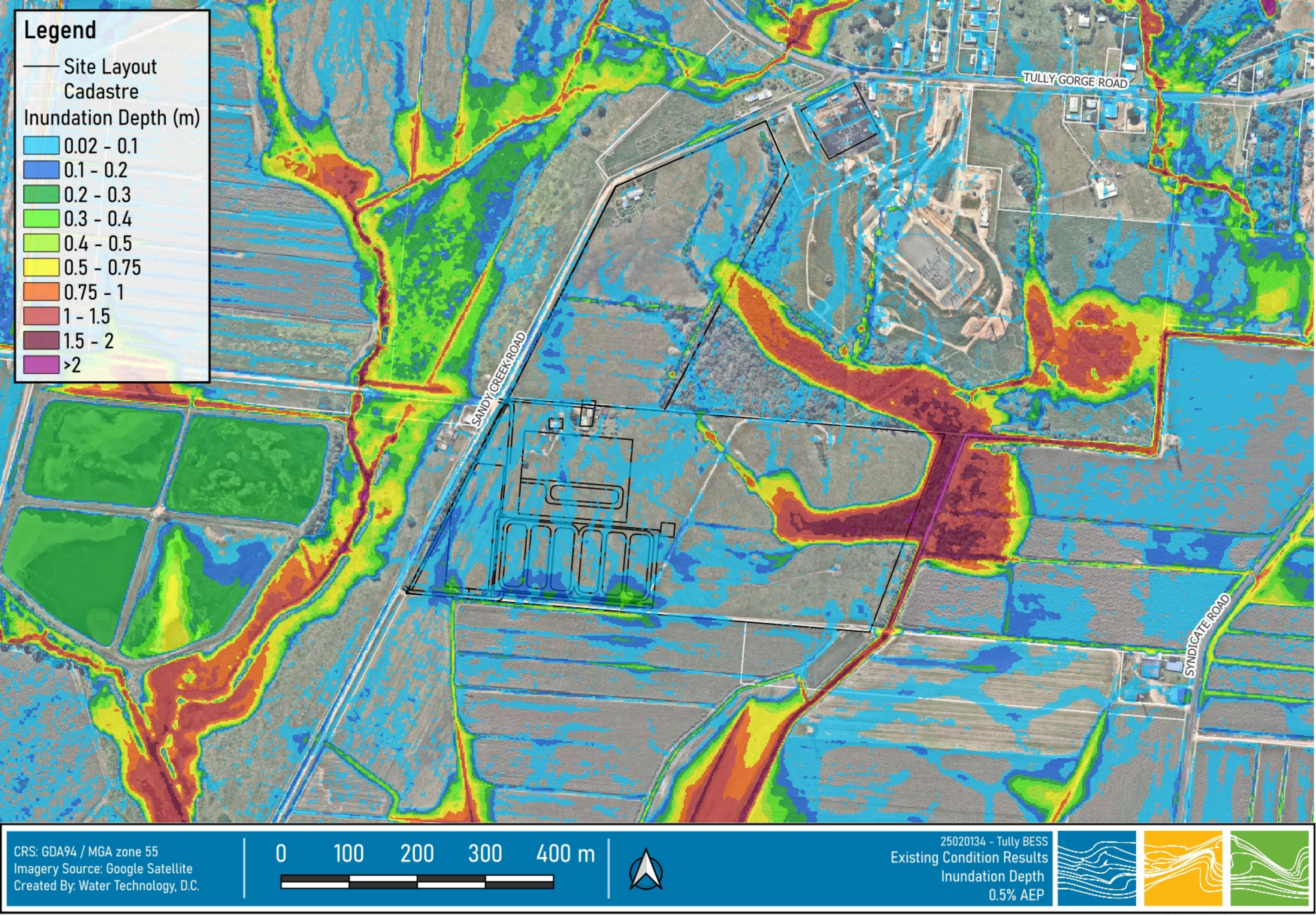

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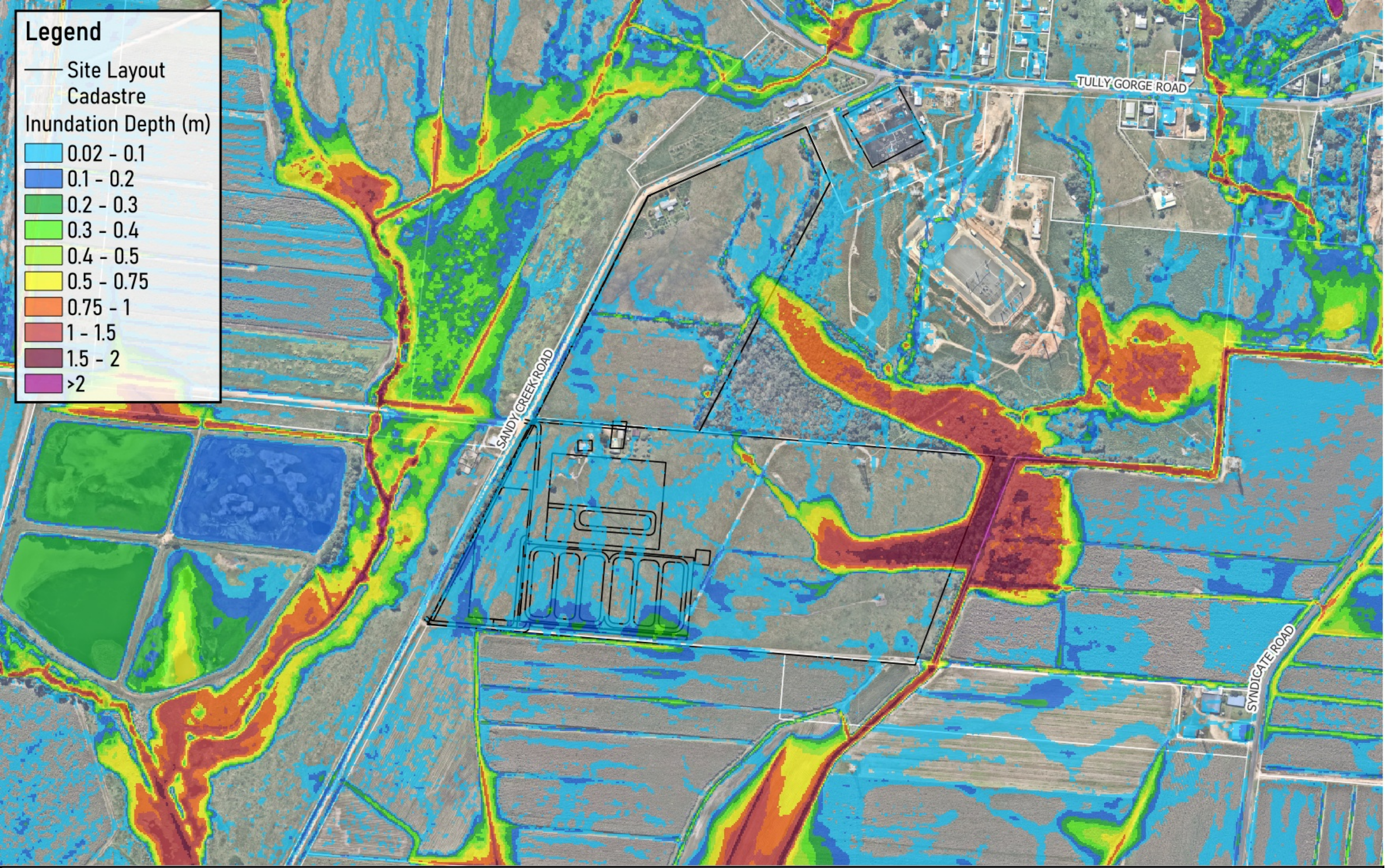

CRS: GDA94 / MGA zone 55
Imagery Source: Google Satellite
Created By: Water Technology, D.C.

0 100 200 300 400 m

25020134 - Tully BESS
Existing Condition Results
Inundation Depth
1% AEP

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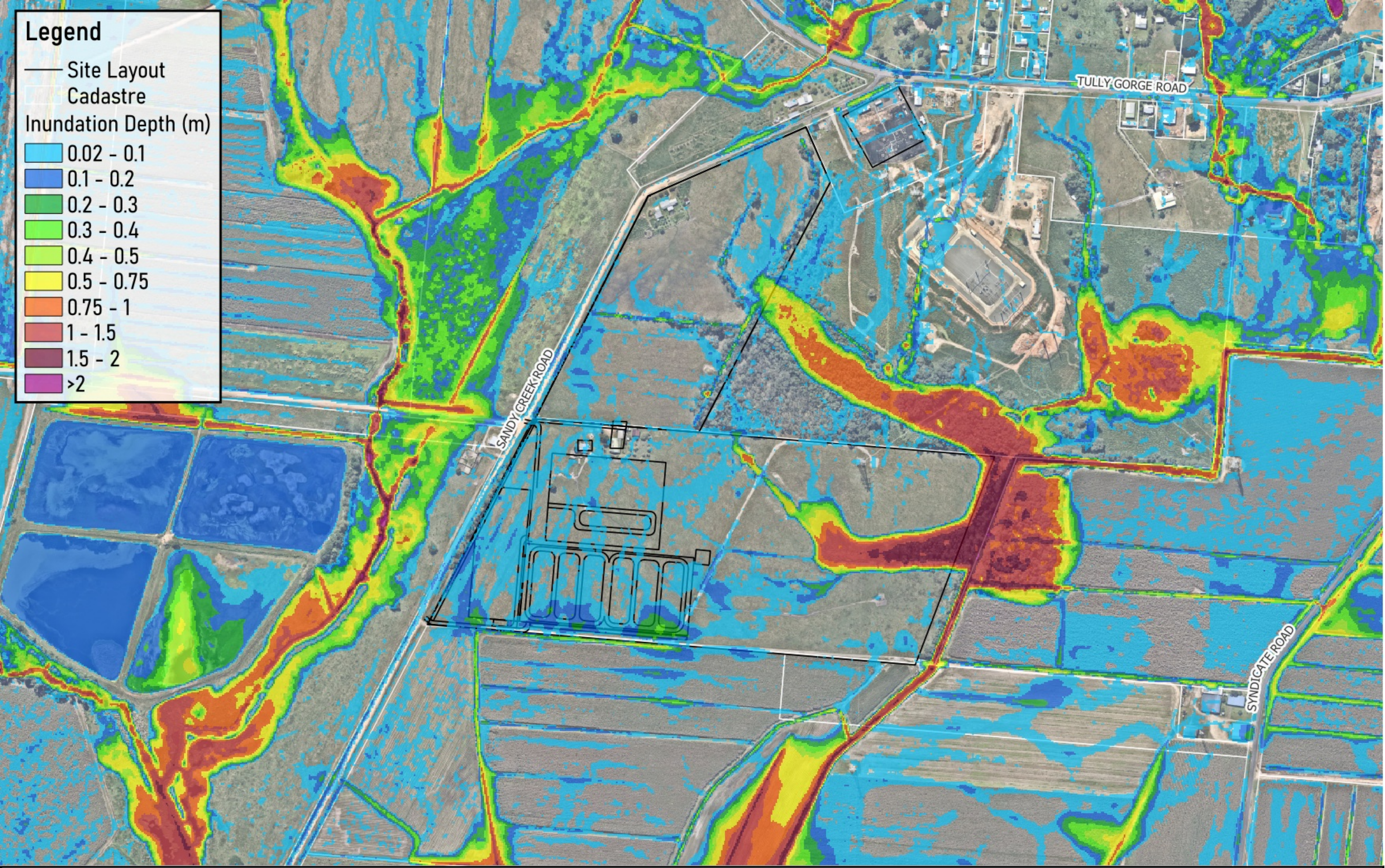

CRS: GDA94 / MGA zone 55
Imagery Source: Google Satellite
Created By: Water Technology, D.C.

0 100 200 300 400 m

25020134 - Tully BESS
Existing Condition Results
Inundation Depth
2% AEP

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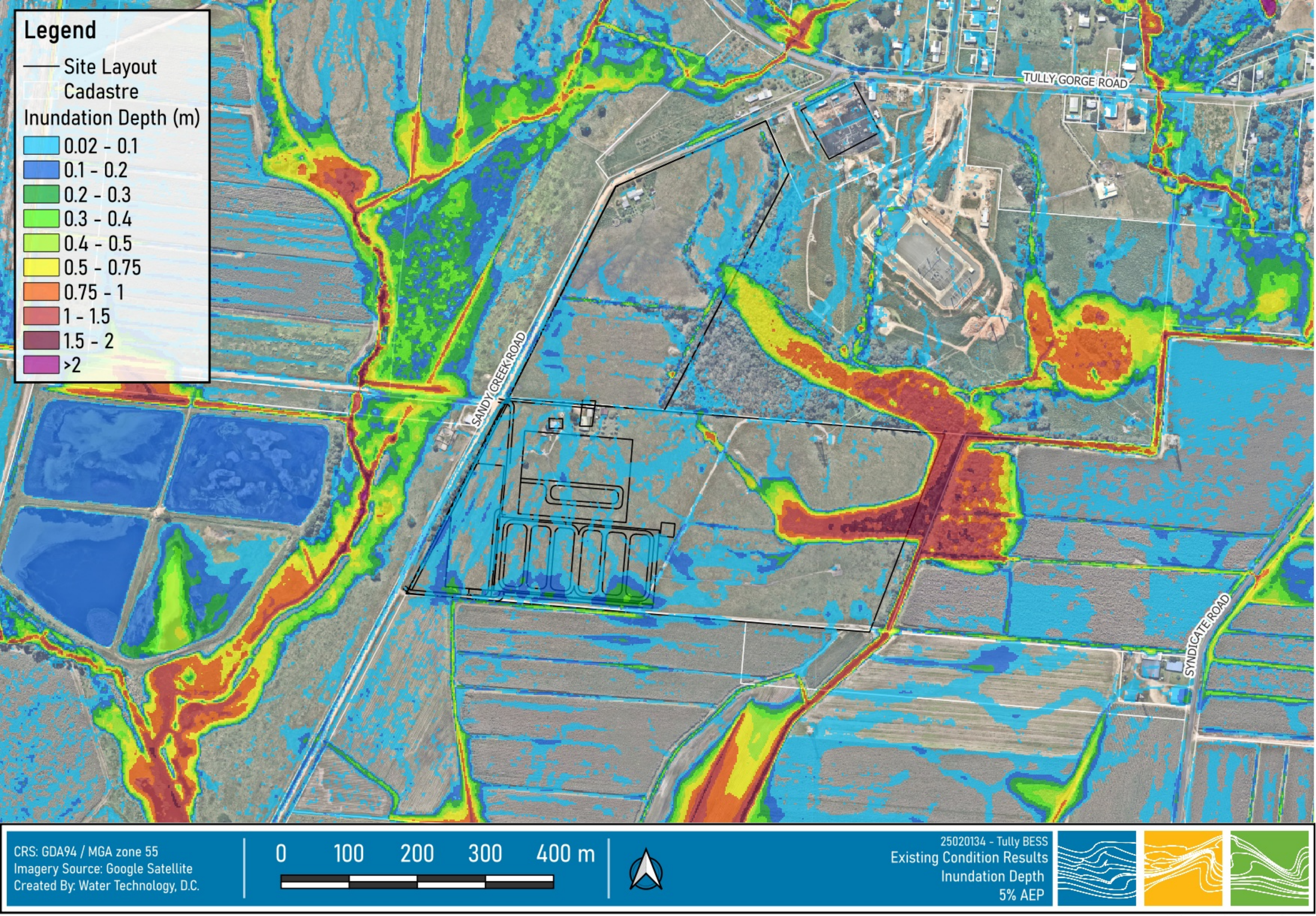

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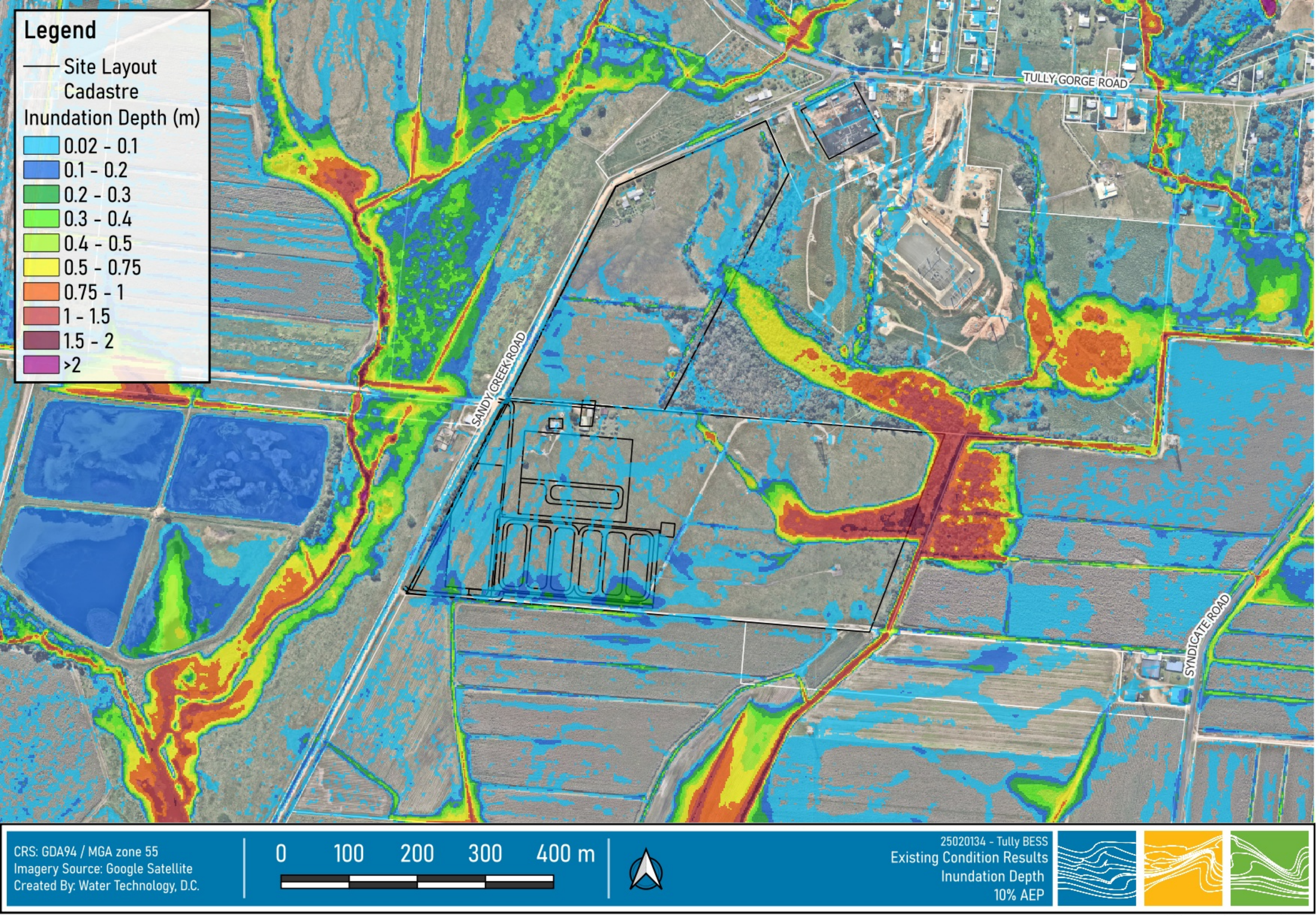


2025-09-18T11:24:49.791

2025-09-18T11:24:50.856

CRS: GDA94 / MGA zone 55
Imagery Source: Google Satellite
Created By: Water Technology, D.C.

25020134 - Tully BESS
Existing Condition Results
Inundation Velocity
0.5% AEP

2025-09-18T11:24:51.945

CRS: GDA94 / MGA zone 55
Imagery Source: Google Satellite
Created By: Water Technology, D.C.

0 100 200 300 400 m

25020134 - Tully BESS
Existing Condition Results
Inundation Velocity
1% AEP

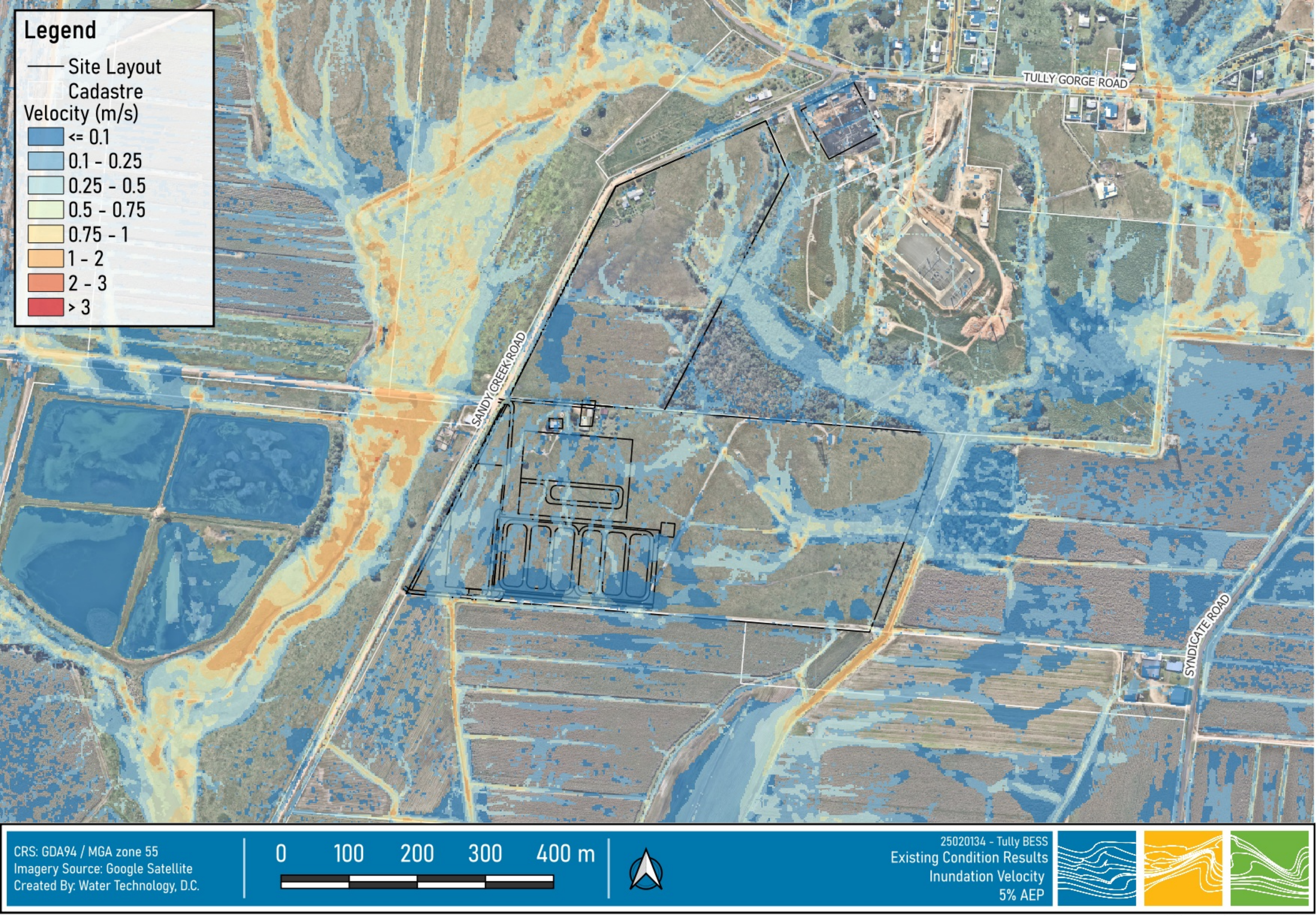
2025-09-18T11:24:53.072

CRS: GDA94 / MGA zone 55
Imagery Source: Google Satellite
Created By: Water Technology, D.C.

0 100 200 300 400 m

25020134 - Tully BESS
Existing Condition Results
Inundation Velocity
2% AEP

2025-09-18T11:24:54.097



2025-09-18T11:24:55.153

CRS: GDA94 / MGA zone 55
Imagery Source: Google Satellite
Created By: Water Technology, D.C.

0 100 200 300 400 m

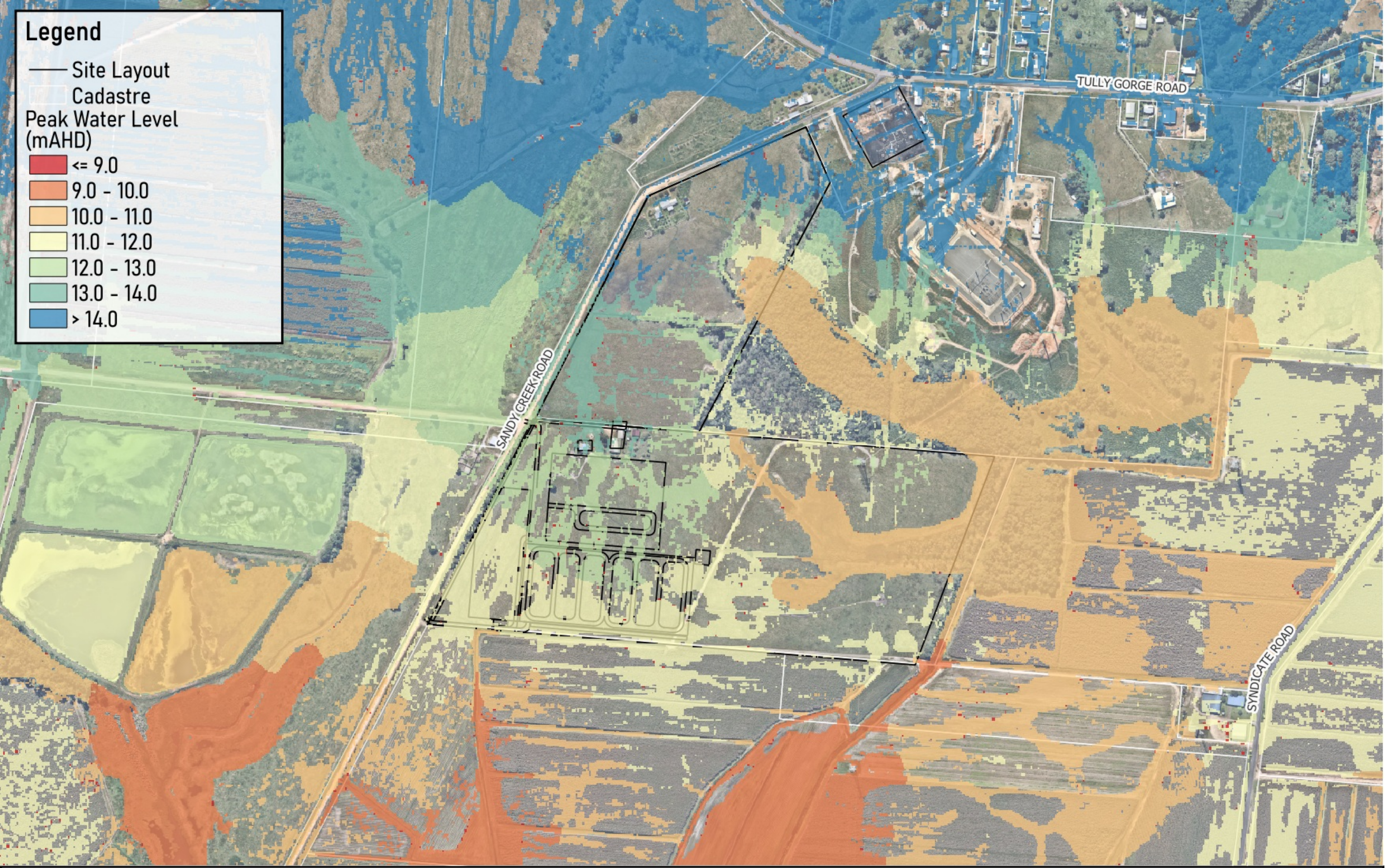
25020134 - Tully BESS
Existing Condition Results
Inundation Velocity
10% AEP

2025-09-18T11:24:56.216

CRS: GDA94 / MGA zone 55
Imagery Source: Google Satellite
Created By: Water Technology, D.C.

25020134 - Tully BESS
Existing Condition Results
Inundation Height
0.2% AEP

2025-09-18T11:24:57.293



CRS: GDA94 / MGA zone 55
Imagery Source: Google Satellite
Created By: Water Technology, D.C.

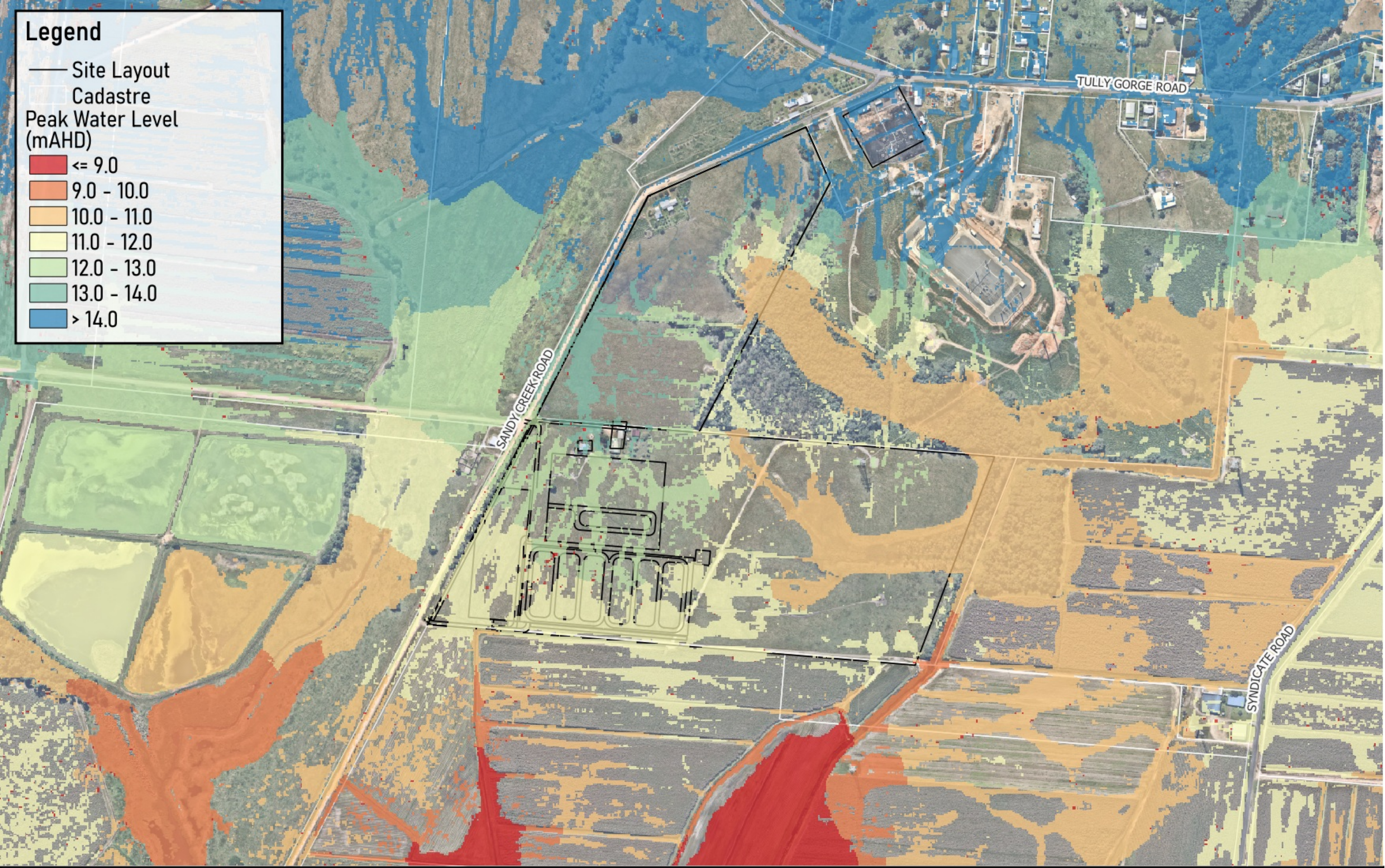
25020134 - Tully BESS
Existing Condition Results
Inundation Height
0.5% AEP

2025-09-18T11:24:58.372

CRS: GDA94 / MGA zone 55
Imagery Source: Google Satellite
Created By: Water Technology, D.C.

25020134 - Tully BESS
Existing Condition Results
Inundation Height
1% AEP

2025-09-18T11:24:59.410

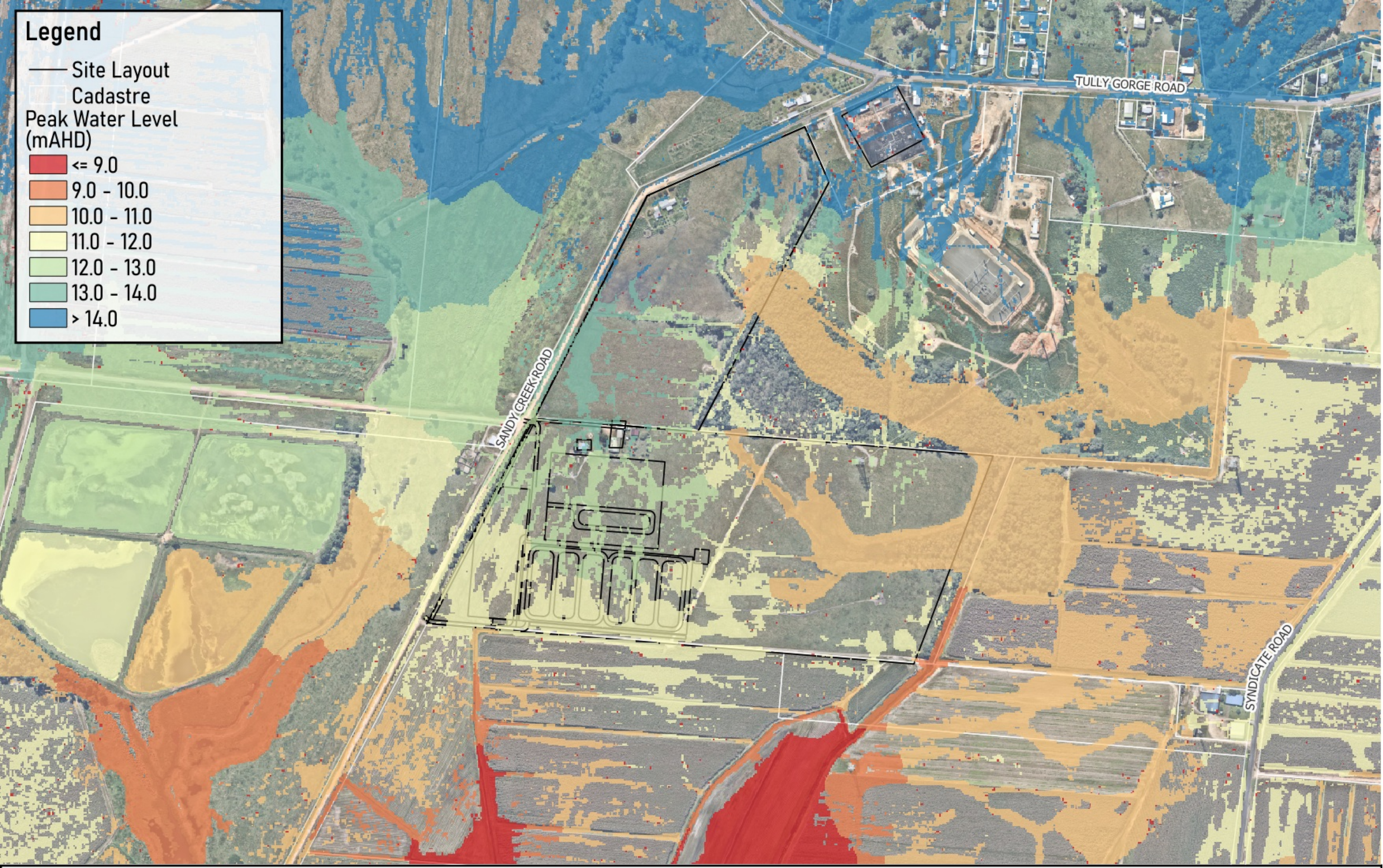


CRS: GDA94 / MGA zone 55
Imagery Source: Google Satellite
Created By: Water Technology, D.C.

0 100 200 300 400 m

25020134 - Tully BESS
Existing Condition Results
Inundation Height
2% AEP

2025-09-18T11:25:00.465

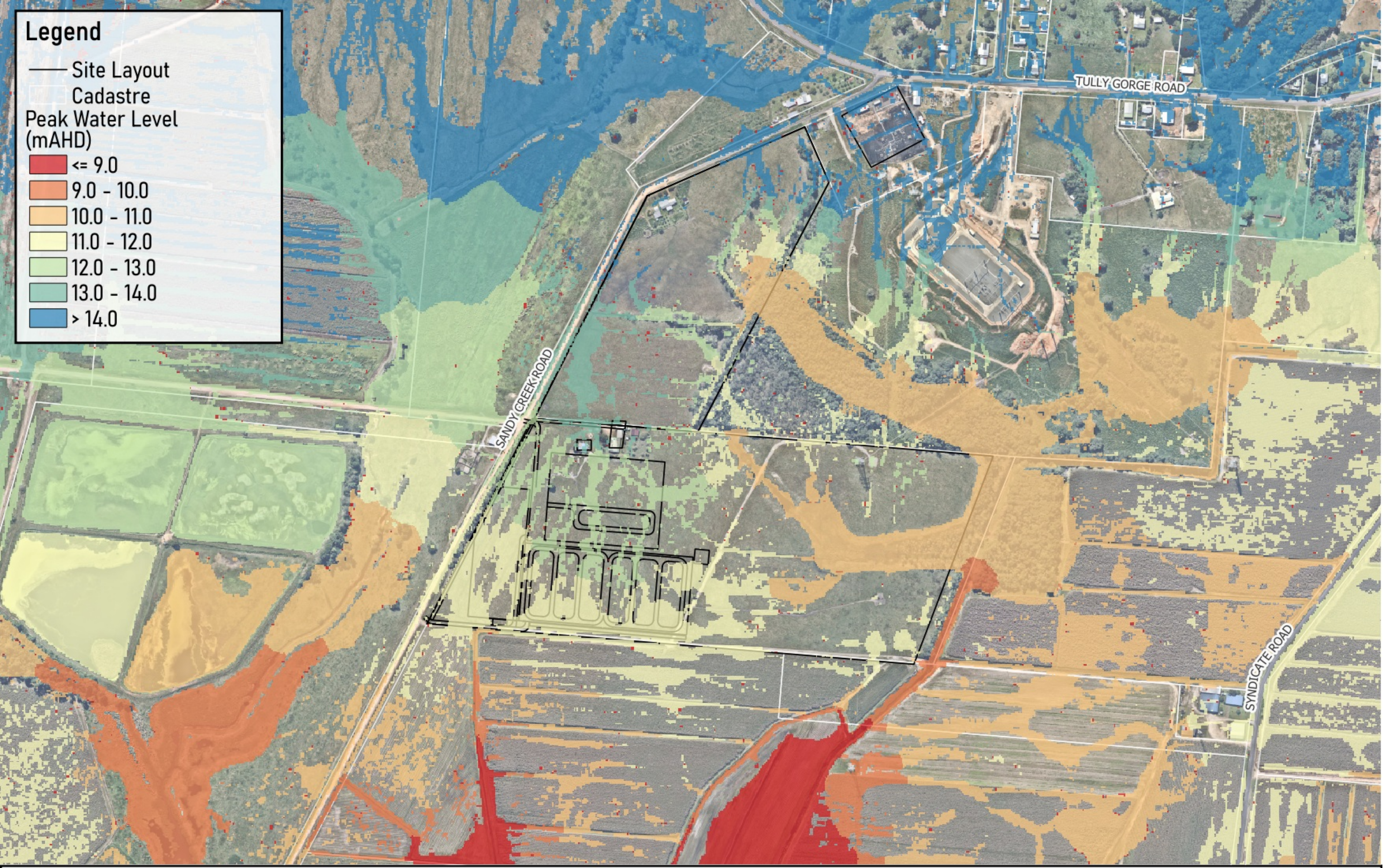


CRS: GDA94 / MGA zone 55
Imagery Source: Google Satellite
Created By: Water Technology, D.C.

0 100 200 300 400 m

25020134 - Tully BESS
Existing Condition Results
Inundation Height
5% AEP

2025-09-18T11:25:01.591



CRS: GDA94 / MGA zone 55
Imagery Source: Google Satellite
Created By: Water Technology, D.C.

0 100 200 300 400 m

25020134 - Tully BESS
Existing Condition Results
Inundation Height
10% AEP

2025-09-18T11:25:02.618

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