



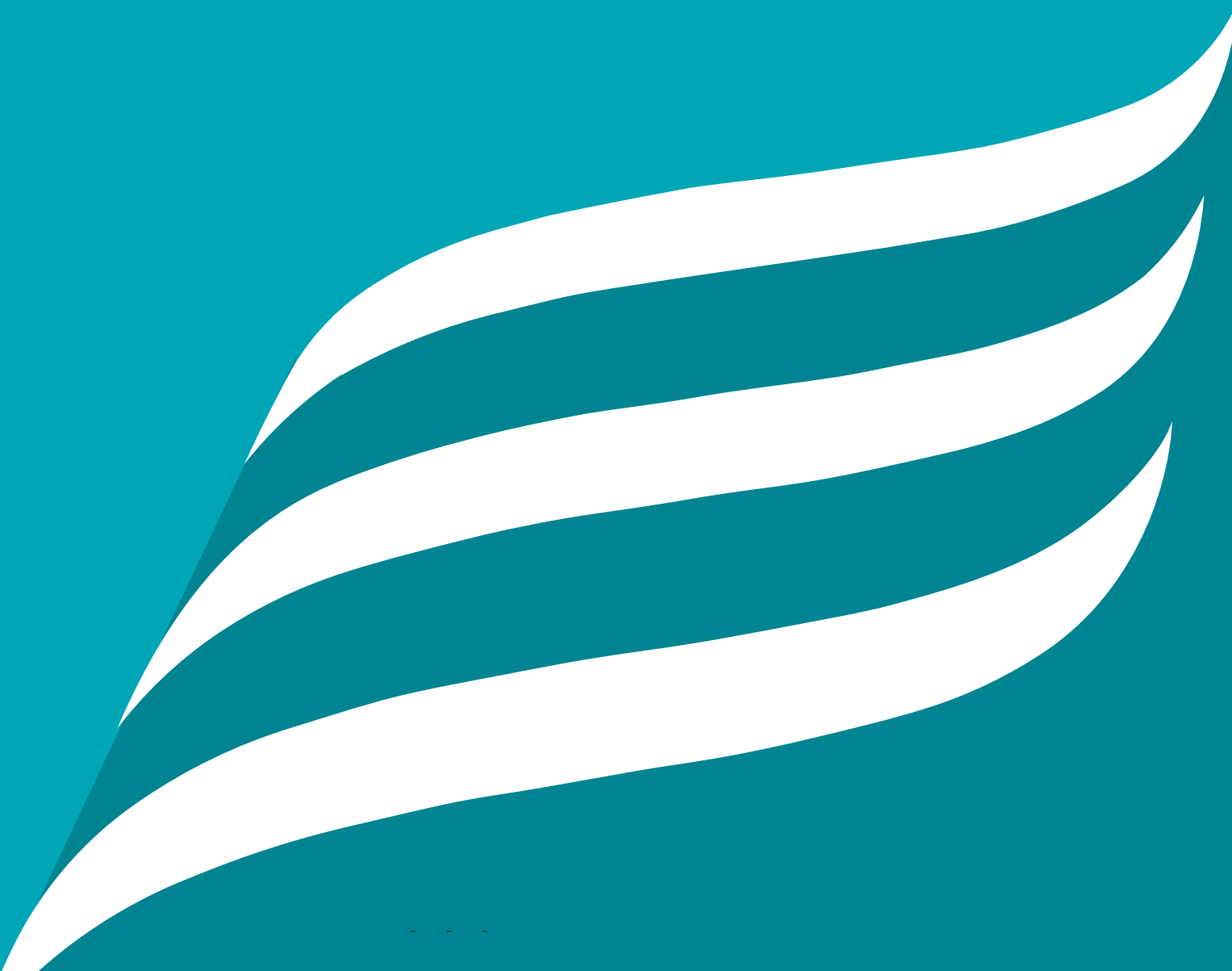
# EDIFY ENERGY

## Brewongle Solar Farm

### Surface Water Impact Assessment

BNTL00206\_015 REP 002 4





3 MARCH 2025



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# EXECUTIVE SUMMARY

## Overview

Edify Energy Pty Ltd (the Applicant) proposes to develop the Brewongle Solar Farm (the Project). The Project is proposed to involve the construction, operation, and decommissioning of photovoltaic (PV) solar arrays and battery energy storage systems (BESS) with an estimated capacity of 90 megawatts (MW) of generation capacity. The Project is located 12 km south-east of Bathurst and lies entirely within the Bathurst Regional Council Local Government Area (LGA) in New South Wales (NSW).

The Project is State Significant Development (SSD) and therefore requires an Environmental Impact Statement (EIS) to be prepared under Part 4, Division 4.7 of the *Environmental Planning and Assessment Act 1979*. This Surface Water Impact Assessment (SWIA) supports the SSD application as an appendix of the EIS for the Project and provides an assessment of the potential impacts to surface water as a result of the Project. The SWIA documents the assessment methods and results, initiatives to avoid and minimise surface water impacts, and additional mitigation and management measures proposed to address residual impacts not able to be avoided.

## Baseline Characteristics

### Surface Water Context

The Project is located within the Macquarie-Bogan catchment. The Study Area encompasses Salt Water Creek, a tributary of the Fish River. The Fish River flows north, joining the Macquarie River approximately 3 km downstream of the Project.

The Study Area is located approximately 12 km south-east of Bathurst, with an undulating landscape and numerous nearby watercourses. Local drainage systems within and surrounding the Study Area are well-defined, and existing farm dams influence flow regimes during events. There are three mapped 1<sup>st</sup> order ephemeral watercourses within the Impact Area. The local catchment is dominated by flat topography, ranging between 590 mAHD to 920 mAHD.

### Flooding

Detailed flood modelling of the Study Area was undertaken as part of the SWIA. Due to the proximity of the Impact Area to Salt Water Creek the hydraulic model included the entire Salt Water Creek catchment. The hydraulic modelling was undertaken using rain-on-grid (RoG) modelling techniques.

The flood modelling indicates that the Impact Area is not significantly impacted by overland flow from the local catchment area, however, flooding within the Impact Area can occur from Salt Water Creek during the probable maximum flood (PMF) event.

### Water Supply

The Applicant does not own land within the Study Area and will source all water externally, primarily through a bulk water permit from Bathurst Regional Council, with supplementary potable water trucked in if required. Although unlikely, if required, additional water may be obtained through agreements with landholders from farm dam runoff, sediment basin reuse, and water recycling. No groundwater extraction is planned.

## Potential Impacts

### Watercourse Characteristics

The Project will not require modification or realignment of existing watercourses in the Study Area, minimising any potential impacts on flow paths or stream ordering. Infrastructure required for construction and operation of the Project may cause some temporary disturbance to minor flow/drainage paths where existing access tracks or watercourse crossings cannot be used.

One 1<sup>st</sup> order ephemeral watercourse in the northern part of the Impact Area, and two 1<sup>st</sup> order ephemeral watercourses in the southern part of the Impact Area will be traversed by solar panel arrays, with installation methods designed to preserve the channel geometry, where present, and minimise disturbance to waterfront land.

## Flooding

The flood model was used to simulate the developed conditions for the 5% and 1% Annual Exceedance Probability (AEP), and PMF events. Results indicate that flood impacts within the Impact Area associated with the Project infrastructure are typically minor and do not present significant erosion or inundation risks. Modelling also indicates that the alignment of the proposed access road may result in some increases to flooding on Tarana Road in the PMF event. Flood depths across Tarana Road are expected to increase from 0.63 m to 0.66 m in the PMF, with negligible change to time and duration of inundation.

A climate change sensitivity was undertaken by modelling the 0.5% and 0.2% AEP design flood events under existing conditions as proxies for climate change. The climate change sensitivity modelling indicates that there is generally little difference in flood extent across the Study Area between the two climate change scenarios.

## Surface Water Quality

Construction, operation, and decommissioning phases pose potential risks to surface water quality, including:

- Soil erosion and sedimentation of downstream watercourses and crops.
- Spill of hydrocarbons or other pollutants used to support transportation and installation activities.
- Release of concrete by-products (dust, slurry, water) into downstream watercourses and crops.
- Discharge/spill of wastewater (treated or untreated) into downstream watercourses and crops.
- Release of tannins to downstream watercourses and crops.

These potential risks can cause harm to aquatic life, contaminate watercourses, and impact crops. Mitigation measures, such as a Construction Erosion and Sediment Control Plan (CESCP) and erosion controls, hydrocarbon storage controls, and wastewater management systems, are proposed to mitigate, manage and minimise these risks. Through best practices and proposed measures, the overall potential impact on water quality is considered to be negligible, especially given the limited connectivity to adjacent watercourses. Operation and decommissioning phases share similar risks, however with appropriate management measures, the potential impacts on water quality during these phases is also considered negligible.

## Cumulative Impacts

The cumulative impact assessment for the Project, in accordance with SSD guidelines, acknowledges the potential cumulative effects arising from the incremental influence of multiple energy projects within the Bathurst Regional LGA and surrounds. Additionally, the Central West Renewable Energy Zone (REZ) exists outside of the Study Area, which is intended to support 4.5 gigawatts of potential energy generation and storage projects. Although individual impacts from specific projects may be minor or negligible, the collective influence needs to be considered. The Project, is located within proximity to four known energy projects, including wind, solar and pumped hydro installations and a new battery energy storage system, and has undergone a comprehensive assessment considering potential cumulative impacts.

Surface water quality and flow were assessed with a focus on Salt Water Creek, a common water receptor for the Project and nearby projects. However, no direct interactions are expected, and with proposed mitigation measures, cumulative impacts on surface water are expected to be negligible.

## Mitigation and Management Measures

Detailed environmental studies have been undertaken for the Project design. The consideration of the outcomes of these studies in the design of the Project minimise the potential for impacts on surface water resources. These considerations include:

- The management of impacts within the existing water allocations.
- Project design to meet legislative requirements and relevant guidelines.

These factors reduce the potential for significant impacts on existing surface water resources. The range of potential impacts resulting from the Project and a summary of the proposed mitigation measures is included in Table 1. It should be emphasised that the majority of the proposed mitigation measures are consistent with best practices for the development of large-scale solar farms. This is appropriate and to be expected given the generally small incremental impact due to the minor disturbance associated with the Project infrastructure.

**TABLE 1: SUMMARY OF POTENTIAL IMPACTS AND MITIGATION AND MANAGEMENT MEASURES**

Watercourse Characteristics		
Filling of streams for infrastructure / water crossings	<p>Consider the following mitigation measures in the Project detailed design:</p> <ul style="list-style-type: none"> <li>• Limit water crossing to existing access tracks where possible.</li> <li>• Arrange solar panel arrays such that stream disturbance and modifications (filling / diversions) are limited to minor watercourses.</li> </ul> <p>In the event construction of waterway crossings is required, these will be designed, constructed and maintained to consider DPE Guidelines for instream works on waterfront land (DPE, 2022) and Guidelines for riparian corridors on waterfront land (DPE, 2022).</p>	Detailed Design
Flooding		
Impacts to in-stream and overland flooding	<p>Consider the following mitigation measures in the Project detailed design stage to minimise impacts to flooding possible:</p> <ul style="list-style-type: none"> <li>• Minimise filling of BESS, substations sites and Operation and Maintenance (O&amp;M) facilities.</li> <li>• Minimise extent of Project infrastructure within the 1% AEP flood extent.</li> <li>• Design to manage flood impacts and flow conveyance at watercourse crossings (if any).</li> </ul>	Detailed Design
Impacts on the Project design due to predicted flooding	<p>Optimisation of the Project design during detailed design to ensure:</p> <ul style="list-style-type: none"> <li>• A minimum of 0.2 to 0.3 m freeboard is maintained between the 1% AEP flood level and proposed solar array panels.</li> <li>• Permanent ancillary infrastructure (BESS) is located above the PMF level.</li> </ul>	Detailed Design
Impacts to site personnel during a flood event	<p>Floodplain management planning to determine site management protocols during flood events that could impact construction or access areas, including:</p> <ul style="list-style-type: none"> <li>• Suitable early warning and communication protocols.</li> <li>• Triggers for closure, evacuation and recovery.</li> <li>• Emergency response and support.</li> </ul>	Post Approval / Pre-Construction
Increased stormwater runoff from vegetation clearing and filling for infrastructure	<p>Increased stormwater runoff during operations (due to clearing of vegetation and filling for infrastructure) will be managed through development of erosion and sediment control plan (ESCP). The ESCP will consider:</p> <ul style="list-style-type: none"> <li>• Location of site infrastructure away from existing watercourses or areas subject to high levels of overland flow.</li> <li>• Diversion of upstream flows around site infrastructure as required, to minimise scouring and erosion.</li> <li>• Inspection and monitoring regimes to maintain stormwater and erosion and sediment control structures.</li> </ul>	Construction

Potential Impacts	Mitigation Measure	Project Implementation Stage
<b>Water Quality</b>		
Erosion and sedimentation of downstream watercourses	<p>Development of erosion and sediment control plans (ESCP) through all project phases, in accordance with Managing Urban Stormwater: Soils and Construction – Volume 1 (Landcom, 2004), Volume 2A Installation of services (DECC, 2008), Volume 2C Unsealed roads (DECC, 2008), Volume 2D Main road construction (DECC, 2008) and Best Practice Erosion and Sediment Control (IECA, 2008).</p> <p>The ESCPs will detail area specific erosion and sediment control measures to be implemented and maintained during construction until the design intent is met by the as-built infrastructure and rehabilitated vegetation. As well as ongoing monitoring and maintenance through operation and decommissioning of additional controls if identified as required.</p> <p>The total area of disturbance at any time should be minimised where possible and ongoing rehabilitation and stabilisation strategies implemented throughout construction.</p>	Construction
Release of sediment or construction byproducts	<p>During construction, the following management measures will be considered to minimise the potential for mobilisation of sediment or dust from topsoil stockpile:</p> <ul style="list-style-type: none"> <li>• Locate stockpiles away from drainage lines, or areas subject to high levels of overland sheet flow and minimise stockpile size.</li> <li>• Develop and implement area specific erosion and sediment control measures including bunding and diversion drains as required.</li> <li>• Use stockpile stabilisation techniques such as covering or dust suppression.</li> </ul>	Construction
Contaminant spills	<p>Prior to commencing construction activities, a Construction Environment Management Plan (CEMP) will be developed to identify site specific controls and procedures to minimise the potential for hydrocarbons and other contaminants being discharged into the environment. This CEMP should consider:</p> <ul style="list-style-type: none"> <li>• Storage of hydrocarbons and other liquid chemicals within an above ground, bunded area away from watercourses or area subject to high levels of overland sheet flow.</li> <li>• Re-fuelling of construction vehicles and equipment to be limited to designated areas, with adequate spill management controls.</li> <li>• Maintain an emergency spill kit and relevant emergency spill response procedures.</li> <li>• Transport and dispose of any hydrocarbons captured during Project construction and operation of the substations and switchyards at a suitable off-site licenced facility.</li> </ul>	Construction, Operation
Surface water and groundwater quality impacts	<p>The CEMP will consider the following management measures to minimise the potential impacts to surface water and groundwater quality within and surrounding the Study Area:</p> <ul style="list-style-type: none"> <li>• Develop and implement a suitable monitoring regime of all stormwater and erosion and sediment control structures, particularly following large flow events.</li> </ul>	Construction, Decommissioning

<b>Water Supply</b>		
Water licences to meet demands	All required water licensing and approvals will be coordinated with associated landholders and/or regulators (e.g. Council, others) if that source is needed to support water supply arrangements for during construction and operation.	Construction, Operation
<b>Wastewater Management</b>		
Discharge of wastewater or effluent from site	<p>Design and implement a wastewater treatment system that:</p> <ul style="list-style-type: none"> <li>• Is appropriately sized for the Project infrastructure and operations.</li> <li>• Collects and treats wastewater from site offices and temporary accommodation facilities for re-use on site to fulfill non-potable construction and operation demands.</li> <li>• Be designed and operated in accordance with best practices.</li> </ul>	Detailed design

# CONTENTS

<b>1. Introduction</b>	<b>1</b>
1.1 Overview	1
1.1.1 Large-scale Solar Energy Guideline	2
1.2 Project Description	3
1.3 Project Terminology	3
<b>2. Baseline Characteristics</b>	<b>5</b>
2.1 Climate	5
2.2 Surface Water Context	6
2.2.1 Regional Systems	6
2.2.2 Local Systems	6
2.2.3 Waterfront Land	7
2.3 Flooding	11
2.3.1 Approach	11
2.3.2 Existing Flood Behaviour	11
2.4 Water Quality and Flow Regimes	11
2.4.1 Water Quality and River Flow Objectives	11
2.4.2 Water Quality Objectives	11
2.4.3 Background Surface Water Quality	13
2.4.4 River Flow Objectives	14
2.5 Soils and Land Use	16
2.6 Published Studies	18
2.7 Water Regulatory Framework	18
2.7.1 Commonwealth Water Licensing and Approvals	18
2.7.2 Water Resource and Water Sharing Plans	18
2.7.3 Water Take for Consumptive Use	20
2.7.4 Existing Local Water Sources	20
2.7.5 NSW Water Licensing and Approvals	20
2.7.6 Basic Landholder Rights	20
2.7.7 Water Access Licences, Water Use Approvals, and Water Supply Works	21
2.7.8 Flood Works Approval	22
2.7.9 Controlled Activity Approval	23
<b>3. Proposed Water Management</b>	<b>24</b>
3.1 Water Balance	24
3.1.1 Water Demands	24
3.1.2 Water Supply	25
3.1.3 Wastewater Management	25
<b>4. Flood Modelling</b>	<b>26</b>
4.1 Overview	26
4.2 Model Development	26
4.3 Existing Flood Behaviour	32

4.3.1	Flood Hazard Classification	32
4.3.2	Flood Planning Area	34
4.3.3	Hydraulic Categorisation	34
4.3.4	Climate Change Assessment	34
4.4	Developed Flood Behaviour	38
<b>5.</b>	<b>Surface Water Impact Assessment</b>	<b>39</b>
5.1	Watercourse Characteristics	39
5.1.1	Flow Regimes	39
5.1.2	Waterfront Land and Riparian Vegetation	39
5.1.3	Flooding	40
5.2	Water Quality	43
5.2.1	Construction	44
5.2.2	Operation	45
5.2.3	Decommissioning	45
5.3	Erosion and Sedimentation	45
5.3.1	Construction	45
5.3.2	Operation and Decommissioning	46
<b>6.</b>	<b>Cumulative Impacts</b>	<b>47</b>
<b>7.</b>	<b>Mitigation and Management Measures</b>	<b>49</b>
<b>8.</b>	<b>References</b>	<b>52</b>
<b>9.</b>	<b>Qualifications</b>	<b>53</b>
<b>Appendices</b>		
<b>Appendix A: Existing Condition Flood Model Results</b>		<b>54</b>
<b>Appendix B: Developed Condition Flood Model Results</b>		<b>56</b>
<b>Appendix C: Water Demand Assumptions</b>		<b>58</b>
<b>Appendix D: Regulatory Submission to SEARs and WERE Addressed</b>		<b>60</b>

## Tables

Table 1: Summary of Potential Impacts and Mitigation and Management Measures .....	v
Table 1.1: SEARs and Where Addressed .....	1
Table 1.2: Solar Energy Guideline requirements relevant to Water Resources .....	2
Table 1.3: Project Terminology .....	3
Table 2.1: Nearby Rainfall Stations .....	5
Table 2.2: Relevant NSW Water Quality Objectives – Macquarie-Bogan catchment .....	12
Table 2.3: Toxicant Default guideline values .....	12
Table 2.4: Statement Of catchments (2010) Water Quality Results .....	13
Table 2.5: Relevant NSW River Flow Objectives – Macquarie Bogan Catchment .....	14
Table 2.6: Published Studies .....	18
Table 2.7: Applicable Plan Areas .....	19
Table 2.8: Fish River Water Source – Total WALs 2024/2025 .....	22
Table 2.9: Lachlan Fold Belt MDB Groundwater Source – Total WALs 2024/2025 .....	22
Table 2.10: Water Supply Work and Use Approvals Applicable to The Study Area .....	22
Table 3.1: Site Water Demands Summary .....	24
Table 4.1: Hydraulic Model Development and Parameters .....	26
Table 4.2: NSW Probability Neutral burst Loss Rainfall Depths (MM) .....	28
Table 4.3: Manning’s Values .....	28
Table 4.4: Hydraulic Structure Attributes .....	29
Table 4.5: Combined Hazard Categories – Vulnerability Thresholds and Limits .....	33
Table 4.6: Hydraulic Categorisation .....	34
Table 5.1: Peak Flood Depth Adjacent to Project Infrastructure .....	40
Table 5.2: Peak Flood Velocity Adjacent to Project Infrastructure .....	41
Table 5.3: Surface Water Quality Impacts .....	43
Table 6.1: Identification of Potential Cumulative Impacts .....	48
Table 7.1: Summary of Potential Impacts and Mitigation and Management Measures .....	49
Table D.1: Regulatory Submission to SEARs and Where Addressed .....	61

## Figures

Figure 1.1: Site Overview .....	4
Figure 2.1: SILO Monthly Average Rainfall and Pan Evaporation within the Study Area .....	6
Figure 2.2: Regional Drainage Overview .....	8
Figure 2.3: Local Drainage Overview .....	9
Figure 2.4: Waterfront Land .....	10
Figure 2.5: Soil Classification .....	17
Figure 2.6: Relationship Between Basin Plan, WRP, and Other Instruments .....	19
Figure 4.1: TUFLOW Model Extent .....	30
Figure 4.2: TUFLOW Material Classification .....	31
Figure 4.3: Flood Hazard Categories .....	33
Figure 4.4: Flood Planning Area .....	35
Figure 4.5: Hydraulic Categorisation .....	36
Figure 4.6: Climate Change Sensitivity .....	37
Figure 5.1: Flood Depth and Velocity Reporting .....	42
Figure 6.1: Central-West Orana Renewable Energy Zone .....	47

# 1. INTRODUCTION

## 1.1 Overview

Engeny Australia Pty Ltd (Engeny) has been engaged in by Environmental Resource Management Australia Pty Ltd (ERM) on behalf of Edify Energy Pty Ltd (the Applicant) to prepare a Surface Water Impact Assessment (SWIA) of the Brewongle Solar Farm for Edify Energy Pty Ltd. This Surface Water Impact Assessment (SWIA) encompasses flooding and surface water assessments for the development of a solar farm situated approximately 12 km south-east of the City of Bathurst town centre. The Study Area covers approximately 299 ha and is depicted in Figure 1.1.

This SWIA report addresses the potential impacts and proposed mitigation measures for surface water resources associated with the Project in accordance with relevant regulatory requirements and guidelines.

This report supports a State Significant Development (SSD) Development Consent application under Part 4, Division 4.7 of the *Environmental Planning and Assessment Act 1979* (SSD- 64834490), and is an appendix to the Environmental Impact Statement (EIS) for the Project.

The following guidelines have been considered in this assessment:

- Water Management Act 2000.
- Water Sharing Plans (refer to Table 2.7).
- Guidelines for instream works on waterfront land (DPE, 2022).
- Waterfront Land e-tool (NRAR, 2020).
- NSW Water Quality and River Flow Objectives.
- Australian and New Zealand fresh and marine water quality guidelines (ANZG 2018).
- Managing Urban Stormwater: Soils & Construction Volume 1 (Landcom 2004), Volume 2A, 2C and 2D (DECC, 2008).
- Renewable Energy Planning Framework (DPHI, 2024) and Large-scale Solar Energy Guideline (DPIE, 2022).
- Guidelines for Controlled Activities on Waterfront Land (DPI, 2018).
- Why Do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings (DPI, 2003).
- Policy & Guidelines for Fish Habitat Conservation & Management (DPE, 2013).

The relevant Planning Secretary's Environmental Assessment Requirements (SEARs) and where each is addressed in this report are listed in Table 1.1 and regulatory submissions to SEARs issues are included in Appendix D.

**TABLE 1.1: SEARS AND WHERE ADDRESSED**

SEAR	Issue	Section addressed in this report
Water and Soil	A site water balance for the development and details of water requirements and supply arrangements for construction and operation.	Section 3.1 (Water Balance).
	An assessment of the likely impacts of the development (including flooding and flood modelling) on surrounding watercourses (including their Strahler Stream Order), and surface water movements, and measures proposed to monitor, reduce and mitigate these impacts including water management issues having regard to the Solar Guideline.	Section 5 (Surface Water Impact Assessment). Section 7 (Mitigation and Management Measures).

SEAR	Issue	Section addressed in this report
	Where the project involves works within 40 metres of any river, lake or wetlands (collectively waterfront land), identify likely impacts to the waterfront land, and how the activities are to be designed and implemented in accordance with the DPI Guidelines for Controlled Activities on Waterfront Land (2018) and (if necessary) Why Do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings (DPI 2003), and Policy & Guidelines for Fish Habitat Conservation & Management (DPE, 2013).	Sections 2.2.3 (Waterfront Land).
	A description of the erosion and sediment control measures that would be implemented to mitigate any impacts in accordance with <i>Managing Urban Stormwater: Soils &amp; Construction</i> (Landcom, 2004).	Section 5.3 (Erosion and Sedimentation) and Section 7 (Mitigation and Management Measures).
	Identify suitable water sources for construction and operation that do not rely on council.	Section 3.1.2 (Water Supply).

### 1.1.1 Large-scale Solar Energy Guideline

The Large-scale Solar Energy Guideline (DPIE, 2022) (Solar Energy Guideline) provides clear and consistent guidance on how to measure and assess key environmental impacts of large-scale solar energy projects in NSW, declared as SSD. Key assessment issues covered by the Solar Energy Guideline include:

- Landscape and visual impacts.
- Agricultural land use.
- Infrastructure contributions, benefit sharing and agreements.
- Waste management and circular design.
- Decommissioning and rehabilitation.
- Glint and glare.

Several other assessment issues related to water resources are also identified in Section 5.7 of the Solar Energy Guideline for careful consideration. Table 1.2 lists the considerations relevant to this assessment and where each is addressed in this report.

**TABLE 1.2: SOLAR ENERGY GUIDELINE REQUIREMENTS RELEVANT TO WATER RESOURCES**

Issue	Assessment	Section addressed in this report
Water Management	Surface water-related impacts, such as flooding, discharge/run-off and erosion, must be assessed. Appropriate mitigation measures, such as sediment controls, must be proposed where warranted.	Section 5.1.3 (Flooding). Section 5.3 (Erosion and Sedimentation). Section 7 (Mitigation and Management Measures).
	Applicants should consult with landholders regarding potential surface water related impacts of the project on neighbouring properties and any mitigation measures.	Section 5 (Surface water impact assessment). Note: no significant impacts on neighbouring properties which require consultation with adjacent landholders.
	Any assessment of surface water-related impacts must be informed by a soil survey that considers the potential for erosion.	Refer to EIS. Section 2.5 (Soils and Land Use).

	If there is any water take associated with the project, the applicant should identify the source of water (both potable and non-potable) and may need to acquire water access licences if the project is approved.	Section 3.1.2 (Water Supply). Section 2.7 (Water Regulatory Framework, including potential existing water supply).
Cumulative Impacts	Any Cumulative Impacts from any other developments (Proposed, Approved and Operative), especially biodiversity, socio-economic and construction traffic impacts must be assessed in accordance with The Department's Cumulative Impact Assessment Guidelines for State significant projects (July 2021, Or Its Latest Version).	Section 6 (Cumulative Impacts).

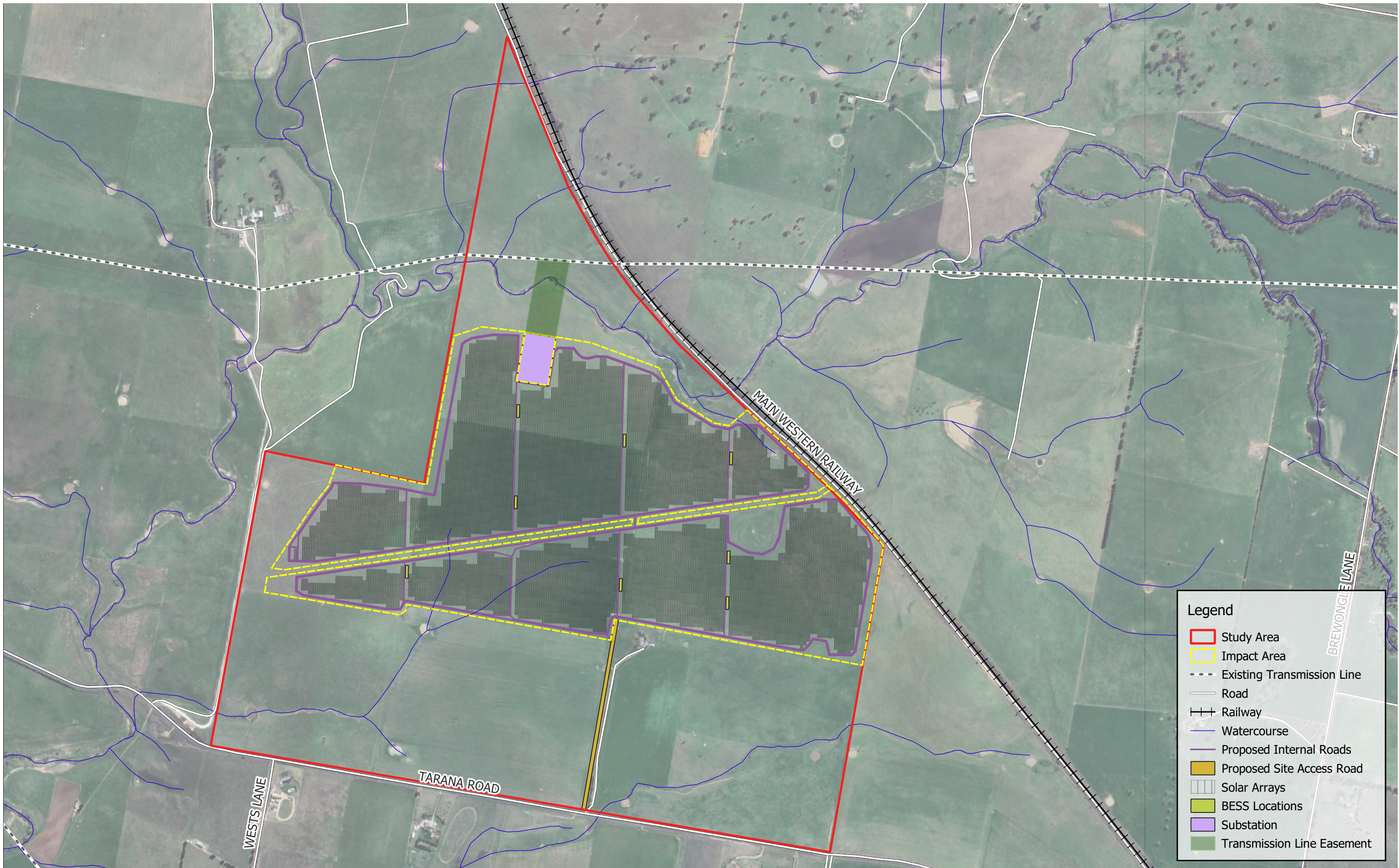
## 1.2 Project Description

The Project will occur largely within the 153 ha Impact Area as shown on Figure 1.1 and generally include construction, operation and decommissioning of a solar photovoltaic energy generating facility with an estimated capacity of 90 MW.

## 1.3 Project Terminology

TABLE 1.3: PROJECT TERMINOLOGY

Term	Definition
Project	A solar farm as described in Section 1.2 to which this Application applies.
Study Area	Lease area to which the Application applies.
Impact Area	The area in which disturbance is proposed.
Applicant	Edify Energy Pty Ltd.



**Legend**

- Study Area
- Impact Area
- Existing Transmission Line
- Road
- Railway
- Watercourse
- Proposed Internal Roads
- Proposed Site Access Road
- Solar Arrays
- BESS Locations
- Substation
- Transmission Line Easement

R	DETAILS	DATE
0	Final Issue	-

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NOTES:

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GDA 2020 / MGA Zone 55

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DATA SOURCE  
Google Maps



Brewongle Solar Farm Project

Figure 1.1: Site Overview

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## 2. BASELINE CHARACTERISTICS

### 2.1 Climate

The town of Brewongle is situated around 12 km south-east of Bathurst and 180 km to the north-west of Sydney. Brewongle is located within the Central Tablelands region, positioned on the Bathurst Granite geological unit. Brewongle experiences a cool temperate climate. Rainfall is relatively steady throughout the year, with minor seasonal fluctuations, typically seeing higher rainfall in the summer months.

Four key Bureau of Meteorology (BoM) operated rainfall stations with varying periods of record are located nearby the Study Area (refer to Table 2.1). In addition, a SILO data extraction (time series of daily data including observed and interpolated data from 1889 to present), from a point in the approximate centre of the Study Area (-33.45 latitude, 149.70 longitude), has been used to provide representative long-term rainfall and evaporation data. There is minor variation in average monthly rainfall between the nearby rainfall stations and the SILO data, indicating that the SILO dataset is suitable to be used to represent long-term rainfall data. The SILO dataset indicates average annual rainfall in the Brewongle area is approximately 650 mm.

Evaporation data obtained from the SILO database is based on using a Class A evaporation pan which indicates the amount of water evaporating from bare ground or open water. The rate of evaporation depends on factors such as cloudiness, air temperature and wind speed. The monthly average rainfall and pan evaporation within the Study Area are presented in Figure 2.1, indicating that monthly evaporation typically exceeds monthly rainfall. However, during June and July, rainfall and evaporation are relatively equal, reflecting the seasonal change into winter, with winter being typically the wetter months of the year.

**TABLE 2.1: NEARBY RAINFALL STATIONS**

Station	Approximate proximity to Study Area	Data Range
Bathurst Stanley Street (Macquarie River) (063287)	11.5 km	2000 - 2024
Bathurst Airport AWS (063291)	6.9 km	1994 - 2024
Chifley Dam (Campbells River) (063298)	11.4 km	2000 - 2024
Bathurst Agricultural (063005)	12.1 km	1908 - 2024
Study Area (SILO)	Centre of Study Area: Coordinates (-33.45, 149.70)	1889 - 2024

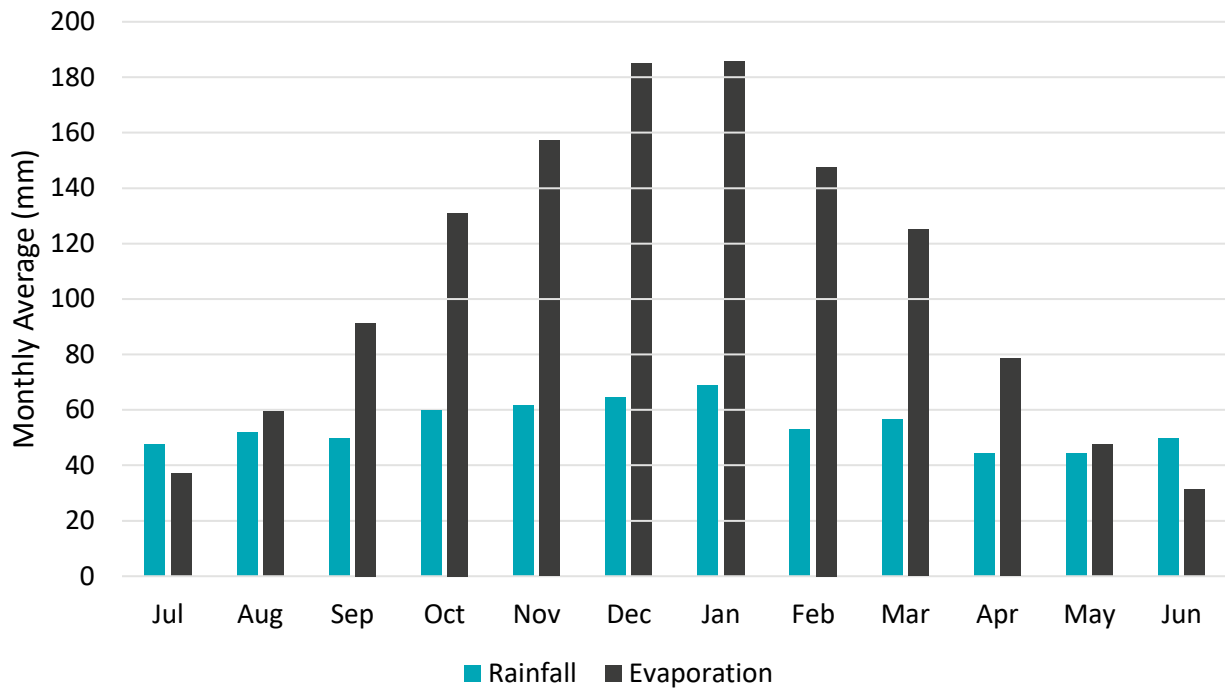


Figure 2.1: SILO Monthly Average Rainfall and Pan Evaporation within the Study Area

## 2.2 Surface Water Context

### 2.2.1 Regional Systems

The Project is located within the upper portion of the Macquarie-Bogan catchment, with an undulating landscape and numerous nearby watercourses which generally flow away from the Study Area to the Fish River, which is a major tributary of the Macquarie River.

The Brewongle area is situated near tributaries of the Fish River, with the river located around 25 km east of Bathurst. The Fish River flows through an elevation range of approximately 700 to 800 mAHD, moving through a varied landscape before flowing into the headwaters of the Macquarie River approximately 3 km downstream of the Study Area.

An overview of the Study Area and its proximity to key regional drainage features is provided in Figure 2.2.

### 2.2.2 Local Systems

The Study Area contains surface level elevations which range from approximately 690 mAHD to 735 mAHD (refer to Figure 2.3).

The local drainage systems within and surrounding the Study Area are well defined, accentuated by the undulating topography. The presence of agricultural activities appears to not majorly impacted the landform, with the undulating topography largely preserved. Existing farm dams likely influence flow regimes within and surrounding the Study Area with runoff being captured in these dams during flow events.

The topography surrounding the Study Area has several elevated landform features and existing drainage patterns defining a west flow direction, along Salt Water Creek which connects into the Fish River.

All mapped “defined” watercourses within the Impact Area have been identified from the Department of Planning and Infrastructure (DPI’s) published hydroline dataset (2018). There are minor Strahler classification watercourses that have been mapped within the Impact Area.

The *Harvestable Rights (central inland-draining catchments) Order 2022* under the *Water Management Act 2000* defines a minor stream as:

- (a) any stream or part of a stream:
  - (i) identified as a watercourse in the hydroline spatial data, and
  - (ii) that is a first or second order stream, or part of such a stream, determined in accordance with the Strahler system set out in Schedule 2 to the *Water Management (General) Regulation 2018*, and

(iii) *that does not maintain a permanent flow of water, being a visible flow which occurs on a continuous basis, or which would so occur if there were no water extractions, diversions, or obstructions of flows upstream, and*

(b) *any stream or part of a stream which is not identified as a watercourse in the hydroline spatial data.*

There are three minor unnamed 1<sup>st</sup> order watercourses mapped within the Impact Area. Two of the 1<sup>st</sup> order watercourses are located in the south of the Impact Area and flow in a southerly direction out of the Impact Area. The other 1<sup>st</sup> order watercourse is located in the north of the Impact Area and flows into Salt Water Creek (refer to Figure 2.3).

In order to define the local drainage systems, Digital Elevation Model (DEM) data for the Study Area, and the contributing upstream catchments, was compiled from the following sources, in order of priority:

- 1 m NSW LPI LiDAR, dated 2019.
- 2 m NSW LPI LiDAR, dated 2015.

### 2.2.3 Waterfront Land

Waterfront land is defined as any river, lake or estuary, and the land within 40 m of the riverbanks, lake shore, or estuary mean high-water mark (NRAR, 2020). As such, waterfront land areas are present for any watercourse or lake with a defined bed and bank and any 3<sup>rd</sup> order or above mapped hydroline. An assessment of waterfront land was undertaken using the DPI hydroline spatial data (2018) and LPI LiDAR data from ELVIS.

The DPI mapped hydrolines were assessed using the DEM, aerial photographs and site photographs, to define partial or fully defined bed and bank as well as the Strahler order. The initial assessment of the Impact Area showed three 1<sup>st</sup> order watercourses associated with the drainage channels (refer to Section 2.2.2). One of these 1<sup>st</sup> order watercourse, located in the north of the Impact Area, shows sections of defined bed and bank indicating waterfront land (refer to Figure 2.4).

For the 1<sup>st</sup> order stream in the north of the Impact Area with defined waterfront land, it is noted that the south-eastern area of waterfront land is likely due to channelisation of the drainage line as a result of overflows/spills from the upslope farm dam. This assessment is supported by historical imagery. Similarly, field observations undertaken as part of the Aquatic Ecology Assessment for the Brewongle Solar Farm (DPM Envirosciences, 2024) indicate that the surrounding land use includes vegetation clearing and light to moderated grazing, indicating that the drainage line is highly modified and not necessarily a natural drainage line. The downstream section of this 1<sup>st</sup> order drainage line that also has waterfront land appears to have a defined bed and bank likely due to an historical upstream migration of an erosion head cut from Salt Water Creek. From aerial photography it appears that this head cut is relatively stable (due to the grassland shown in recent aerial photography).

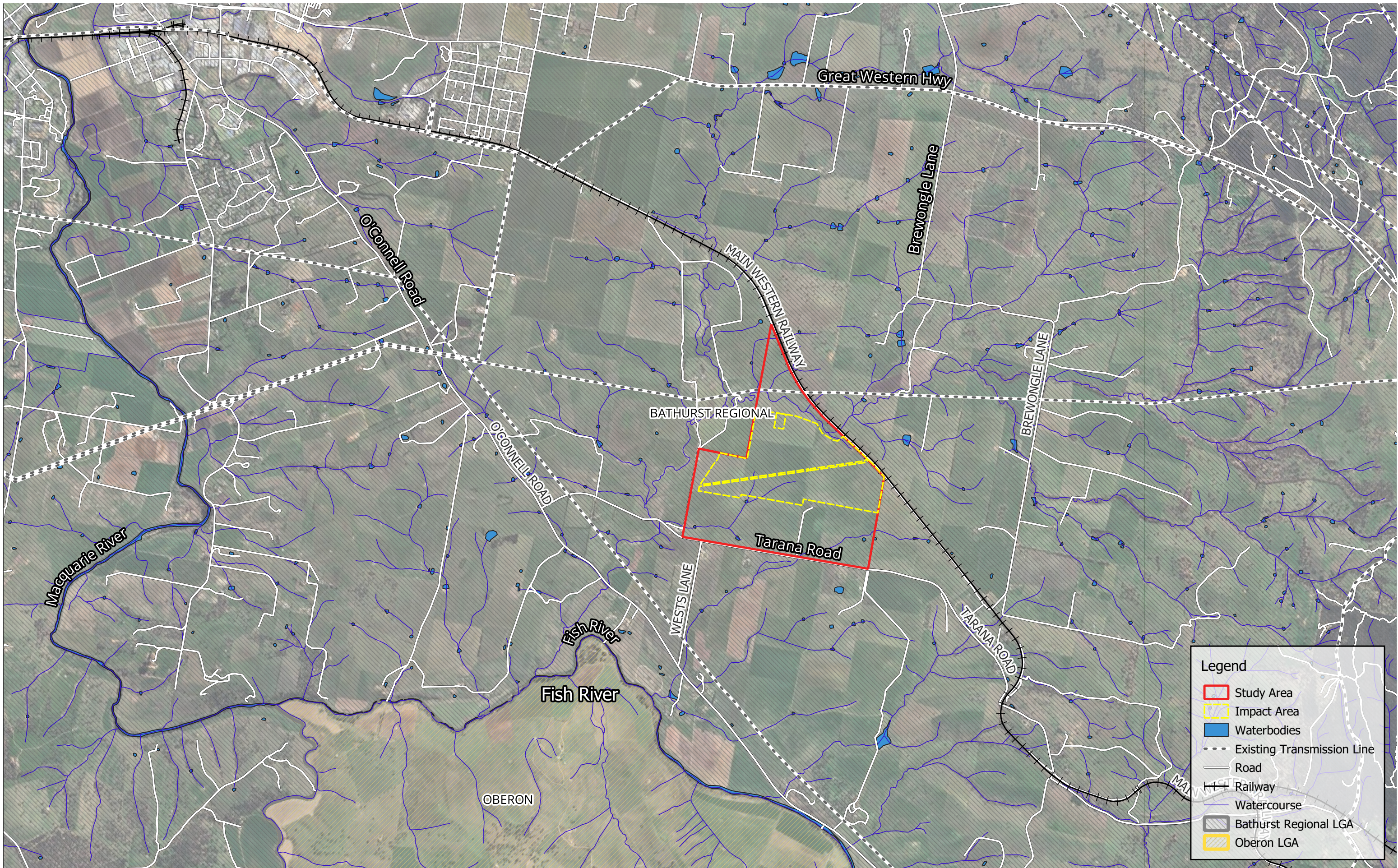
Salt Water Creek, which borders the Impact Area, within the north of the Study Area, is a 5<sup>th</sup> order watercourse and therefore is classified as having waterfront land. A section of this waterfront land is located within the Impact Area and is where proposed internal access tracks and the proposed transmission line easement are located.

The potential impacts of waterfront land on the proposed Project infrastructure are discussed in Section 5.1.2.

Although a Controlled Activity Approval will not be required for works within waterfront land as the Project is SSD, the Applicant proposes to undertake the development in accordance with:

- DPI Guidelines for Controlled Activities on Waterfront Land (2018); and (if necessary)
- Why Do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings (DPI 2003); and
- Policy & Guidelines for Fish Habitat Conservation & Management (DPI, 2013).

Additionally, a Construction Environmental Management Plan (CEMP) and Erosion and Sediment Control Plan (ESCP) will be developed post approval to manage and mitigate any potential impacts on waterfront lands.



**Legend**

- Study Area
- Impact Area
- Waterbodies
- Existing Transmission Line
- Road
- Railway
- Watercourse
- Bathurst Regional LGA
- Oberon LGA

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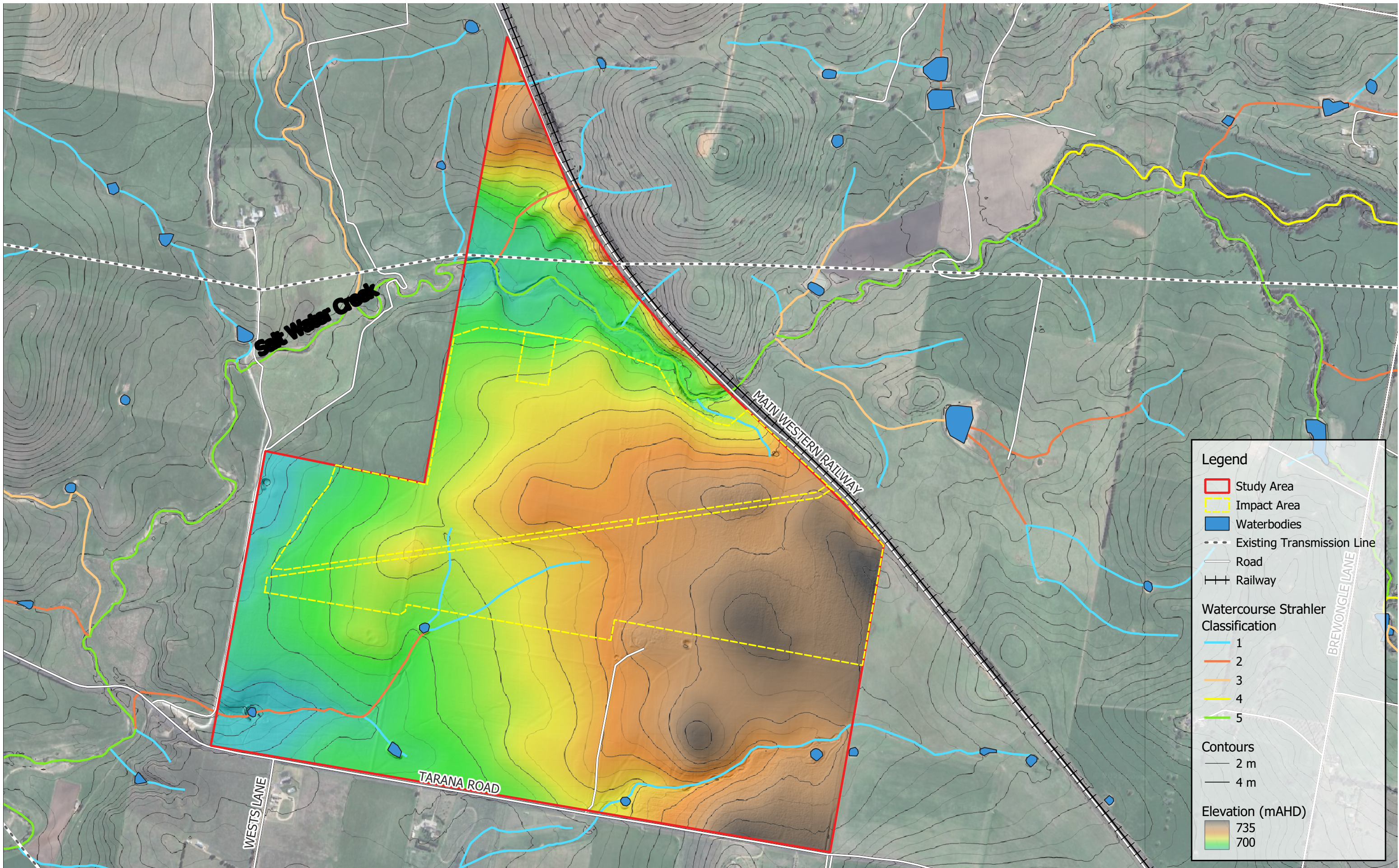
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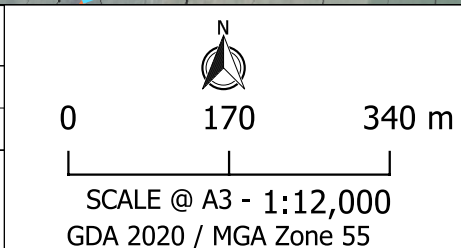
Figure 2.2: Regional Drainage Overview

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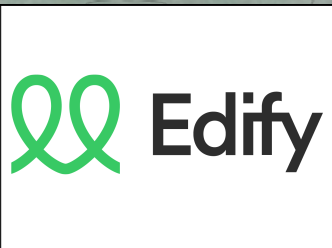


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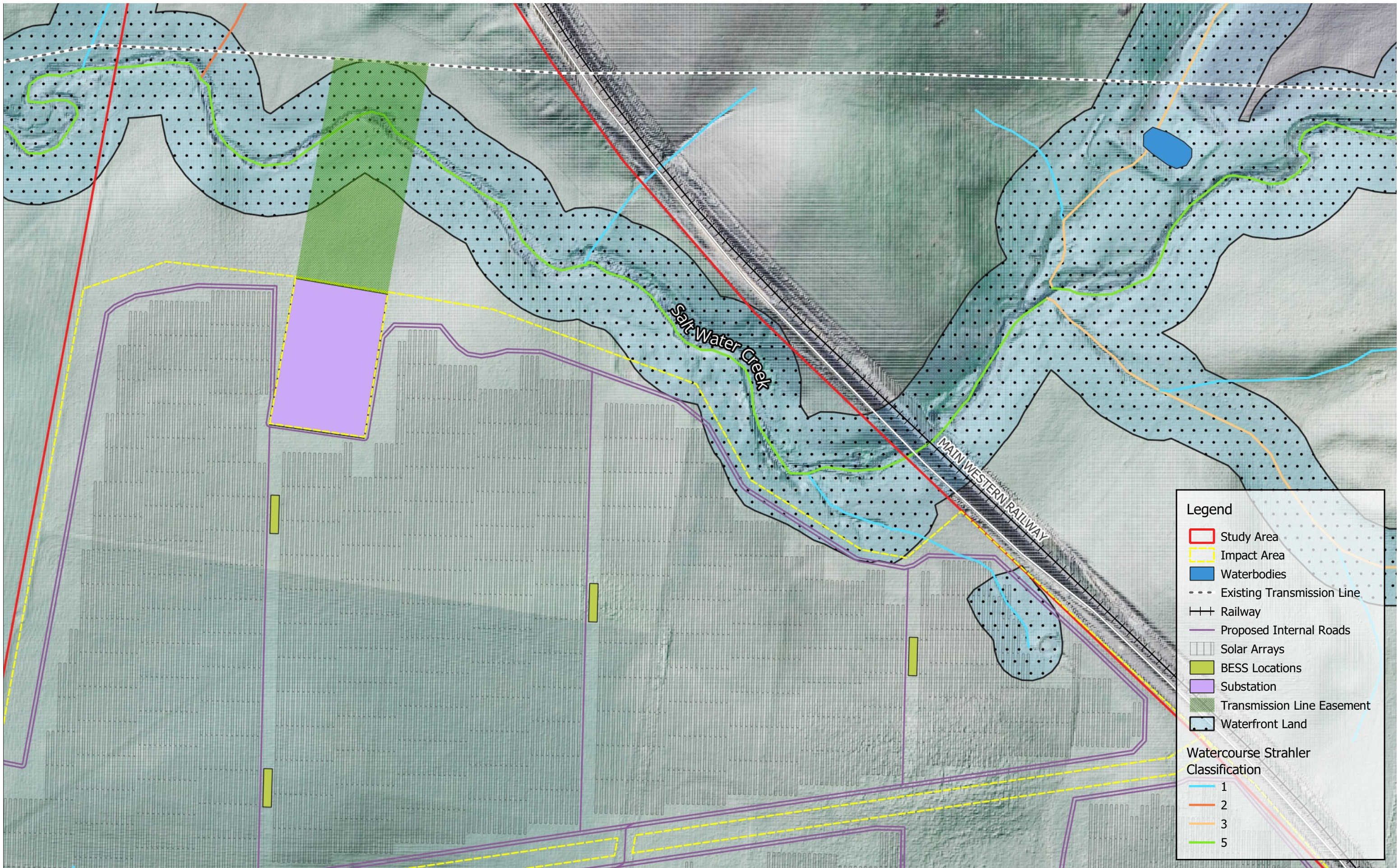
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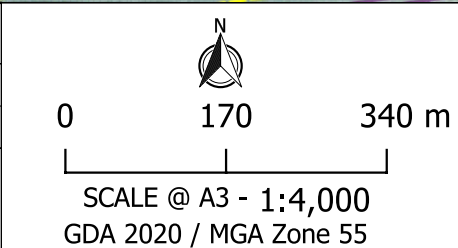


Brewongle Solar Farm Project  
Figure 2.3: Local Drainage Overview  
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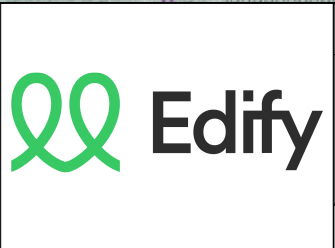


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Brewongle Solar Farm Project
Figure 2.4: Waterfront Land
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## 2.3 Flooding

### 2.3.1 Approach

An assessment of flooding regimes within the Study Area has been undertaken. The methodology is described in detail in Section 4, and included:

- Review of available nearby flood studies.
- Development of a local TUFLOW model, with runoff for the Study Area determined using a RoG approach.
- Simulation of design flood events for the 5%, 1%, 0.5% and 0.2% AEP and Probable Maximum Flood (PMF), to determine flood behaviour through the Study Area.

### 2.3.2 Existing Flood Behaviour

Detailed mapping of flood conditions including depth, velocity and hazard is provided in Appendix A for the Project baseline conditions (i.e. existing land uses). The existing flood behaviour is discussed in detail in Section 4.3 and impacts predicted to result from the Project are detailed in Section 5.1.3.

The adopted modelling approach and modelled flood behaviour are discussed in detail in Section 4. Figure 2.3 indicates that the local catchment reporting to the Study Area is typically confined to the Study Area boundary with small amounts of overland flow occurring through the Impact Area. There are a few semi-defined flow paths, in which where flood depths and velocities within the Impact Area generally remain below 0.2 m and 0.6 m/s, respectively, during the 1% AEP event. During the PMF event, flooding within the Impact Area is impacted by flood flows within the adjacent Salt Water Creek.

## 2.4 Water Quality and Flow Regimes

### 2.4.1 Water Quality and River Flow Objectives

The NSW Water Quality and River Flow Objectives (as published by the Office of Environment and Heritage (OEH)) are the agreed environmental values and long-term goals for NSW surface waters (OEH, 2006). The objectives consist of the NSW Water Quality Objectives (WQOs) and the NSW River Flow Objectives (RFOs), which aim to achieve the right water quality for different land uses and improve environmental results from managing the riverine system.

The Study Area exists within the Upper Macquarie-Bogan Catchment, and consists of areas with the following classifications:

- Town water supply sub catchments – streams in town water supply sub catchments typically feed into a town's water supply storage. In many cases, the catchment may be declared as specially protected to minimise land use effects on water quality.
- Uncontrolled streams - category covers uncontrolled waterways that are not in the other categories. Their flow patterns remain largely natural.
- Controlled rivers with reduced flows – sections of rivers immediately below major town water supply dams, where water is diverted directly from the dam (streams below Oberon, Suma Park and Winburndale dams and Bathurst town water supply offtake). This category is applicable to Fish River, directly downstream of the Study Area

The different WQOs and RFOs relevant to the project are detailed in Sections 2.4.2 and 2.4.4.

### 2.4.2 Water Quality Objectives

The NSW Water Quality Objectives (WQOs) are consistent with the agreed national framework for assessing water quality as set out in the Australian and New Zealand Guidelines (ANZG) for Fresh and Marine Water Quality (ANZG, 2000). The WQOs most applicable to the Project are associated with aquatic ecosystems and are summarised in Table 2.2.

The ANZG default guideline values for Upland rivers (>150 mAHD and <1500 mAHD) in south-east Australia provide guidance on acceptable levels (trigger values) of key water quality indicators associated with the Project.

**TABLE 2.2: RELEVANT NSW WATER QUALITY OBJECTIVES – MACQUARIE-BOGAN CATCHMENT**

Objective	Indicator	Guideline / Trigger Value	Applicability to the Project
<b>Aquatic Ecosystems -</b> <i>Maintaining or improving the ecological condition of waterbodies and their riparian zones over the long term.</i>	pH	6.5 to 8.0	Low Relevance – The most prominent watercourse within the Study Area is classified as perennial (NSW Gov).
	Total phosphorus (TP)	20 µg/L for upland rivers	
	Total nitrogen (TN)	250 µg/L for upland rivers	
	Chlorophyll-a	n/a	
	Turbidity	2 to 25 NTU	
	Salinity (electrical conductivity) (EC)	30 to 350 µS/cm	
	Dissolved oxygen (DO)	90 to 110%	

Additionally, Managing Urban Stormwater: Soils and Construction Volume 1 (the ‘Blue Book’) (Landcom, 2004), Volume 2A Installation of services (DECC, 2008) and Volume 2C Unsealed roads (DECC, 2008) provide guidance on acceptable practice in NSW to mitigate the impacts of land disturbance activities (involving changes in land uses from rural, open space or bushland settings to other forms) on soils, landforms and receiving waters by focussing on erosion and sediment control. The Blue Book provides guidance on typically accepted total suspended solids (TSS) to be < 50 mg/L.

Toxicant default guideline values for protecting aquatic ecosystems were published by ANZG in 2023. A summary of the default guideline values (DGVs) for metals/metalloids in freshwater are included in Table 2.3 for differing levels of species protection (LOSP) (%), including:

- High ecological/conservation value system – 99% species protection DGV.
- Slightly to moderately disturbed system – 95% species protection DGV.
- Highly disturbed system – 90% or 80% species protection DGV.

Field investigations undertaken for the *Aquatic Ecology Assessment – Brewongle Solar Farm* (DPM Envirosiences, 2024) indicate that the overall disturbance of the catchment is moderate, which, in accordance with the ANZG, are ecosystems in which aquatic biological diversity may have been adversely affected to a relatively small but measurable degree by human activity. For example, rural streams receiving runoff from land are disturbed to varying degrees by grazing or pastoralism. It is therefore assumed that the 95% LOSP is relevant to the Project.

**TABLE 2.3: TOXICANT DEFAULT GUIDELINE VALUES**

Toxicant name	Tox LOSP 95	Tox LOSP Unit
Aluminium (pH >6.5)	55	µg/L
Arsenic (AsIII)	24	µg/L
Arsenic (AsV)	13	µg/L
Boron	940	µg/L
Cadmium	0.2	µg/L
Chromium (CrVI)	1	µg/L
Copper	1.4	µg/L
Lead	3.4	µg/L

Toxicant name	Tox LOSP 95	Tox LOSP Unit
Manganese	1900	µg/L
Mercury (inorganic)	0.6	µg/L
Nickel	11	µg/L
Selenium (total)	11	µg/L
Silver	0.05	µg/L
Zinc	8	µg/L

## 2.4.3 Background Surface Water Quality

### 2.4.3.1 Local Surface Water Quality

In-situ measurements and water quality sampling were undertaken at six aquatic habitat assessment sites as part of the *Aquatic Ecology Assessment – Brewongle Solar Farm* (DPM Envirosiences, 2024). When compared to the WQOs in Table 2.2, the results indicate that:

- Two out of six results exceed the WQO for pH.
- Four out of six results exceed the WQO for EC.
- Five out of six results are outside of the WQO range or DO.
- Two out of six results exceed the WQO for turbidity.

The above is indicative of the moderately disturbed system.

### 2.4.3.2 Regional Surface Water Quality

The State of Catchments (SOC) 2010 Riverine Ecosystems reports developed by the Department of Environment, Climate Change and Water NSW (DECCW NSW) in 2010 provide a holistic water quality report for the 84,000 km<sup>2</sup> Murrumbidgee Catchment, assessing the water quality condition and trend. The SOCs for the Murrumbidgee and Murray regions have been reviewed to provide an understanding of existing surface water quality surrounding the Project (DCCEEWSW, 2010). It is acknowledged that the information provided in the SOC may be outdated, however, provides an indication of historical surface water quality in the region. A site-specific water quality assessment for the Project was undertaken as part of the *Aquatic Ecology Assessment – Brewongle Solar Farm* (DPM Envirosiences, 2024).

The SOCs describe water quality condition as the percentage of samples exceeding the ANZECC / ANZG water quality guidelines for turbidity and total phosphorus. Additionally, fish, macroinvertebrates, and hydrology are used to indicate water quality condition, and trend based on the Sustainable Rivers Audit (SRA).

Water quality findings relevant to the Study Area within the Macquarie River catchment were recorded in the Fish River Upstream of the Tarana Road Bridge, downstream of the Study Area.

A summary of the guideline values for phosphorus and turbidity for upland rivers (>150 mAHD and <1500 mAHD) and results from the SOCs are summarised in Table 2.4.

**TABLE 2.4: STATEMENT OF CATCHMENTS (2010) WATER QUALITY RESULTS**

Location	Catchment	Total Phosphorus Guideline Value (mg/L)	Percentage of Results Exceeding Guideline Value (%)	Turbidity Guideline Value (NTU)	Percentage of Results Exceeding Guideline Value (%)
Fish River	Macquarie	0.02	75%	25	0%

Further, the waterway health was characterised by data recorded for aquatic biota including fish and macroinvertebrates. Macroinvertebrate data indicates that the Study Area is in a poor to moderate condition, however fish data suggests it to contain extremely poor conditions due to low nativeness of the fish species within this area.

## 2.4.4 River Flow Objectives

The River Flow Objectives (RFOs) associated with surface water and their relevance to the Project are summarised in in Table 2.5.

**TABLE 2.5: RELEVANT NSW RIVER FLOW OBJECTIVES – MACQUARIE BOGAN CATCHMENT**

Objective	Description	Measures to achieve objective	Applicability to the Project
<b>Protect pools in dry times</b> - <i>Protect natural water levels in pools of creeks and rivers and wetlands during periods of no flows</i>	During dry times, some streams stop flowing and form pools. Pools and wetlands are refuges for aquatic plants and animals. Pumping water from these areas can make it more difficult for many species to recover after a drought.	<ul style="list-style-type: none"> <li>• There should be no water extraction from streams or wetlands in periods of no flow.</li> <li>• If conditions on water licences do not provide for this objective to be met, priority should be given to implementing it by actions appropriate to local circumstances.</li> </ul>	Moderate Relevance – Pools are likely to occur during flood conditions.
<b>Protect natural low flows</b> - <i>Protect natural low flows</i>	Water extraction and storage are high in dry times and impose long artificial droughts that increase the stress on aquatic plants and animals.	<ul style="list-style-type: none"> <li>• Share low flows between the environment and water users and fully protect all very low natural flows. <ul style="list-style-type: none"> <li>– Very low flows: flows below the level naturally exceeded on 95% of all days with flow.</li> <li>– Low flows: flows below the level naturally exceeded on 80% of all days with flow.</li> </ul> </li> <li>• Unless environmental, social and economic evaluations give an appropriate alternative, the following limits on water extraction apply: <ul style="list-style-type: none"> <li>– Environmental share in high-conservation-value streams: to be all very low flows and most of the low flows. There should be no increase in extraction of low flows.</li> <li>– Environmental share in other streams: all very low flows and 50-70% of daily low levels.</li> </ul> </li> <li>• New or transferred licences should not allow extraction during low flows below the 80th percentile.</li> <li>• In streams with little water use or important conservation values, minimise risks to ecosystems during low flows.</li> <li>• Review management of town water supplies to assess whether changes may help achieve the objective without significantly affecting reliability.</li> </ul>	High Relevance – The Project has potential to impact surface water flows in downstream watercourses, which are typically already classified as ephemeral (dry in periods).

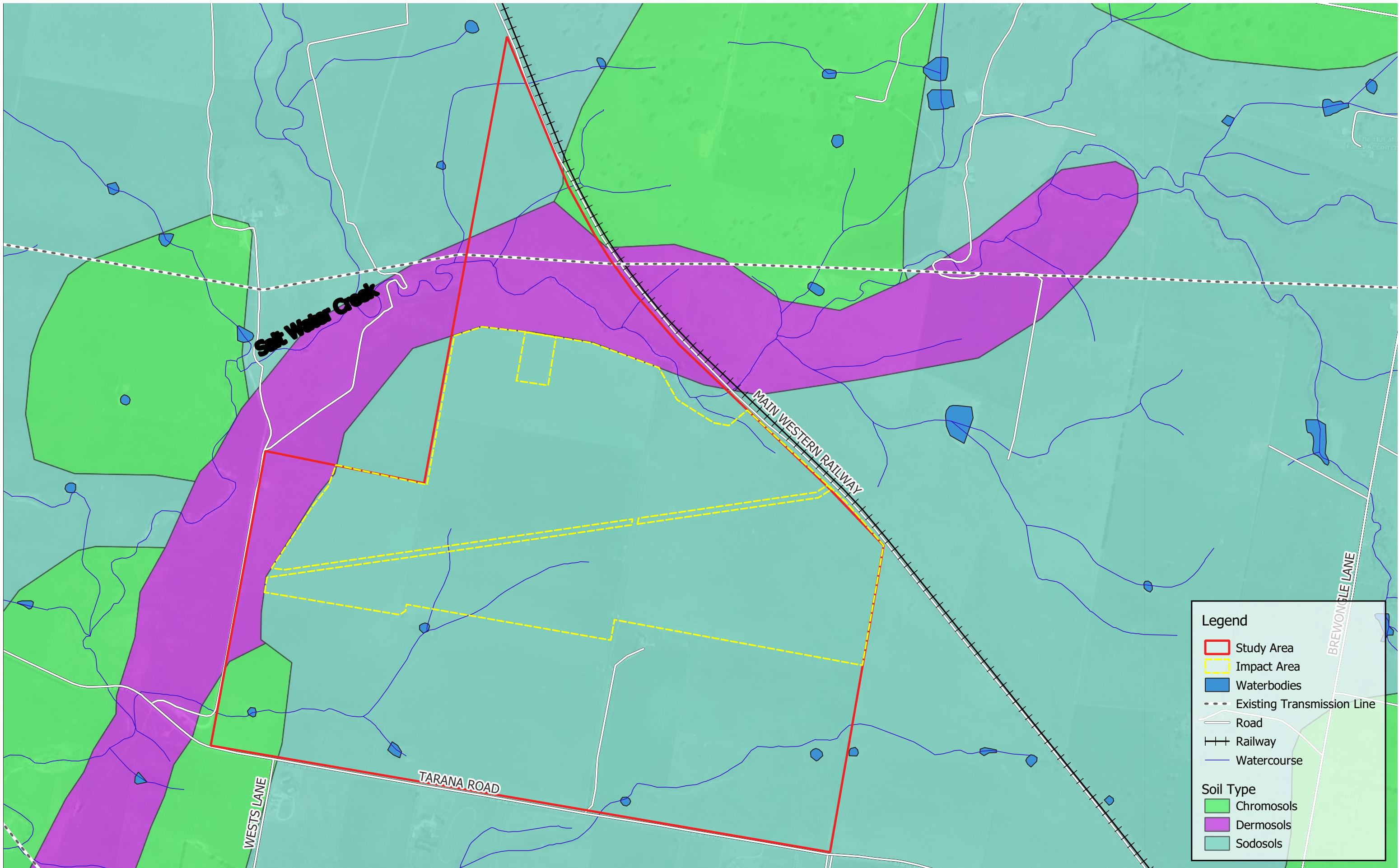
Objective	Description	Measures to achieve objective	Applicability to the Project
<p><b>Minimise effects of weirs and other structures –</b> <i>Minimise the impact of instream structures</i></p>	<p>Most instream structures (e.g. weirs) convert flowing water to still water, thus altering habitat and increasing the risk of algal blooms or other water quality problems. Barriers prevent passage of plant propagules (e.g. seeds) and animals.</p>	<ul style="list-style-type: none"> <li>• Implement the NSW Weirs Policy (DLWC 1997b).</li> <li>• Identify and take action to improve fish passage on other structures that impede the two-way movement of native fish along streams or natural high-flow channels.</li> </ul>	<p>Moderate Relevance - The Study Area does not contain any major watercourses. Where watercourse crossings area required, instream works will involve minimum disturbance.</p>
<p><b>Maintain natural flow variability -</b> <i>Maintain or mimic natural flow variability in all streams</i></p>	<p>Australia's rainfall and river flows are naturally variable. The way we currently store and divert river water can reduce natural pulsing of water down rivers and maintain artificially high or stable river heights. Hydro-electric releases can vary unnaturally between day and night. In urban areas and other places where the ability of the land to absorb or detain rainfall is reduced, more water runs off rapidly, so water levels will rise higher. These changes often create problems with streambank stability, biodiversity and signals for breeding and migration.</p>	<ul style="list-style-type: none"> <li>• Identify streams with unnatural flow variability and develop actions to mimic natural variability.</li> <li>• Identify streams with potential for flow variability problems and take early action.</li> </ul>	<p>High Relevance - The Project has potential to impact surface water flows in downstream watercourses, which are typically classified as ephemeral (dry in periods).</p>
<p><b>Mimic natural drying in temporary waterways</b> <i>Mimic the natural frequency, duration and seasonal nature of drying periods in naturally temporary waterways</i></p>	<p>Continuous or seasonal water releases from water storages can mean streams and wetlands can sometimes be 'wetter' than natural. In streams and wetlands that naturally dry out, this can create problems in maintaining habitat, vegetation, nutrient cycling and signals for breeding. It can also lead to a high water table and associated salinity problems. Natural wetting and drying cycles produce diversity of habitat and, therefore, high species diversity.</p>	<ul style="list-style-type: none"> <li>• Identify any creeks or unregulated rivers where unnatural flows have greatly reduced drying periods. Assess potential short- and long-term environmental, economic and social effects of this change and of possible management alternatives.</li> <li>• Decide what, if any, action is appropriate to implement this objective in streams and wetlands should be worked out on a case-by-case basis after giving due consideration to local views. Where relevant, agreements under land and water management plans should be respected, but this objective should be taken into account, along with WQOs, social objectives and economic objectives, in resolving outstanding or new management issues for drainage water.</li> </ul>	<p>High Relevance - The Project has potential to impact surface water flows in downstream watercourses, which are typically classified as ephemeral (dry in periods).</p>

Objective	Description	Measures to achieve objective	Applicability to the Project
<p><b>Protect important rises in water levels</b></p> <p><i>Protect or restore a proportion of moderate flows ('freshes') and high flows</i></p>	<p>Rain causes peaks in river flows. This 'pulsing' of flows, including their duration, may trigger migration of animals and reproduction of plants and animals; provide over-bank flows to wetlands and floodplains; shape the river channel; and control water quality and nutrients. Water storage and extraction can alter or remove freshes, inhibiting these vital processes. The height, duration, season and frequency of higher flow events are all important.</p>	<ul style="list-style-type: none"> <li>• Unless local information shows appropriate alternative targets, the following limits on extraction are recommended for use by RMCs: <ul style="list-style-type: none"> <li>– No extraction of more than 30-50% of moderate to high flows on a daily basis. (This means that, for each stream, the WSP may recommend an appropriate limit on the proportion of flows that may be extracted whenever flows are greater than the level that would naturally be exceeded on 80% of all days with flow. For some streams this limit may be 30%; for other streams it may be as high as 50%).</li> </ul> </li> <li>• No increase in extractions in high-conservation streams.</li> <li>• Where use exceeds the above limit, appropriate ways of limiting the volume or controlling the timing of extraction are needed.</li> </ul>	<p>Moderate Relevance – The Project may be required to rely on surface water extraction to meet construction demands, potentially impacting the natural levels.</p>
<p><b>Maintain wetland and floodplain inundation</b></p> <p><i>Maintain or restore the natural inundation patterns and distribution of flood waters supporting natural wetland and floodplain ecosystems</i></p>	<p>Floodplain and wetland ecosystems develop in response to flow patterns and the landscape between the river and wetlands or floodplains. Floodplain works can change the flooding patterns, which will lead to changes in habitat and vegetation. These changes can be expected to result in reduced or different species diversity and abundance, particularly reduced numbers of native fish, and water quality problems.</p>	<ul style="list-style-type: none"> <li>• WSPs and actions need to include strategies to: <ul style="list-style-type: none"> <li>– Maintain, restore or mimic natural inundation and drying patterns in natural and semi-natural wetlands and remaining native floodplain ecosystems.</li> <li>– Ensure adequate access for native fish to and from floodplain wetlands.</li> </ul> </li> <li>• Flooding patterns should not be altered without proper environmental assessment.</li> </ul>	<p>Moderate Relevance – The Project has potential to impact surface water flows in downstream watercourses / floodplain areas.</p>

## 2.5 Soils and Land Use

The soil types (in accordance with the Australian Soil Classification) within the Study Area are Sodosols, with larger areas of Chromosols and Dermosols occurring along Salt Water Creek just outside of the Study Area (Figure 2.5). Sodosols, which represent the soil type within the Study Area, have poor initial infiltration which usually causes increased runoff and likely leads to erosion. They also generally have low nutrient status due to high salinity.

The Study Area consists of privately owned farmland, zoned for Primary Production (RU1) in the Bathurst Regional Local Environmental Plan (LEP) 2014. It is understood that this area has historically been used for agricultural purposes, including grazing and cropping. The Study Area and surrounding landscape is predominately cleared land, with minimal vegetation remaining, which facilitates ongoing agricultural operations.

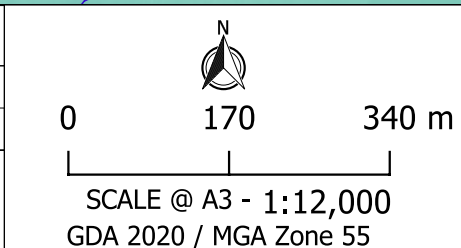


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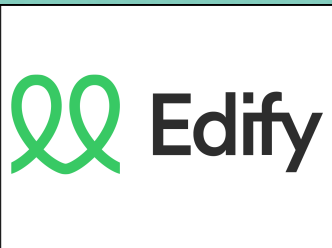
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Figure 2.5: Soil Classification

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## 2.6 Published Studies

The Study Area is located within the central west region of the Murray-Darling Basin, within the upper Macquarie River Catchment. The Study Area is located within the Bathurst Regional Council LGA (refer to Figure 2.2). The Study Area is not identified as flood prone land within the Bathurst Regional Local Environmental Plan (LEP) 2014, however, lies entirely within the mapped Drinking Water Catchment.

TABLE 2.6: PUBLISHED STUDIES

Source	Dataset(s)	Applicability
Bathurst Regional Local Environment Plan 2014	Flood Planning Map Drinking Water Catchment (DWC)	No interaction with Study Area Entire Study Area lies within the DWC

## 2.7 Water Regulatory Framework

### 2.7.1 Commonwealth Water Licensing and Approvals

The *Commonwealth Water Act 2007* was developed to manage the Murray-Darling Basin water resources in the national interest in a way that will optimise economic, social and environmental outcomes. The Murray-Darling Basin Authority (MDBA) is established by the *Water Act 2007* to prepare and implement the Commonwealth Basin Plan 2012 (the Basin Plan).

The Basin Plan sets sustainable diversion limits for the Basin as a whole and for each individual water management area, sets water trading rules, and contains an Environmental Watering Plan and a Water Quality and Salinity Management Plan. The Basin Plan covers 1,000,000 km<sup>2</sup> across NSW, Queensland, Victoria and the Australia Capital Territory. The Basin Plan has the following key elements, which are to be managed under Water Resource Plans (WRPs):

- Water limits for consumption – managed by setting sustainable diversion limits, and WRPs.
- Water for the environment – environmental water and recovery of water from communities, industries and irrigators to sustain the natural ecosystems of the Murray-Darling Basin.
- Infrastructure development, operation and maintenance – relating to dams, barrages and weirs to regulate water flows and deliver water to communities, irrigators and the environment.
- Managing groundwater – to preserve and improve water quality.
- Maintaining water quality to be suitable for drinking, agriculture, recreation and the environment.
- Water markets and trade – via WRPs.
- Monitoring and enforcing compliance, via the Inspector-General of Water Compliance.
- Monitoring and evaluating the effectiveness of water management, via annual and 5 yearly cycles.

### 2.7.2 Water Resource and Water Sharing Plans

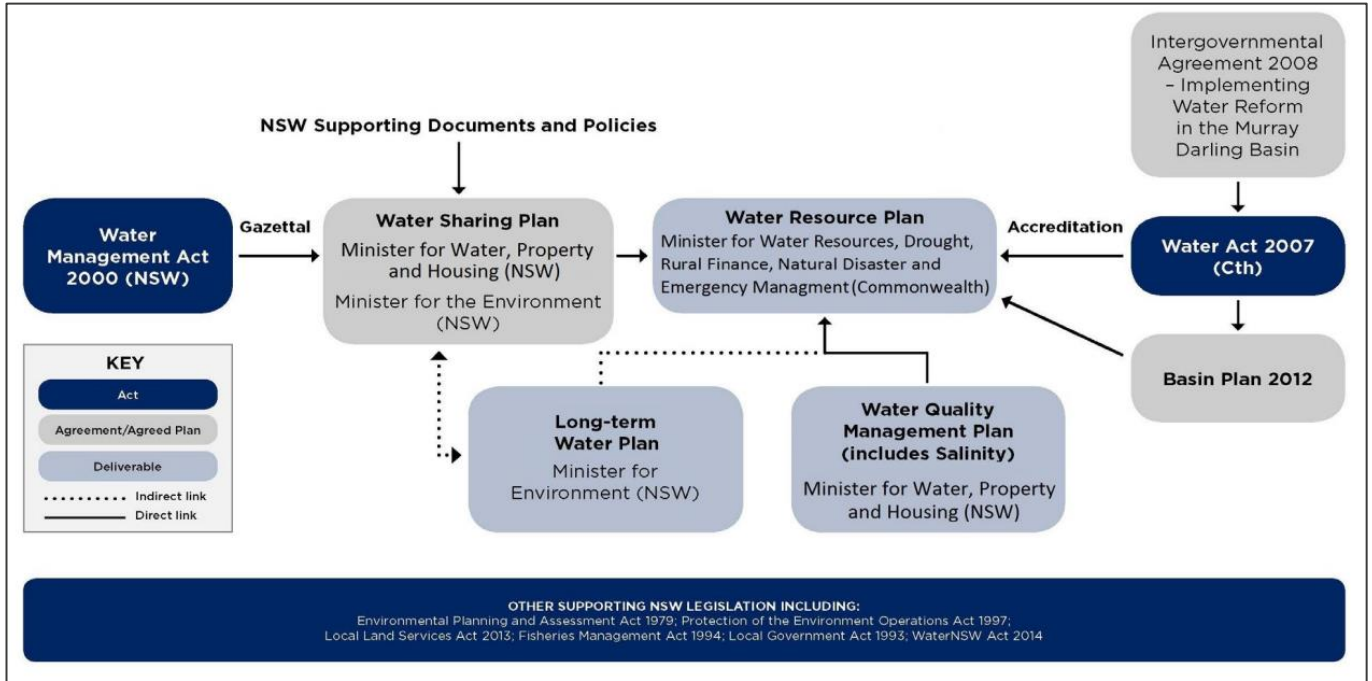
WRPs are a key requirement of the Basin Plan, indicating limits on water take, water for the environment, and how to meet water quality standards. The WRPs rely heavily on the NSW water sharing plans (WSPs), the plans provide a clear framework and ruleset for managing NSW Basin water resources. The objectives of WRPs and the relationship with the Basin Plan are outlined below and in Figure 2.6.

#### **Overarching Objectives**

- *To give effect to relevant international agreements through the integrated management of Basin water resources.*
- *To establish a sustainable and long-term adaptive management framework for the Basin water resources, that takes into account the broader management of natural resources in the Murray-Darling Basin.*
- *To optimise social, economic and environmental outcomes arising from the use of the Basin water resources in the national interest*
- *To improve water security for all uses of Basin water resources.*

**Outcomes**

- Communities with sufficient and reliable water supplies that are fit for a range of intended purposes, including domestic, recreational and cultural use.
- Productive and resilient water-dependent industries, and communities with confidence in their long-term future.
- Healthy and resilient ecosystems with rivers and creeks regularly connected to their floodplains and, ultimately, the ocean.



**FIGURE 2.6: RELATIONSHIP BETWEEN BASIN PLAN, WRP, AND OTHER INSTRUMENTS**

Source: NSW Murray and Lower Darling Surface Water Resource Plan (2024)

The Water Resource and Water Sharing Plans applicable to the Study Area are summarised in Table 2.7.

**TABLE 2.7: APPLICABLE PLAN AREAS**

<b>Water Resource Plans</b>	
Surface water resource plan area	Macquarie – Castlereagh
Surface water sustainable diversion limit area	Macquarie – Castlereagh
Water quality zone	Lowland – Castlereagh, Lachlan, Macquarie and Murrumbidgee
<b>Water Sharing Plans</b>	
Surface water sharing plan	Macquarie Bogan Unregulated Rivers Water Source 2012
Surface water source	Fish River Water Source

### 2.7.3 Water Take for Consumptive Use

As part of the Basin Plan, Basin-wide limits have been set on the amount of groundwater that can be taken from the Basin. These limits are called sustainable diversion limits (SDLs). The SDLs are managed as part of the WRPs. SDLs are determined by the NSW WSP available water determinations (AWD) process. An AWD is an NSW ministerial order issued to allocate water to the accounts of licence holders. AWDs are made on 1 July each year (beginning of the water year) and as necessary then throughout the year.

### 2.7.4 Existing Local Water Sources

The Study Area is zoned as RU1 – Primary Production under the Bathurst Local Environmental Plan (LEP) 2014, historically used for agricultural purposes that is supported by existing water infrastructure and irrigation systems.

The landholdings within the Study Area do not hold any current water access licences (WALs). However, harvestable rights dams exist within the Study Area and support the existing land use activities (refer to Section 2.7.6).

### 2.7.5 NSW Water Licensing and Approvals

The NSW state government controls the use and flow of all water in rivers, lakes, and aquifers. Some landholders can take water without a licence, this is known as basic land holder rights (refer to Section 2.7.6). You may need a water access licence, or a water supply work and/or water use approval to take water from a river, lake or aquifer (refer to Section 2.7.7). Approvals can also be required for flood works that are likely to have an effect on the flow of water (refer to Section 2.7.8), and works within waterfront land (refer to Section 2.7.9).

The *Water Management Act 2000* applies to all regions where there is a WSP in operation.

The following sections discuss:

- Basic landholder rights, including the maximum harvestable right for the Applicant and associated land holdings.
- Water Access Licences, Water Use Approvals, and Water Supply Works, including those currently held by the Applicant and associated land holdings.
- Requirements for Flood Works and Controlled Activity Approvals, including what applies to the Brewongle Solar Farm Project.

### 2.7.6 Basic Landholder Rights

There are three types of basic landholder rights (BLR) in NSW (*Water Management Act 2000*):

- Domestic and stock rights – allows take and use of water for domestic consumption and non-intensive stock watering without the need for a water access license (WAL) or water use approval. A water supply work approval (i.e. for a bore or dam, etc) is required.
- Harvestable rights – allows landholders to capture and store a proportion of the rainfall-runoff from their landholding in one or more harvestable rights dams, without requiring a WAL, water use approval, or water supply work approval.
- Native title rights- allows take and use of water in the exercise of native title rights (under the *Commonwealth Native Title Act 1993*), without requiring a WAL, water use approval, or water supply work approval (unless the work is a dam or bore).

#### 2.7.6.1 Harvestable Rights

Harvestable Rights provisions for the capture and reuse of surface water runoff generated within a property is subject to the following rules:

- (1) Landholdings (owned and leased) must be contiguous (generally omits public roads and easements).
- (2) Harvestable rights cannot be transferred between water sources – i.e. water captured within a water source must be covered by a harvestable right (or licence) in that source.
- (3) Water captured (in dams, mining pits, etc) from higher order (3<sup>rd</sup> order and above) watercourses and above (or within 40 m (measured perpendicular), or on any floodplain, or on or within 3 km upstream of any Ramsar wetland, must be covered by a WAL, regardless of the Harvestable Right, unless exempt from licensing (refer to Section 2.7.7).

Harvestable rights dams do not require a WAL, water use approval or water supply work approval.

However, if a harvestable rights dam also stores and/or captures water taken under another right or licence this dam is known as a Mixed-rights dam. Mixed-rights dams may require a WAL and water supply work approval prior to construction.

## 2.7.6.2 Maximum Capacity of Harvestable Rights Dams – Method of Calculation

WaterNSW provides a tool to estimate harvestable rights, based on location and property area<sup>1</sup>. This method uses a simple average annual unit runoff rate. The volume of water a landholder can capture and store under harvestable rights is expressed as the maximum harvestable right dam capacity for a landholding. The combined volume of all dams (or parts thereof) that capture and store harvestable rights water cannot exceed the maximum dam capacity.

There are three different harvestable rights orders applying to three different regions in NSW. These are:

- Coastal-draining catchments (May 2022).
- Central inland-draining catchments (May 2022).
- Western division order (March 2006).

The method is outlined below (refer to Section 2.7.6.2.1), with the following outcomes:

- Brewongle Solar Farm Project lies within Central inland-draining catchments.
- 299 ha of contiguous landholdings (by associated landowners) in one contiguous area (covered by the Study Area).
- Maximum capacity of harvestable rights dams is **20.93 ML**. (Source: <https://www.waternsw.com.au/customer-services/water-licensing/maximum-harvestable-rights-calculator>).

### 2.7.6.2.1 Central-inland draining catchments

To calculate the maximum capacity of harvestable rights on a landholding the method outlined in Schedule 1 of the Harvestable Rights (central inland-draining catchments) Order 2022 dated 12 May 2022 should be used. This method is summarised, as follows:

- (1) Identify the total size of the landholding in hectares (being only that part within the harvestable rights area).
- (2) Identify the area (in hectares) of the landholding from which water is captured, taken or otherwise impounded by means of an excluded work or works specified in clauses 1-4 in Schedule 1 to the Water Management (General) Regulation 2018.
- (3) Calculate the capacity for a harvestable rights dam or dams which represents up to 10% of the average annual regional rainfall runoff on the landholding – multiply (1) by the harvestable rights multiplier (Type 1).

## 2.7.7 Water Access Licences, Water Use Approvals, and Water Supply Works

### 2.7.7.1 Water Access License (WALs)

In water sharing plan (WSP) areas, a WAL authorises the holder of the WAL to take water from a water source.

There are a number of exemptions for WALs specified in the *Water Management (General) Regulation 2018*. Exemption categories include landholders, public authorities, and general exemptions.

There are three types of WALs:

- Zero share licence.
- Specific purpose access licence.
- Controlled allocation licence.

The Applicant currently hold no WALs.

A summary of the WALs issued for the water sources in which the Project lies is included in Table 2.8 (surface water) and Table 2.9 (groundwater).

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<sup>1</sup> [www.waternsw.com.au/customer-service/water-licensing/blr/harvestable-rights-dams/maximum-harvestable-right-calculator](https://www.waternsw.com.au/customer-service/water-licensing/blr/harvestable-rights-dams/maximum-harvestable-right-calculator)

**TABLE 2.8: FISH RIVER WATER SOURCE – TOTAL WALs 2024/2025**

Access Licence Category	No. of WAL(s)	Total Share Component	Total IDEC (Daily flow shares)	Cumulative AWD	Usage YTD (ML)
Domestic and Stock	6	30	N/A	1	0
Domestic and Stock [Town Water Supply]	1	15	N/A	1	0
Major Utility	1	15,876	N/A	1	0
Unregulated River	44	2,12.5	N/A	1	0

**TABLE 2.9: LACHLAN FOLD BELT MDB GROUNDWATER SOURCE – TOTAL WALs 2024/2025**

Access Licence Category	No. of WAL(s)	Total Share Component	Cumulative AWD	Usage YTD (ML)
Aquifer	1,067	74,174.7	1	278.2
Aquifer (General Security)	1	0	1	0
Aquifer [Town water supply]	6	467.35	1	0
Local Water Utility	36	3,370.5	1	9.4
Local Water Utility [Domestic and Commercial]	2	65	1	0
Salinity and Water Table Management	1	236	1	0

### 2.7.7.2 Water Supply Work and/or Use Approvals

Water supply work and/or water use approvals allow you to use water from a river, lake, or groundwater source, and to construct infrastructure to do this.

A water supply work approval allows construction and use of works to take water (e.g. pumps, bores, dams, dewatering, etc).

A water supply use approval allows use of water for a particular purpose (e.g. irrigation, power generation, mining, etc).

A water use approval allows you to use water on your land. Examples of water uses that require approval are irrigation, town water supply, power generation and mining.

A summary of all water supply work and use approvals applicable to the Study Area is included in Table 2.10.

**TABLE 2.10: WATER SUPPLY WORK AND USE APPROVALS APPLICABLE TO THE STUDY AREA**

Basic Rights	Extraction Works GW (Bore)	80WA710734	Lachlan Fold Belt MDB Groundwater Source	Lot 2, DP 1236901
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### 2.7.8 Flood Works Approval

Flood work approvals allow proponents to construct and use a work that is situated in or near a river, estuary or lake, or within a floodplain, and is likely to have an effect on the flow of water to or from a river, estuary or lake, or the distribution or flow of floodwater.

WaterNSW issues flood work approvals for private rural landholders and rural industries, whereas DPE Water issues flood work approvals for government agencies, including Councils.

Major projects which are SSD or state significant infrastructure are exempt from flood work approvals.

## 2.7.9 Controlled Activity Approval

Controlled activities refer to work or action done on waterfront land, as defined by the *Water Management Act 2000*. These activities must be designed in a way to protect our waterways and ensure minimal harm as a result of the work carried out on the land, and include:

- Waterfront land includes the bed of rivers, lakes, or estuaries, as well as land on each side within 40 m of a riverbank.
- That is within 40 m of the high bank of all watercourses with defined bed and banks as well as  $\geq$ 3rd order DPI mapped hydrolines.

It should be noted that although the Project interacts with three areas of defined waterfront lands, only one of these areas is considered to be a natural watercourse (i.e., Salt Water Creek). The two areas of defined waterfront land on the 1<sup>st</sup> order unnamed drainage line in the north of the Study Area are considered to be a result of historical erosion due to human/farming activities (refer to Section 2.2.3).

Controlled activities may include:

- Erecting a building.
- Carrying out works: including the construction of bridges, roads, control measures, sea walls, and more.
- Removing material from waterfront land: including plants, rocks, sand, gravel and more.
- Depositing material on waterfront land: including gravel or fill.
- Any activity which affects the quantity or flow of water in a water source.

Although SSD projects are exempt from requiring Controlled Activity Approvals, where the Project involves a controlled activity, assessment and design will be in accordance with:

- DPI Guidelines for Controlled Activities on Waterfront Land (2018); and (if necessary)
- Why Do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings (DPI 2003); and
- Policy & Guidelines for Fish Habitat Conservation & Management (DPI, 2013).

# 3. PROPOSED WATER MANAGEMENT

## 3.1 Water Balance

Water supply will be required during the Project construction phase, including for:

- Dust Suppression.
- Concrete Works for construction of infrastructure hardstand areas (including batching and construction).
- Road Construction and Compaction.
- Vehicle Equipment Washdown.
- Potable Water for site amenities.

### 3.1.1 Water Demands

Water demand will vary, depending on the stages of construction. The total water demand during construction, presented in Table 3.1, has been estimated based on the current Project layout, as described in Section 1.2. Post-construction water demands will be negligible, primarily consisting of occasional cleaning and potable water demands. A detailed breakdown of the assumption adopted in the water demand estimation is included in Appendix C.

**TABLE 3.1: SITE WATER DEMANDS SUMMARY**

Demand	Demand (ML)
Construction of Hardstands (BESS)	0.2
Road Construction / Compaction	9.5
Dust Suppression	4.4
Vehicle and Equipment Washdown	4.7
Potable Water	2.9
<b>Total Construction Demand</b>	<b>21.7</b>

The construction water demands are based on the workforce breakdown available at the time of this assessment, which includes a peak workforce of up to approximately 200 full time employees during installation of the solar panels and BESS. During operation, approximately 5 full time employees will be required.

The peak raw water (non-potable) demand is expected to occur during site set up, due to road construction and compaction. This is anticipated to occur between months 3 and 7. The peak potable water demand is expected to occur during installation of the solar panels and BESS when workforce is at 200 FTE, between months 8 and 10. This results in the following maximum demand rates:

- Maximum daily non-potable construction demand = 75 kL/d
- Maximum daily potable construction demand = 10 kL/d
- Maximum daily operational demand = 0.3 kL/d (potable water for employees only)

The provided water demand volumes and rates are estimates based on the information available at the time this assessment and will be confirmed during detailed design.

### 3.1.2 Water Supply

The Applicant does not own any of the land within the Study Area and therefore will be limited in their water harvesting options. The Applicant plans to source all water for the Project externally without relying on existing landholding allocations.

The Applicant is currently in consultation with Bathurst Regional Council, and in the process of applying for a bulk water permit to support the water demands. Consultation with Council has indicated that the bulk water permit will be sufficient to supply demands, however, supplementary potable water may be trucked in from Sydney if required. Potable water and water for site amenities will be imported and stored in water tanks on site. Similarly, it is understood that the solar panels will mostly rely on direct rainfall to remove any dirt build up. If cleaning is required in dry periods, water would be purchased and imported to site.

If additional water is required to fulfill construction and operation demands, this could be sourced from:

- Harvesting runoff from farm dams under agreement with associated landholders (refer to Section 2.7.6).
- Reuse water from sediment basins (which may be used during the construction phase to prevent contamination of downstream watercourses).
- Purchasing and transporting water to site by water tanker.
- Recycling and reuse of water.

In accordance with basic landholder rights, the maximum capacity of harvestable rights dams within the Study Area is 20.93 ML. This water could be captured from local runoff in dams placed on 1<sup>st</sup> and 2<sup>nd</sup> order watercourses, up to 20.93 ML/year for use during construction and operation. It is important to note that the ability to make use of this water supply will be dependent on available infrastructure (dams) and rainfall, requirements for stock. It should be noted that at this stage the Applicant is proposing to truck water in as the primary water supply for the Project construction.

Where possible during construction, water should be recycled and reused. It is assumed that this will likely be possible for vehicle and equipment washdown demands.

It is understood that no extraction of groundwater is proposed, however, if deemed necessary to support construction, the Applicant will obtain applicable WALs, works approvals and water use approvals prior to any water extraction taking place. The requirement for such activities will be determined during the detailed design stage of the Project.

### 3.1.3 Wastewater Management

During construction, wastewater from the site office and temporary construction facilities should be collected and managed through an on-site treatment system. The treated wastewater would be re-purposed on site to fulfill non-potable construction and operation demands such as dust suppression, earthworks and concrete conditioning. To prevent interaction with natural surface and groundwater systems, the treated wastewater would be contained in tanks on site.

Waste solids generated by the treatment system will be handled by a licensed contractor, who will transport and dispose of at a nearby Council wastewater treatment plant or other appropriately licensed facility.

The specifics of the on-site wastewater management system, including its design and capacity, will be determined in the detailed design phase, and should consider best practice guidelines and standards.

Once construction is complete, all temporary wastewater management infrastructure will be decommissioned and removed from the Impact Area for rehabilitation.

# 4. FLOOD MODELLING

## 4.1 Overview

The hydraulic 1D/2D modelling software TUFLOW was used to develop a hydraulic model to assess flood regimes and local overland flow paths within the Study Area. Local catchments were modelled using the 'Rain-on-Grid' (RoG) modelling approach to determine overland flow paths, flood extents, depths, velocities, etc. through and around the Study Area. In accordance with the requirements of the SEARs, baseline flood modelling is required for the Project, as well as flood modelling of the potential impacts of the solar farm components.

## 4.2 Model Development

The lumped 2D hydraulic model was developed using the TUFLOW modelling package. Key aspects of the hydraulic model development are summarised in Table 4.1. A description of the model layout is provided below, and an overview of the Study Area model is shown in Figure 4.1.

**TABLE 4.1: HYDRAULIC MODEL DEVELOPMENT AND PARAMETERS**

Model Parameter	Details
Modelled Events	The 5% AEP and 1% AEP and Probable Maximum Flood (PMF) events were assessed.  For the current baseline assessment, two climate change events were assessed, those being the 0.5% AEP and 0.2% AEP.
Durations and Temporal Patterns	For each of the AEP events (5%, 1%, 0.5%, 0.2%), a range of durations ranging from the 10 minute to the 9 hour were assessed to determine the critical duration event. This was done by assessing 10 temporal patterns using the ensemble temporal patterns from the ARR Data Hub.  For the PMF, durations up to 5 hours were assessed using calculated rainfall depths in accordance with the Generalised Short Duration Method (GSDM), detailed in <i>The Estimation of Probable Maximum Precipitation in Australia: Generalised Short-Duration Method</i> (GSDM) (BoM, 2003). For each duration, 11 temporal distributions were modelled, determined using the methodologies outlined in the GSDM and <i>Growth curves and temporal patterns of short duration design storms for extreme events</i> (Jordan, Nathan, Mittiga, & Taylor, 2005).
Areal Reduction Factors	ARF factors derived from the model boundary area of approximately 68 km <sup>2</sup>
Rainfall Losses	Initial and continuing rainfall losses sourced from the ARR Data Hub (BoM, 2022), and in accordance with the <i>Floodplain Risk Management Guide</i> (Office of Environment and Heritage, 2019) and Review of ARR Design Inputs for NSW (NSW OEH, 2019).  This assessment has adopted the recommendations of the guide, with the applied probability neutral burst losses provided in Table 4.2. The 0.5% and 0.2% AEP events have adopted the 1% AEP depths.  In accordance with the ARR2019 Guidelines (Ball, et al., 2019), values of 1 mm for initial loss and 0 mm/hr for continuing loss was adopted for the PMF event.
Grid Size	Cell size of 60 m, with a 5 m sub-grid sampling (SGS) size.
DEM	Compiled from the following sources in order of priority: <ul style="list-style-type: none"> <li>• 1 m NSW LPI LiDAR (flown in 2019).</li> <li>• 2 m NSW LPI LiDAR (flown in 2015).</li> </ul>

Model Parameter	Details																																						
Timestep & Model Build	The hydraulic models use TUFLOW's Heavily Parallelised Compute (HPC) computational method for calculations of the Shallow Water Equation. A part of this allows for the model to use a variable time step. The model build used for each assessment was the latest available at the time, 2023-03-AE.																																						
Inflow Boundaries	No discrete inflow boundaries have been applied, with flow applied directly across the model terrain using the rain-on-grid (RoG) method.																																						
Downstream Boundary	Represented as a normal depth based on low flow channel grades at the downstream extent of the models.  Downstream boundaries were applied to the TUFLOW model to allow flow to exit the model area.																																						
Manning's 'n' Roughness	<p><b>Manning's 'n' roughness classifications for baseline and developed case modelling is shown on Figure 4.2. Adopted roughness values are presented in Table 4.3. Land use delineation was based on aerial imagery was sourced from ArcGIS online Esri Imagery and Google Maps.</b></p> <p>The Manning's 'n' value adopted for the solar panel arrays was determined using the Modified Cowan Method for Floodplain Roughness:</p> <p>Modified Manning's 'n' = (n<sub>b</sub> + n<sub>1</sub> + n<sub>2</sub> + n<sub>3</sub> + n<sub>4</sub>) m, where:</p> <table border="1"> <thead> <tr> <th rowspan="2">Floodplain Condition</th> <th colspan="2">Adopted n and m value</th> <th rowspan="2">Description</th> </tr> <tr> <th>Existing</th> <th>Solar Pannels</th> </tr> </thead> <tbody> <tr> <td>Floodplain Material (n<sub>b</sub>)</td> <td>0.045</td> <td>0.045</td> <td>Grassland with Low-Density Vegetation</td> </tr> <tr> <td>Degree of irregularity (n<sub>1</sub>)</td> <td></td> <td>No change from pre-development</td> <td></td> </tr> <tr> <td>Variation in Floodplain Cross Section (n<sub>2</sub>)</td> <td></td> <td>No change from pre-development</td> <td></td> </tr> <tr> <td>Effect of Obstructions (n<sub>3</sub>)</td> <td>0.000</td> <td>0.003</td> <td>Based on typical solar array modules of a frame supported by ~150 mm diameter piers at a typical grid spacing of ~5 m, resulting ~2.5% flow obstruction.</td> </tr> <tr> <td>Amount of vegetation (n<sub>4</sub>)</td> <td></td> <td>No change from pre-development</td> <td></td> </tr> <tr> <td>Change in roughness</td> <td>0.000</td> <td>0.003</td> <td>n<sub>b</sub> + n<sub>1</sub> + n<sub>2</sub> + n<sub>3</sub> + n<sub>4</sub></td> </tr> <tr> <td>Adopted Manning's 'n'</td> <td>0.045</td> <td>0.048</td> <td></td> </tr> <tr> <td>Correlation Factor for meandering of the channel (m)</td> <td>1</td> <td>1</td> <td>Minor</td> </tr> </tbody> </table>	Floodplain Condition	Adopted n and m value		Description	Existing	Solar Pannels	Floodplain Material (n <sub>b</sub> )	0.045	0.045	Grassland with Low-Density Vegetation	Degree of irregularity (n <sub>1</sub> )		No change from pre-development		Variation in Floodplain Cross Section (n <sub>2</sub> )		No change from pre-development		Effect of Obstructions (n <sub>3</sub> )	0.000	0.003	Based on typical solar array modules of a frame supported by ~150 mm diameter piers at a typical grid spacing of ~5 m, resulting ~2.5% flow obstruction.	Amount of vegetation (n <sub>4</sub> )		No change from pre-development		Change in roughness	0.000	0.003	n <sub>b</sub> + n <sub>1</sub> + n <sub>2</sub> + n <sub>3</sub> + n <sub>4</sub>	Adopted Manning's 'n'	0.045	0.048		Correlation Factor for meandering of the channel (m)	1	1	Minor
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Model Parameter	Details
1D Network	<p>Hydraulic structures (culverts/bridges) located within the model extent were identified based on a desktop review of aerial imagery along with a survey conducted by Bathurst Regional Council (Council).</p> <p>Key hydraulic structures identified are shown in Figure 4.1 with characteristics provided in Table 4.4. Culvert dimensions were obtained through an on-site survey by Bathurst Regional Council or estimated from on-site photography, aerial and LiDAR. Invert levels were estimated through use of DEM, aerial imagery and Google Earth data. A roughness of 0.015 was typically applied to culverts, consistent with the supplied surveyed identification of the material, as reinforced concrete.</p>
Model Calibration	Due to the lack of gauged flood/flow data in the region, the flood model cannot be calibrated to historical gauge data.

**TABLE 4.2: NSW PROBABILITY NEUTRAL BURST LOSS RAINFALL DEPTHS (MM)**

Duration	5% AEP	1% AEP
1 hour	11.3	11.6
1.5 hours	11.2	8.7
2 hours	11.8	9.1
3 hours	12.6	9.4
6 hours	11.8	7.9
12 hours	15.6	7.5
18 hours	18.1	11.0
24 hours	21.3	11.7
36 hours	25.1	15.4
48 hours	27.3	20.3
72 hours	29.0	24.7

**TABLE 4.3: MANNING'S VALUES**

Material Classification	Manning's 'n' Value
Open Waterbodies	0.030
Waterways	0.035
Infrastructure	0.100
Roads and Other Hardstand	0.015

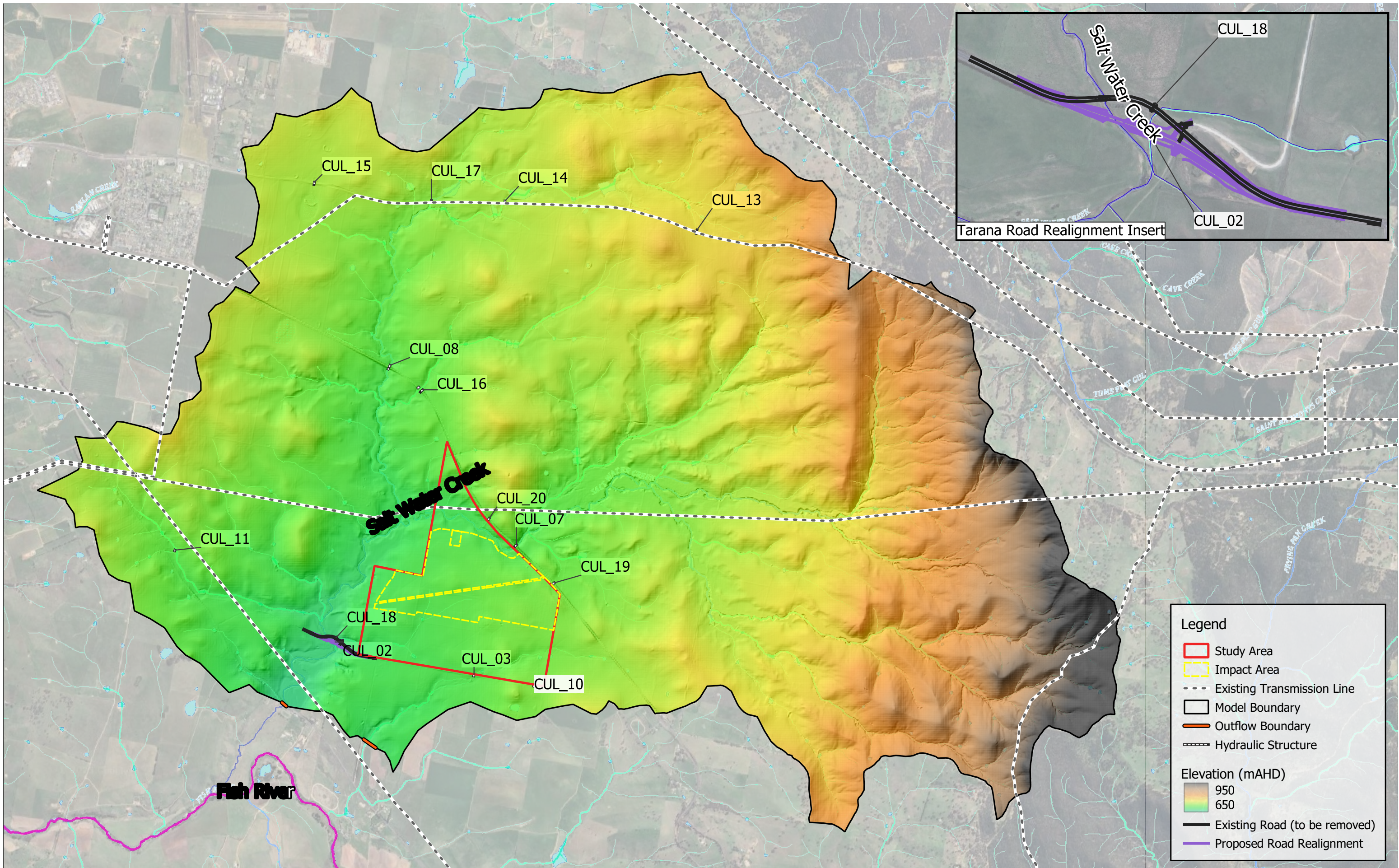
Material Classification	Manning's 'n' Value
Moderate Density Vegetation	0.050
High-Density Vegetation	0.085
Grassland with Low-Density Vegetation	0.045
Solar Array	0.048

**TABLE 4.4: HYDRAULIC STRUCTURE ATTRIBUTES**

Culvert ID	Cylindrical (C), Arch (A) or Bridge (B)	Dimensions (m)
CUL02	C	1 x 1.8 m diameter
CUL03	C	2 x 0.9 m diameter
CUL07	A	Arch culvert with base with 7 m and height 5 m
CUL08	A	Arch culvert with base with 5 m and height ~3.5 m
CUL09	A	Arch culvert with base with 5 m and height ~3.5 m

**Notes:**

- It is understood that Council is proposing a road re-alignment on Tarana Road, which will include relocation and upgrade to the existing CUL02 and adjacent bridge. As this realignment is not associated with the Project, modelling assumes the realignment and culvert upgrades are completed prior to the Project commencing and are included in the baseline flood model. The above CUL02 attributes are based on draft designs developed by Council (2023).
- Bridge flow paths were captured by DEM and therefore not modelled as a 1d structure.
- CUL10 to CUL20 – minor culverts, not surveyed. Nominal 1 x 0.9 m diameter culvert adopted.

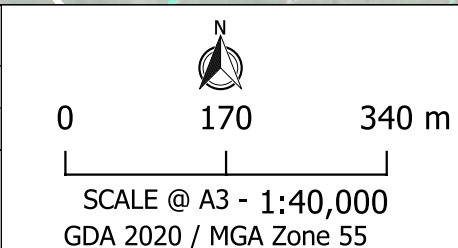


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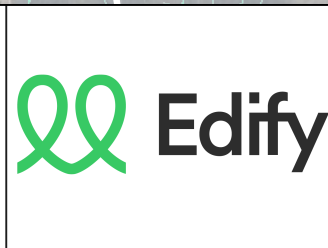
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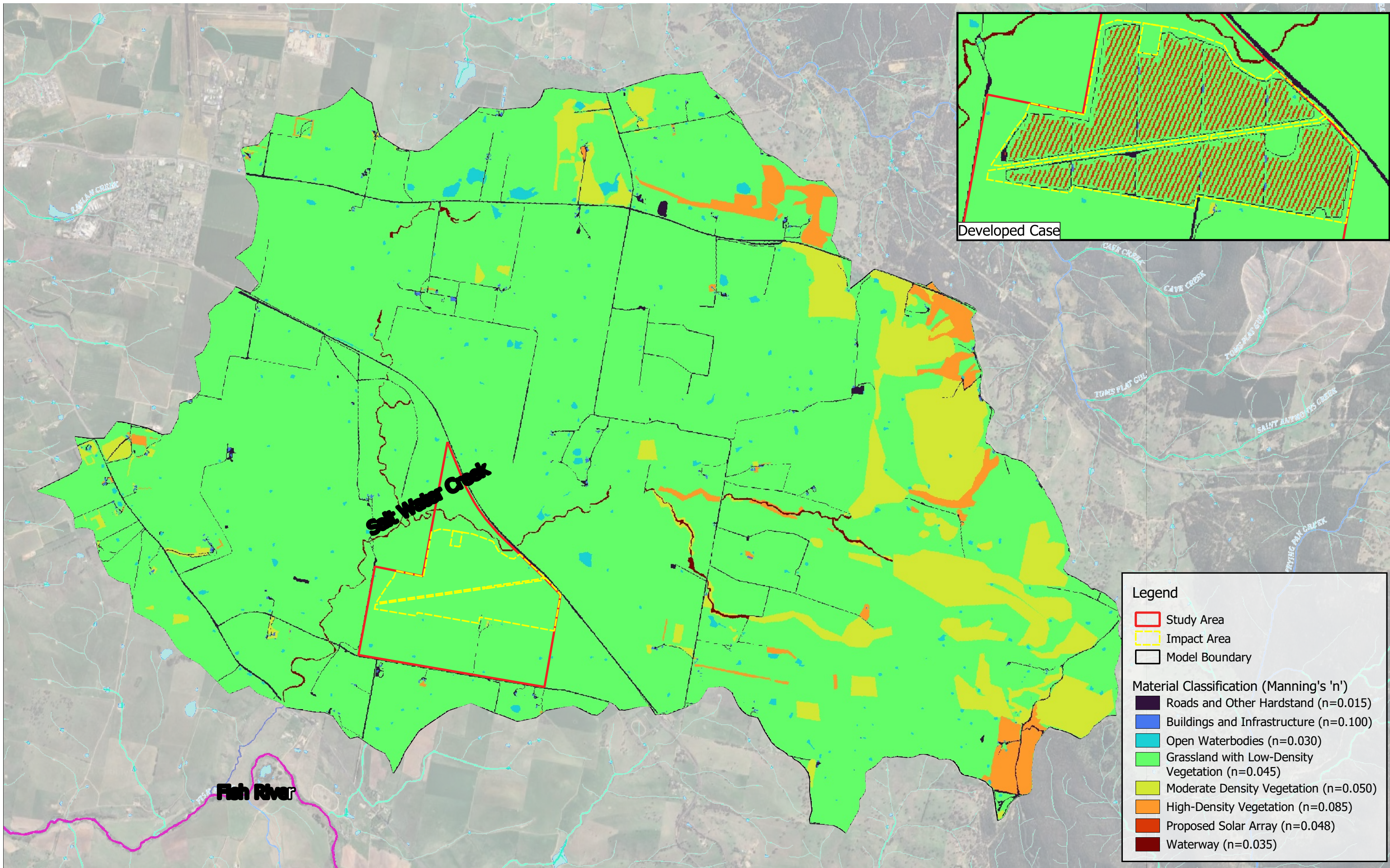
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Figure 4.1: TUFLOW Model Extent
Drg Ref. BNTL00206_0015-FIG-009



**Legend**

- Study Area
- Impact Area
- Model Boundary

**Material Classification (Manning's 'n')**

- Roads and Other Hardstand (n=0.015)
- Buildings and Infrastructure (n=0.100)
- Open Waterbodies (n=0.030)
- Grassland with Low-Density Vegetation (n=0.045)
- Moderate Density Vegetation (n=0.050)
- High-Density Vegetation (n=0.085)
- Proposed Solar Array (n=0.048)
- Waterway (n=0.035)

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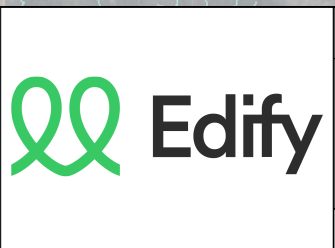
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Figure 4.2: TUFLOW Material Classification

Drg Ref. BNTL00206\_0015-FIG-008

## 4.3 Existing Flood Behaviour

Appendix A contains mapping of flood depth, velocity, and hazard categories for the baseline flooding results (i.e. with the Study Area undeveloped) for the 5%, 1%, 0.5% and 0.2% AEP and PMF events. The following is a summary of the baseline results within the Impact Area:

- Flooding within the Impact Area is dominated by overland flow, due to local catchments upstream of the site, rather than from Salt Water Creek, with the only exception being in the PMF. The PMF event results in additional flooding over the Impact Area due to the tailwater impact from Salt Water Creek. The tailwater impacts are not significant enough in the 5% or 1% AEP events to impact flows from the Impact Area during these events.
- Flood depths typically do not exceed 0.2 m across the Impact Area in events up to and including the 0.2% AEP, except within existing farm dam locations. Interactions with the Salt Water Creek floodplain are expected to induce flood depths of up to approximately 3.0 m within the northern boundary of the Impact Area in the PMF, and up to approximately 0.5 m in some areas toward the south and south east of the Impact Area.
- Flooding is observed across Tarana Road, south of the Impact Area in all modelled events, with depths up to 0.66 m observed in the PMF. This flooding occurs where the site access road is proposed to join Tarana Road and is typically used by vehicle traffic and not pedestrians.
- The average velocity through the Impact Area does not exceed 2.0 m/s in all events up to the PMF, which has velocities greater than 5.0 m/s in areas of the Salt Water Creek floodplain.
- The general flood hazard curves and categorisation presented in ARR (Ball, et al., 2019) have been adopted (refer to Figure 4.3) and the predominant hazard category for the site is low (H1), with higher hazards typically either being due to ponding in existing farm dams, or due to engagement with the Salt Water Creek floodplain in the PMF.

### 4.3.1 Flood Hazard Classification

The general flood hazard curves and categorisation presented in ARR (Ball, et al., 2019) have been adopted (refer to Figure 4.3) to determine the flood hazard categorisation for the Study Area. In accordance with the methodology in the *Australian Disaster Resilience Handbook 7 – Managing the Floodplain: A Guide to Best Practice in Flood Risk Management in Australia* (AIDR, 2017), the combined flood hazard curves set hazard thresholds that relate to the vulnerability of the community when interacting with floodwaters. The combined curves are divided into hazard classifications that relate to specific vulnerability thresholds as described in Table 4.5.

From the flood hazard mapping in Appendix A, the predominant hazard category for the site is low (H1), with higher hazards typically either being due to ponded areas resulting in significant flood depths, or due to engagement with the Salt Water Creek floodplain in the PMF.

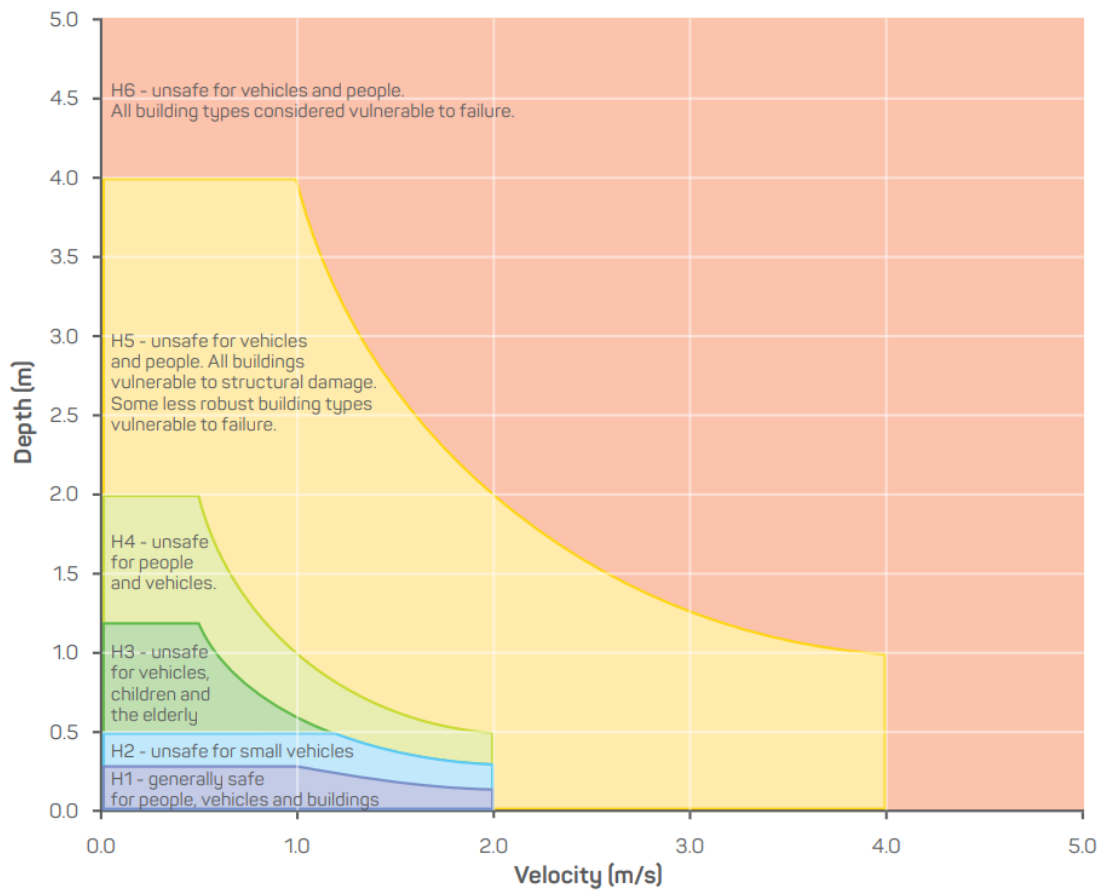


Figure 4.3: Flood Hazard Categories

TABLE 4.5: COMBINED HAZARD CATEGORIES – VULNERABILITY THRESHOLDS AND LIMITS

Hazard Vulnerability Classification	Description	Classification Limit (D and V in combination) m <sup>2</sup> /s	Limiting still water depth (D) m	Limiting velocity (V) m/s
H1	Generally safe for vehicles, people and buildings.	$D \cdot V \leq 0.3$	0.3	2.0
H2	Unsafe for small vehicles.	$D \cdot V \leq 0.6$	0.5	2.0
H3	Unsafe for vehicles, children and the elderly.	$D \cdot V \leq 0.6$	1.2	2.0
H4	Unsafe for vehicles and people.	$D \cdot V \leq 1.0$	2.0	2.0
H5	Unsafe for vehicles and people. All building types vulnerable to structural damage. Some less robust building types vulnerable to failure.	$D \cdot V \leq 4.0$	4.0	4.0
H6	Unsafe for vehicles and people. All building types considered vulnerable to failure.	$D \cdot V \leq 4.0$	-	-

### 4.3.2 Flood Planning Area

The flood planning area for the Study Area has been considering by assessing the 1% AEP and adding 0.5 m freeboard to the flood levels, in accordance with the recommended methodology in the *Flood risk management manual* (DPE, 2023). Due to the assessment using a RoG approach, depths less than 10 mm have not been included in the 1% AEP flood extent. The flood planning area extent within the site is provided in Figure 4.4.

### 4.3.3 Hydraulic Categorisation

Three hydraulic categories of flood prone land are identified, those being the floodway, flood storage and flood fringe, and are a distinction used to aid in the process of developing a floodplain risk management plan. The DEP *Floodplain Risk Management Guideline* document definitions and the adopted criteria for each categorisation are summarised in Table 4.6.

**TABLE 4.6: HYDRAULIC CATEGORISATION**

Category	Definition	Adopted Criteria
Floodway	Are generally areas which convey a significant portion of water during floods and are particularly sensitive to changes that impact flow conveyance. They often align with naturally defined channels.	1% AEP Hazard Category of $\geq 4$
Flood Storage	Are areas outside of a floodway and are generally areas that store a significant proportion of the volume of water and where flood behaviour is sensitive to changes that impact the storage of water during a flood.	1% AEP Hazard Category of $< 4$
Flood Fringe	Are areas within the extent of flooding for the event but which are outside floodway's and flood storage areas. Flood fringe areas are not sensitive to changes in either flow conveyance or storage.	PMF extent

Figure 4.5 provides the hydraulic categorisation within the Study Area for each of these areas. The majority of the Study Area is classified as Flood Storage and Flood Fringe. As a result of the low hazard categorisation identified in Section 4.3.1, only areas within Salt Water Creek are classified as Floodway, with no areas within the Impact Area classified as Floodway.

### 4.3.4 Climate Change Assessment

A climate change sensitivity assessment was undertaken to understand the sensitivity of flooding and flood impacts to climate change. The 0.5% and 0.2% AEP design events are typically used as proxies for climate change and have been adopted as so for this assessment. A comparison of the flood extents between these events is presented in Figure 4.6 while further detailed flood mapping for the full range of events is provided in Appendix A.

The climate change sensitivity modelling indicates that there is generally little difference in flood extent across the Study Area for the two climate change scenarios assessed. Additional outcomes from the climate change assessment are as follows:

- The difference in flood depth for climate change proxies relative to the 1% AEP is less than 0.05 m, which is below the 0.5 m freeboard adopted in setting flood planning levels. This indicates that a climate change scenario would result in the future flood planning reference event (1% AEP plus climate change) not exceeding the current flood planning level (existing 1% AEP plus 500 mm freeboard).
- The increase in inundation during flood events (refer to Figure 4.6) from the 1% AEP (blue) to the 0.5% AEP (green) and the 0.2% AEP (orange) is shown on the figure with minimum areas that are only inundated by the 0.2% AEP and 0.5% AEP that are not inundated by the 1% AEP.
- This change in depth and extent does not result in inundation of additional buildings or potential ancillary infrastructure locations.
- The small change in flood regime (i.e., flood level or extent) for the agricultural land (grazing and cropping) or crown land is not considered to have a resulting impact on the use of the land under a climate change scenario.



**Legend**

- Study Area
- Impact Area
- Existing Transmission Line
- Flood Planning Area
- Cadastre

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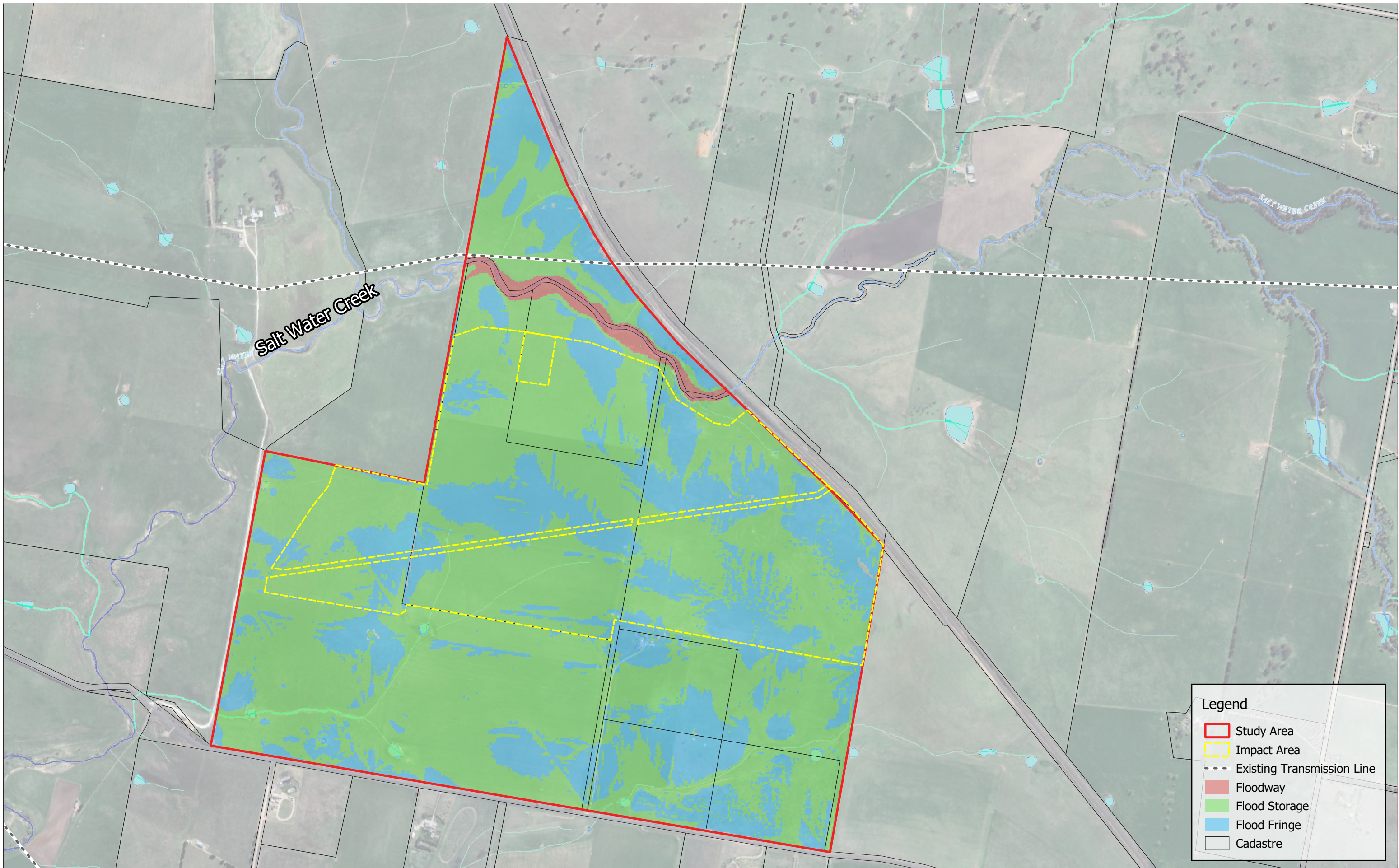
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Figure 4.4: Flood Planning Area

Drg Ref. BNTL00206\_0015-FIG-0012



**Legend**

- Study Area
- Impact Area
- Existing Transmission Line
- Floodway
- Flood Storage
- Flood Fringe
- Cadastre

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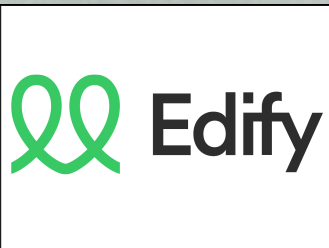
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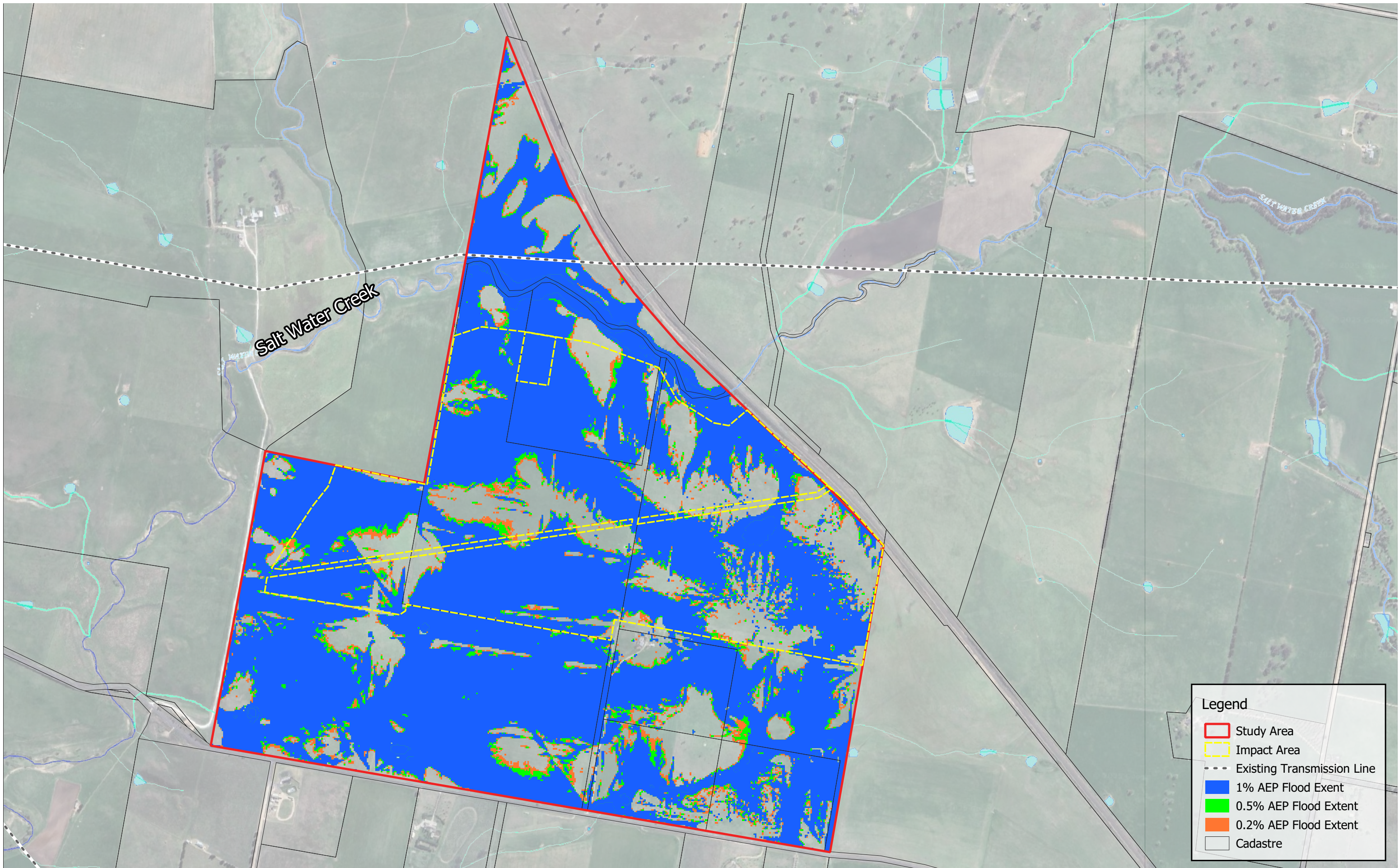
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Figure 4.5: Hydraulic Categorisation

Drg Ref. BNTL00206\_0015-FIG-0013



**Legend**

- Study Area
- Impact Area
- Existing Transmission Line
- 1% AEP Flood Extent
- 0.5% AEP Flood Extent
- 0.2% AEP Flood Extent
- Cadastre

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Figure 4.6: Climate Change Sensitivity

Drg Ref. BNTL00206\_0015-FIG-0014

## 4.4 Developed Flood Behaviour

Appendix B contains mapping of flood depth, velocity, and hazard categories for the following flood modelling results for the ultimate flooding results (i.e. with the Study Area developed) for the 5%, 1% AEP and PMF events.

The changes made to the baseline hydraulic model to represent the development of the Study Area are as follows:

- Change to Mannings 'n' values for infrastructure areas, including solar panels, BESS locations and roads.
- Solar ancillary infrastructure (BESS locations) raised to PMF level.

The following is a summary of the developed results within the Study Area, with emphasis on the Impact Area (proposed area of disturbance):

- The BESS infrastructure structures are not flooded up to and including the PMF event, however, due to the RoG approach, they still show some flood flows on the figures in Appendix B. The inundation shown on the figures is related to local runoff.
- Increases in flood depths of up to 0.1 m in all events (5% AEP, 1% AEP and PMF) within the Study Area, due to impeded flows and changed flow routes around the BESS infrastructure as well as modified runoff rates associated with the solar arrays.
  - Maximum flood depths within the solar array area are 0.2 m in the 5% and 1% AEP events and 2.0 m in the PMF, in areas directly adjacent to Salt Water Creek. Excluding inundation associated with Salt Water Creek, flood maximum flood depths within the solar array area are 0.5 m in the PMF. In the 5% AEP and 1% AEP events, these depths occur within overland flow paths upstream of existing farm dams. During the PMF, inundation from Salt Water Creek results in an increase in peak flows within the northern area of the Project.
  - Maximum flood depths adjacent to permanent ancillary infrastructure (BESS locations) reach approximately 0.06 m in the 5% AEP, 0.07 m in the 1% AEP and 0.22 m in the PMF.
  - Due to the sloped topography, flooding, including under existing conditions, generally does not result in prolonged ponding within the Impact Area, except in the PMF when Salt Water Creek becomes inundated.
- One location shows minor increases in flood depths (typically < 30 mm) outside of the Study Area in the 5% AEP and 1% AEP events. This is to the south of the Study Area, where the proposed site access road joins Tarana Road and is associated with an increase in Manning's 'n' roughness for the proposed access road. Similarly, some areas of reduced flooding is observed around the site access road and Tarana Road in these locations.
- Two locations show minor increases in flood depths outside of the Impact Area in the PMF:
  - Increases of up to 50 mm are observed adjacent to the proposed site access road and up to 30 mm (increasing from 0.63 m to 0.66 m) across Tarana Road. There is negligible change to the time and duration of inundation across Tarana Road as a result of these increases.
  - Increases of up to 30 mm are observed in localised areas north of the Impact Area, due to impeded flows and changed flow routes around the BESS infrastructure and modified runoff rates associated with the solar arrays.
- Some decreases in flood depth are observed within the Study Area, on the downstream side of the BESS locations due to changed flow routes around the structures.
- Minor increases in flood velocity impacts (typically < 0.5 m/s) are reported through the Impact Area in all flood events. These increases are primarily associated with changed flow routes around the BESS and modified runoff rates associated with the access tracks and solar arrays. The impacts extend outside of the Impact Area at the proposed site access road, however, are within the overall Study Area. These increases result in peak velocities of up to 0.9 m/s in localised areas through the solar arrays during the 1% AEP and up to 2.2 m/s during the PMF.
- Typically, velocities within the solar array area remain below 0.5 m/s during the 1% AEP event, except in key overland flow paths, and 2.0 m/s during the PMF, including through the key overland flow paths.
- Minor increases outside of the Impact Area (typically < 0.4 m/s) occur during all events in a localised area adjacent to the proposed site access road. However, these are maintained within the wider Study Area. Additionally, minor increases (typically < 0.15 m/s) occur in localised locations within the Impact Area in the PMF. This is due to modified runoff rates associated with the solar arrays.
- Negligible changes in flood hazards are reported through the Study Area, with no external impacts. Flood hazard remains between H1 to H2 in the 5% AEP and 1% ARP events within the Impact Area, except within existing farm dams which have depths greater than 0.5 m. H1 and H2 hazard categories typically indicate low risk around Project infrastructure.
- During the PMF, increased flooding is expected within the northern portion of the Impact Area, including over proposed access tracks. In some locations, a flood hazard of H6 is reported due to significant flood depths associated with Salt Water Creek, indicating these areas would be unsafe for people and vehicles in the PMF event.

# 5. SURFACE WATER IMPACT ASSESSMENT

The following sections detail the potential impacts to surface waters associated with the Project during the construction, operation and decommissioning phases, including to:

- Flow Regimes.
- Waterfront Lands and Riparian Vegetation.
- Flooding.
- Water Quality.
- Erosion and Sedimentation.
- Irrigation Infrastructure.

## 5.1 Watercourse Characteristics

### 5.1.1 Flow Regimes

The proposed works will not involve modification or realignment of any existing watercourses traversing the Impact Area, resulting in no impacts to flow paths or stream ordering. The proposed disturbance associated with construction and operation infrastructure (e.g. solar arrays, BESS infrastructure and roads) may result in some disturbance to minor flow/drainage paths. Where possible, existing access tracks will be used during construction and operation of the Project, limiting the crossings of flow/drainage paths.

There are three 1<sup>st</sup> order ephemeral watercourses located within the Impact Area, with one in the north-east and two to the south. Solar panel arrays are proposed within a portion of these watercourses (Figure 5.1), however, it is understood the proposed installation methods will not modify the channel geometry. Similarly, an existing access track across this watercourse will be used, limiting influences on the existing flow regimes.

Existing farm dams within the Project will be retained. Maintaining this on-site detention means that the potential for the Project to impact overland flow regimes in larger flow events is reduced.

### 5.1.2 Waterfront Land and Riparian Vegetation

As described in Section 2.2.3, installation of solar arrays, access tracks and a transmission line easement are proposed within the waterfront land of a 1<sup>st</sup> order unnamed drainage line and Salt Water Creek (5<sup>th</sup> order watercourse).

The 1<sup>st</sup> order unnamed drainage line within mapped waterfront land is a minor, ephemeral channel and likely the result of historical dam overflows from the upslope farm dam, as well as a historical head cut from Salt Water Creek. As discussed in Section 5.1.1, it is understood the proposed installation methods will not modify the channel geometry and with appropriate mitigation measures (e.g. erosion and sediment controls), it is considered that there will be negligible impacts on the water quality or stability of the unnamed 1<sup>st</sup> order drainage line.

Similarly, where internal access tracks and the transmission line easement are proposed to traverse watercourses, the DPE *Guidelines for instream works on waterfront land* (DPE, 2022) and *Guidelines for riparian corridors on waterfront land* (DPE, 2022) should be considered to minimise disturbance. As a Controlled Activity Approval will not be required for works within waterfront land as the Project is SSD, further design in accordance with *Why Do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings* (Fairfull & Witheridge, 2003) and the *Policy & Guidelines for Fish Habitat Conservation & Management* (DPI, 2013) is not required, however may be considered during detailed design.

The proposed works (solar array installation, internal access tracks and transmission line easement) are considered to likely have a negligible impact on flows within the watercourses, or any existing riparian vegetation.

### 5.1.3 Flooding

During construction, operation and decommissioning of the Project, careful consideration should be given to the impacts of flooding both on the Project itself and any potential changes to flooding downstream of the Project.

The flood assessment has considered the impacts of permanent infrastructure, including solar arrays, access tracks and BESS infrastructure. Due to the sloped topography in the Impact Area, toward Salt Water Creek, most of the proposed infrastructure remains outside of the 5% AEP and 1% AEP flood extents, while portions of the infrastructure exists within the PMF flood extent. A summary of peak flood depths and velocities recorded at locations shown on Figure 5.1 is included in Table 5.1 and Table 5.2 respectively. Table 5.1 and Table 5.2 also show where here has been a change compared to baseline flood conditions.

The results indicate that the worst impacts to flood depths are observed around BESS 3, with a modelled peak increase of 0.11 m. In order to manage flooding of the BESS areas, filling would be required to ensure these are raised to above the PMF level (as presented in Table 5.1).

The greatest impacts to flood velocities are observed at the site access location, with an increase in velocity of up to 0.5 m/s in the 1% AEP event. Flood velocity over Tarana Road are expected to increase by less than 0.1 m/s and does not present significant risk of erosion. Typically, the peak velocities observed across the Impact Area are minor and do not present significant risk of erosion. Additionally, Appendix B indicates some greater increases in velocity adjacent to proposed access tracks, which should be managed during detailed design using appropriate materials and scour protection.

The flood assessment (refer to Section 4) indicates that the Project has minimal potential to impact surrounding properties in the 1% AEP and PMF events, as it is understood the Applicant has agreements with the lots directly to the north and south of the Impact Area (i.e. within the Study Area). The only external impacts are potential minor increases to flood depths (0.01 m in the 1% AEP) across Tarana Road. Tarana Road is typically used by vehicle traffic and not pedestrians and a 0.01 m increase is therefore considered minor.

**TABLE 5.1: PEAK FLOOD DEPTH ADJACENT TO PROJECT INFRASTRUCTURE**

Infrastructure Item	Peak Flood Depth (m)			Change in Peak Flood Depth from Baseline (m)		
	5% AEP	1% AEP	PMF	5% AEP	1% AEP	PMF
BESS 1	0.04	0.04	0.12	0.06	0.03	0.05
BESS 2	0.02	0.02	0.06	0.03	0.00	0.02
BESS 3	0.05	0.06	0.14	0.11	0.00	0.10
BESS 4	-	-	0.04	0.00	0.00	0.00
BESS 5	0.06	0.07	0.22	0.10	0.04	0.10
BESS 6	-	-	0.01	-	-	0.00
BESS 7	0.01	0.01	0.05	0.01	0.00	0.01
BESS 8	0.01	0.01	0.06	0.01	0.00	0.01
Salt Water Creek	1.10	1.28	4.57	0.01	0.00	0.02
Site Access	0.09	0.12	0.56	-0.24	-0.04	-0.24
Tarana Road	0.11	0.15	0.66	0.03	0.01	0.03

**TABLE 5.2: PEAK FLOOD VELOCITY ADJACENT TO PROJECT INFRASTRUCTURE**

Infrastructure Item	Peak Flood Velocity (m/s)			Change in Peak Flood Velocity from Baseline (m/s)		
	5% AEP	1% AEP	PMF	5% AEP	1% AEP	PMF
BESS 1	0.09	0.11	0.30	-0.20	-0.11	-0.20
BESS 2	0.10	0.11	0.26	-0.08	-	-0.09
BESS 3	0.10	0.12	0.32	-0.04	-	-0.06
BESS 4	-	-	0.37	-	-	-0.01
BESS 5	0.17	0.20	0.53	-0.06	-0.01	-0.06
BESS 6	-	-	0.20	-	-	0.00
BESS 7	0.16	0.18	0.47	-0.11	0.00	-0.12
BESS 8	0.16	0.18	0.48	0.07	0.00	0.07
Salt Water Creek	2.32	2.41	5.24	-0.04	0.00	-0.04
Site Access	1.20	1.43	3.83	0.98	0.53	0.98
Tarana Road	1.72	1.87	2.95	0.12	0.07	0.13



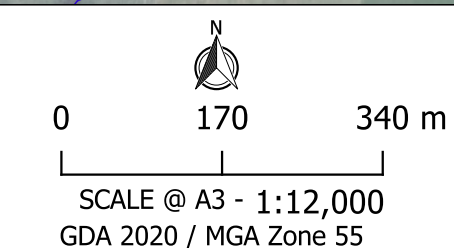
**Legend**

- Study Area
- Impact Area
- Road
- Railway
- Watercourse
- Proposed Site Access Road
- Solar Arrays
- BESS Locations
- Reporting Locations

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Figure 5.1: Flood Depth and Velocity Reporting Locations

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## 5.2 Water Quality

Several components of the Project introduce potential for impacts to the quality of surrounding surface water. The activities and potential impacts are summarised in Table 5.3 and discussed in further detail in subsequent sections. Potential mitigation measures are discussed in further detail in Section 7.

**TABLE 5.3: SURFACE WATER QUALITY IMPACTS**

Project Phase	Project Component	Activity	Risk / Impact	Mitigation Measure Overview
Construction	<ul style="list-style-type: none"> <li>Solar Panel Installation.</li> </ul>	<ul style="list-style-type: none"> <li>Ground disturbance.</li> <li>Vehicle movement.</li> </ul>	<ul style="list-style-type: none"> <li>Soil erosion and sedimentation of downstream watercourses and crops.</li> <li>Spill of hydrocarbons or other pollutants used to support transportation and installation activities.</li> </ul>	<ul style="list-style-type: none"> <li>Erosion and Sediment Control Plan (ESCP).</li> <li>Construction Environmental Management Plan (CEMP).</li> </ul>
	<ul style="list-style-type: none"> <li>Establishment of temporary laydown, storage and site facilities areas.</li> <li>Construction of permanent ancillary infrastructure.</li> </ul>	<ul style="list-style-type: none"> <li>Vegetation clearing &amp; ground disturbance.</li> <li>Earthworks.</li> <li>Concrete works.</li> <li>Vehicle movement.</li> <li>Soil stockpiling.</li> </ul>	<ul style="list-style-type: none"> <li>Soil erosion and sedimentation of downstream watercourses and crops.</li> <li>Spill of hydrocarbons or other pollutants used to support transportation and construction activities.</li> <li>Release of stockpiled materials or concrete by-products (dust, slurry, water) into downstream watercourses and crops.</li> </ul>	<ul style="list-style-type: none"> <li>Erosion and Sediment Control Plan (ESCP)</li> <li>Construction Environmental Management Plan (CEMP).</li> </ul>
	<ul style="list-style-type: none"> <li>Construction / establishment of access tracks</li> </ul>	<ul style="list-style-type: none"> <li>Vegetation clearing &amp; ground disturbance.</li> <li>Earthworks.</li> <li>Vehicle movement.</li> </ul>	<ul style="list-style-type: none"> <li>Soil erosion and sedimentation of downstream watercourses and crops.</li> <li>Spill of hydrocarbons or other pollutants used to support transportation and construction activities.</li> </ul>	<ul style="list-style-type: none"> <li>Erosion and Sediment Control Plan (ESCP).</li> <li>Construction Environmental Management Plan (CEMP).</li> </ul>
	<ul style="list-style-type: none"> <li>Installation of electrical infrastructure (underground).</li> </ul>	<ul style="list-style-type: none"> <li>Vegetation clearing &amp; ground disturbance.</li> <li>Earthworks.</li> <li>Vehicle movement.</li> </ul>	<ul style="list-style-type: none"> <li>Soil erosion and sedimentation of downstream watercourses and crops.</li> <li>Spill of hydrocarbons or other pollutants used to support transportation and construction activities.</li> </ul>	<ul style="list-style-type: none"> <li>Erosion and Sediment Control Plan (ESCP).</li> <li>Construction Environmental Management Plan (CEMP).</li> </ul>
	<ul style="list-style-type: none"> <li>Site workers.</li> </ul>	<ul style="list-style-type: none"> <li>Wastewater from site amenities.</li> </ul>	<ul style="list-style-type: none"> <li>Discharge / spill of wastewater (treated or untreated) into downstream watercourses and crops.</li> </ul>	<ul style="list-style-type: none"> <li>Appropriately designed and maintained wastewater management system.</li> </ul>

Project Phase	Project Component	Activity	Risk / Impact	Mitigation Measure Overview
Operation	<ul style="list-style-type: none"> <li>Site workers.</li> </ul>	<ul style="list-style-type: none"> <li>Wastewater from site amenities (O&amp;M Facility).</li> </ul>	<ul style="list-style-type: none"> <li>Discharge / spill of wastewater (treated or untreated) into downstream watercourses and crops.</li> </ul>	<ul style="list-style-type: none"> <li>Appropriately designed and maintained wastewater management system.</li> </ul>
	<ul style="list-style-type: none"> <li>Use of access tracks.</li> </ul>	<ul style="list-style-type: none"> <li>Vehicle movement.</li> </ul>	<ul style="list-style-type: none"> <li>Soil erosion and sedimentation of downstream watercourses and crops.</li> <li>Spill of hydrocarbons or other pollutants used to support transportation and operation activities.</li> </ul>	<ul style="list-style-type: none"> <li>Erosion and Sediment Control Plan (ESCP).</li> <li>Construction Environmental Management Plan (CEMP).</li> </ul>
Decommissioning	<ul style="list-style-type: none"> <li>Solar Panel Removal.</li> </ul>	<ul style="list-style-type: none"> <li>Ground disturbance.</li> <li>Vehicle movement.</li> </ul>	<ul style="list-style-type: none"> <li>Soil erosion and sedimentation of downstream watercourses and crops.</li> <li>Spill of hydrocarbons or other pollutants used to support transportation and decommissioning activities.</li> </ul>	<ul style="list-style-type: none"> <li>Erosion and Sediment Control Plan (ESCP).</li> <li>Construction Environmental Management Plan (CEMP).</li> </ul>
	<ul style="list-style-type: none"> <li>Removal of ancillary infrastructure.</li> </ul>	<ul style="list-style-type: none"> <li>Ground disturbance.</li> <li>Vehicle movement.</li> </ul>	<ul style="list-style-type: none"> <li>Soil erosion and sedimentation of downstream watercourses and crops.</li> <li>Spill of hydrocarbons or other pollutants used to support transportation and installation activities.</li> </ul>	<ul style="list-style-type: none"> <li>Erosion and Sediment Control Plan (ESCP).</li> <li>Construction Environmental Management Plan (CEMP).</li> </ul>
	<ul style="list-style-type: none"> <li>Rehabilitation establishment.</li> </ul>	<ul style="list-style-type: none"> <li>Planting and mulching.</li> </ul>	<ul style="list-style-type: none"> <li>Release of tannins to downstream watercourses and crops.</li> </ul>	<ul style="list-style-type: none"> <li>Erosion and Sediment Control Plan (ESCP).</li> </ul>

There are only three minor, ephemeral watercourses within the Impact Area so direct pathways to downstream watercourses are therefore limited, minimising the overall potential surface water quality impacts.

### 5.2.1 Construction

During the Project construction phase the potential risks to surface water quality, due to greater amounts of ground disturbance and earthworks, vehicle movement, concrete works, and stockpiling, require management. As outlined in Table 5.3, the key risks include:

- Soil erosion and sedimentation of downstream watercourses and crops.
- Spill of hydrocarbons or other pollutants used to support transportation and installation activities.
- Release of concrete by-products (dust, slurry, water) into downstream watercourses and crops.
- Discharge/spill of wastewater (treated or untreated) into downstream watercourses and crops.

If sediments are exposed to the surrounding environment, they can degrade water quality, affect aquatic habitats, and harm crops through siltation. The impacts and mitigation strategies for the mobilisation and release of sediments during construction activities is further discussed in Section 5.3.

Surface water contamination resulting from a spill of hydrocarbons or other chemical pollutants, including concrete by-products, can be toxic to aquatic life, contaminate downstream watercourses and have long-term ecological impacts. Spills and contamination may also affect surrounding vegetation and soil, resulting in contamination of shallow groundwater pockets within and surrounding the Study Area, potentially harming crops that rely on water from affected sources. Best practice spill management controls can adequately minimise the potential contamination impacts.

Similarly, the discharge or spill of wastewater, whether treated or untreated, into downstream watercourses presents a risk to surface water quality. Untreated wastewater may contain pollutants harmful to aquatic life, while even treated effluent and residual solids can also contain residual chemicals that can impact the environment. These impacts can be significantly reduced through design, location and implementation of a suitable wastewater management system.

If unmanaged, the overall effect of the above risks could cause detrimental impacts on the ecological balance of watercourses. However, considering the limited connectivity of the Project to adjacent watercourses and through adopting best practice approaches and proposed mitigation measures (Section 7), these impacts are considered negligible. Such mitigation measures include the development of a construction erosion and sediment control plan (CESCP), suitable placement and controls for sediment stockpiles and hydrocarbon storage and implementation of a suitable monitoring regime.

## 5.2.2 Operation

As outlined in Table 5.3, potential surface water quality impacts associated with the Project operation phase include:

- Soil erosion and sedimentation of downstream watercourses and crops, associated with vehicle movement, scouring and poor site stabilisation.
- Spill of hydrocarbons or other pollutants used to support transportation and operation of substations.
- Discharge / spill of wastewater (treated or untreated) into downstream watercourses and crops.

Operation activities, as well as poor site stabilisation following construction may result in sediments being exposed to the surrounding environment. As discussed in Section 5.2.1, this can degrade water quality, affect aquatic habitats, and harm crops through siltation. The impacts of the mobilisation and release of sediments during operation activities is further discussed in Section 5.3.

Surface water contamination resulting from a spill of hydrocarbons and wastewater would be managed through the same processes used during construction (refer to Section 7) and are considered negligible with these management measures in place.

## 5.2.3 Decommissioning

The equipment and process required for Project decommissioning would be similar to the construction phase and therefore result in similar risks to surface water quality due to ground disturbance, vehicle movement, and vegetation management. As outlined in Table 5.3, risks associated with decommissioning and rehabilitation are summarised below:

- Soil erosion and sedimentation of downstream watercourses and crops.
- Spill of hydrocarbons or other pollutants used to support transportation and decommissioning activities.
- Release of tannins to downstream watercourses and crops.

Water quality mitigation and management measures required during the construction phase would be informed by the practices used during construction and are further discussed in Section 7. With the proposed management measures in place, overall water quality impacts during decommissioning are expected to be negligible.

# 5.3 Erosion and Sedimentation

## 5.3.1 Construction

Project construction would require up to 153 ha of land disturbance for the installation of solar panel arrays and the establishment of site facilities and access tracks. Construction activities involving ground disturbance, earthworks and transporting and stockpiling soil introduce pathways for soils erosion and, in turn, potential movement of sedimentation into downstream water systems.

Impacts associated with the mobilisation of soil include:

- Degradation of the quality of downstream domestic and stock drinking water.

- Increased turbidity and reduced visual clarity of downstream watercourses, impacting aquatic ecosystem health (changes to natural reflectance of water, smothering aquatic life and clogging fish gills).
- Increased sediment build up in downstream watercourses and waterbodies, changing the geomorphology and disturbing natural flow regimes.
- Increased levels of dissolved metals and nutrients become mobilised with the soil, entering watercourses and waterbodies. This can be a threat if high concentrations of undesirable metals and nutrients reach water supplies for aquatic life or domestic, irrigation and livestock users.

Project construction would require area specific construction erosion and sediment control plans (ESCP) to be developed in accordance with *Managing Urban Stormwater: Soils and Construction – Volume 1* (Landcom, 2004), *Volume 2A Installation of services* (DECC, 2008), *Volume 2C Unsealed roads* (DECC, 2008), *Volume 2D Main road construction* (DECC, 2008) and *Best Practice Erosion and Sediment Control* (IECA, 2008).

### 5.3.2 Operation and Decommissioning

Poor site stabilisation during and following construction will lead to impacts associated with the mobilisation of soil, as described in Section 5.3.1. This can be effectively managed through development of an ESCP and ongoing inspections and maintenance, in accordance with *Managing Urban Stormwater: Soils & Construction Volume 1* (Landcom 2004), *Volume 2A, 2C and 2D* (DECC, 2008).

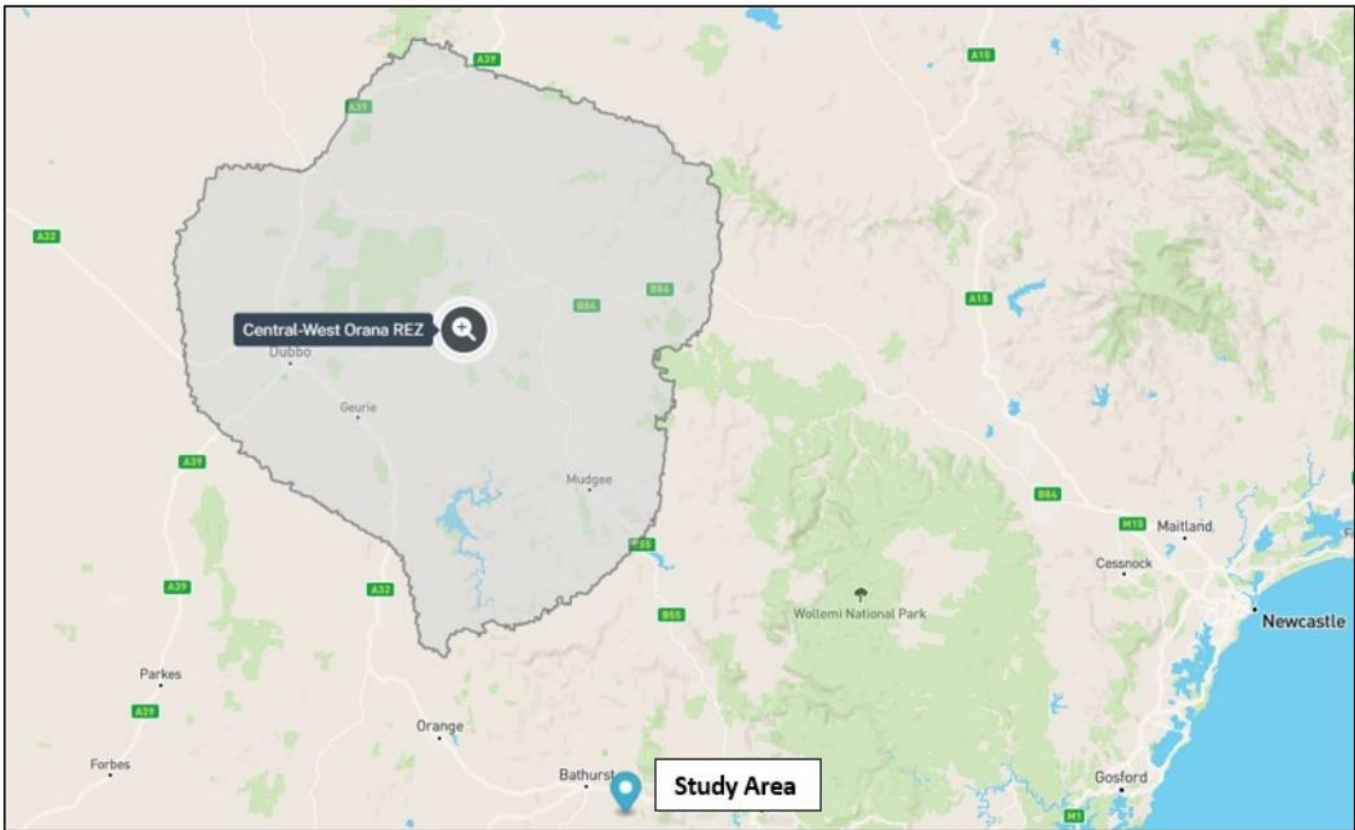
# 6. CUMULATIVE IMPACTS

In accordance with the *Cumulative Impact Assessment Guidelines for State Significant Projects* (DPIE, 2022), cumulative impacts are a result of incremental, sustained and combined effects of human action and natural variations over time and can be both positive and negative. The accumulation of effects from past, current and future activities can result in cumulative impacts on surface and groundwater resources. When considered in isolation, impacts from specific projects may be considered minor or negligible, however, when multiple projects influence common receivers, the cumulative impact may be more significant.

A total of four known approved and proposed energy projects were identified from the NSW Government Major Projects websites as being within the Bathurst Regional LGA and surrounds. These include:

- Glanmire Solar Farm (Approved SSD-21208499).
- Crudine Ridge Wind Farm (Approved SSD-6697).
- Central West Pumped Hydro (Proposed SSD-32286107).
- Panorama Battery Energy Storage System (Proposed SSD-50587460).

Additionally, the Project exists within proximity of the Central West and Orana REZ, shown in Figure 6.1, which is intended to support 4.5 gigawatts of potential generation and storage projects.



**FIGURE 6.1: CENTRAL-WEST ORANA RENEWABLE ENERGY ZONE**

The potential for cumulative impacts from the Project and adjacent known projects has been considered as presented in Table 6.1.

The key common surface water receptor which has been considered in the cumulative impact assessment includes Salt Water Creek which flows through the Study Area, directly adjacent to the proposed solar farm. The only direct interaction between project infrastructure and this watercourse is a crossing easement which will be suitably designed, constructed and installed to mitigate downstream impacts. Adopting appropriate mitigation and management will prevent indirect impacts, such as erosion and sedimentation, to the other surface water receptors. Therefore, cumulative impacts to surface water quality and flow are considered negligible.

**TABLE 6.1: IDENTIFICATION OF POTENTIAL CUMULATIVE IMPACTS**

Category of Impact	Potential Cumulative Impact
Flooding	<ul style="list-style-type: none"> <li>• Adjacent projects may interact with Salt Water Creek, however, the Project infrastructure is located outside of direct channel bed and banks for these waterways and does not impact other defined flow paths connecting to them, such as tributaries.</li> <li>• Impacts to Salt Water Creek from the Project are anticipated to be negligible due to limited hydraulic connectivity and therefore cumulative impacts are considered negligible.</li> </ul>
Water Quality	<ul style="list-style-type: none"> <li>• Contamination of common receiving waterways (Salt Water Creek) from erosion and sedimentation or contaminant/wastewater spills during overlapping construction periods is considered negligible provided the recommended mitigation measures are implemented.</li> </ul>
Surface Water Supply	<ul style="list-style-type: none"> <li>• Potable water use will be supplemented with imported town water. Overlapping project timelines may result in a cumulative impact to potable water supply, however, it is expected to be negligible in the context of the regional township water supply capacity.</li> </ul>

# 7. MITIGATION AND MANAGEMENT MEASURES

Detailed environmental studies have been undertaken to inform the Project design, including the surface water assessments detailed in this SWIA. The consideration and outcomes of these studies in the design and integration with the approved operations minimise the potential for impacts on surface water resources.

The proposed mitigation measures for the Project are summarised in Table 7.1.

**TABLE 7.1: SUMMARY OF POTENTIAL IMPACTS AND MITIGATION AND MANAGEMENT MEASURES**

Watercourse Characteristics		
Filling of streams for infrastructure / water crossings.	<p>Consider the following mitigation measures in the Project detailed design:</p> <ul style="list-style-type: none"> <li>• Limit water crossing to existing access tracks where possible.</li> <li>• Arrange solar panel arrays such that stream disturbance and modifications (filling / diversions) are limited to minor watercourses.</li> </ul> <p>In the event construction of watercourse crossings is required, these will be designed, constructed and maintained to consider DPE Guidelines for instream works on waterfront land (DPE, 2022) and Guidelines for Riparian Corridors on Waterfront Land (DPE, 2022).</p>	Detailed Design
Flooding		
Impacts to in-stream and overland flooding	<p>Consider the following mitigation measures in the Project detailed design stage to minimise impacts to flooding possible:</p> <ul style="list-style-type: none"> <li>• Minimise filling of BESS, substations sites and O&amp;M facilities.</li> <li>• Minimise extent of Project infrastructure within the 1% AEP flood extent.</li> <li>• Design to manage flood impacts and flow conveyance at watercourse crossings (if any).</li> </ul>	Detailed Design
Impacts on the Project design due to predicted flooding	<p>Optimisation of the Project design during detailed design to ensure:</p> <ul style="list-style-type: none"> <li>• A minimum of 0.2 to 0.3 m freeboard is maintained between the 1% AEP flood level and proposed solar arrays.</li> <li>• Permanent ancillary infrastructure (BESS) is located above the PMF level.</li> </ul>	Detailed Design
Impacts to site personnel during a flood event	<p>Floodplain management planning to determine site management protocols during flood events that could impact construction or access areas, including:</p> <ul style="list-style-type: none"> <li>• Suitable early warning and communication protocols.</li> <li>• Triggers for closure, evacuation and recovery.</li> <li>• Emergency response and support.</li> </ul>	Post Approval / Pre-Construction

Increased stormwater runoff from vegetation clearing and filling for infrastructure	<p>Increased stormwater runoff during operations (due to clearing of vegetation and filling for infrastructure) will be managed through development of erosion and sediment control plan (ESCP). The ESCP will consider:</p> <ul style="list-style-type: none"> <li>• Location of site infrastructure away from existing watercourses or areas subject to high levels of overland flow.</li> <li>• Diversion of upstream flows around site infrastructure as required, to minimise scouring and erosion.</li> <li>• Inspection and monitoring regimes to maintain stormwater and erosion and sediment control structures.</li> </ul>	Construction
<b>Water Quality</b>		
Erosion and sedimentation of downstream watercourses	<p>Development of erosion and sediment control plans (ESCP) through all project phases, in accordance with Managing Urban Stormwater: Soils and Construction – Volume 1 (Landcom, 2004), Volume 2A Installation of Services (DECC, 2008), Volume 2C Unsealed roads (DECC, 2008), Volume 2D Main Road Construction (DECC, 2008) and Best Practice Erosion and Sediment Control (IECA, 2008).</p> <p>The ESCPs will detail area specific erosion and sediment control measures to be implemented and maintained during construction until the design intent is met by the as-built infrastructure and rehabilitated vegetation. As well as ongoing monitoring and maintenance through operation and decommissioning of additional controls if identified as required.</p> <p>The total area of disturbance at any time should be minimised where possible and ongoing rehabilitation and stabilisation strategies implemented throughout construction.</p>	Construction
Release of sediment or construction byproducts	<p>During construction, the following management measures will be considered to minimise the potential for mobilisation of sediment or dust from topsoil stockpile:</p> <ul style="list-style-type: none"> <li>• Locate stockpiles away from drainage lines, or areas subject to high levels of overland sheet flow and minimise stockpile size.</li> <li>• Develop and implement area specific erosion and sediment control measures including bunding and diversion drains as required.</li> <li>• Use stockpile stabilisation techniques such as covering or dust suppression.</li> </ul>	Construction
Contaminant spills	<p>Prior to commencing construction activities, a Construction Environment Management Plan (CEMP) will be developed to identify site specific controls and procedures to minimise the potential for hydrocarbons and other contaminants being discharged into the environment. This CEMP should consider:</p> <ul style="list-style-type: none"> <li>• Storage of hydrocarbons and other liquid chemicals with above ground, bunded area away from watercourses or area subject to high levels of overland sheet flow.</li> <li>• Re-fuelling of construction vehicles and equipment to be limited to designated areas, with adequate spill management controls.</li> <li>• Maintain an emergency spill kit and relevant emergency spill response procedures.</li> <li>• Transport and dispose of any hydrocarbons captured during Project construction and operation of the substations and switchyards at a suitable off-site licenced facility.</li> </ul>	Construction, Operation

Surface water and groundwater quality impacts	<p>The CEMP will consider the following management measures to minimise the potential impacts to surface water and groundwater quality within and surrounding the Study Area:</p> <ul style="list-style-type: none"> <li>• Develop and implement a suitable monitoring regime of all stormwater and erosion and sediment control structures, particularly following large flow events.</li> </ul>	Construction, Decommissioning
<b>Water Supply</b>		
Water licences to meet demands	All required water licensing and approvals will be coordinated with associated landholders and/or regulators (e.g. Council, others) if that source is needed to support water supply arrangements for construction and operation.	Construction, Operation
<b>Wastewater Management</b>		
Discharge of wastewater or effluent from site	<p>Design and implement a wastewater treatment system that:</p> <ul style="list-style-type: none"> <li>• Is appropriately sized for the Project infrastructure and operations.</li> <li>• Collects and treats wastewater from site offices and temporary accommodation facilities for re-use on site to fulfill non-potable construction and operation demands.</li> <li>• Be designed and operated in accordance with best practices.</li> </ul>	Detailed design

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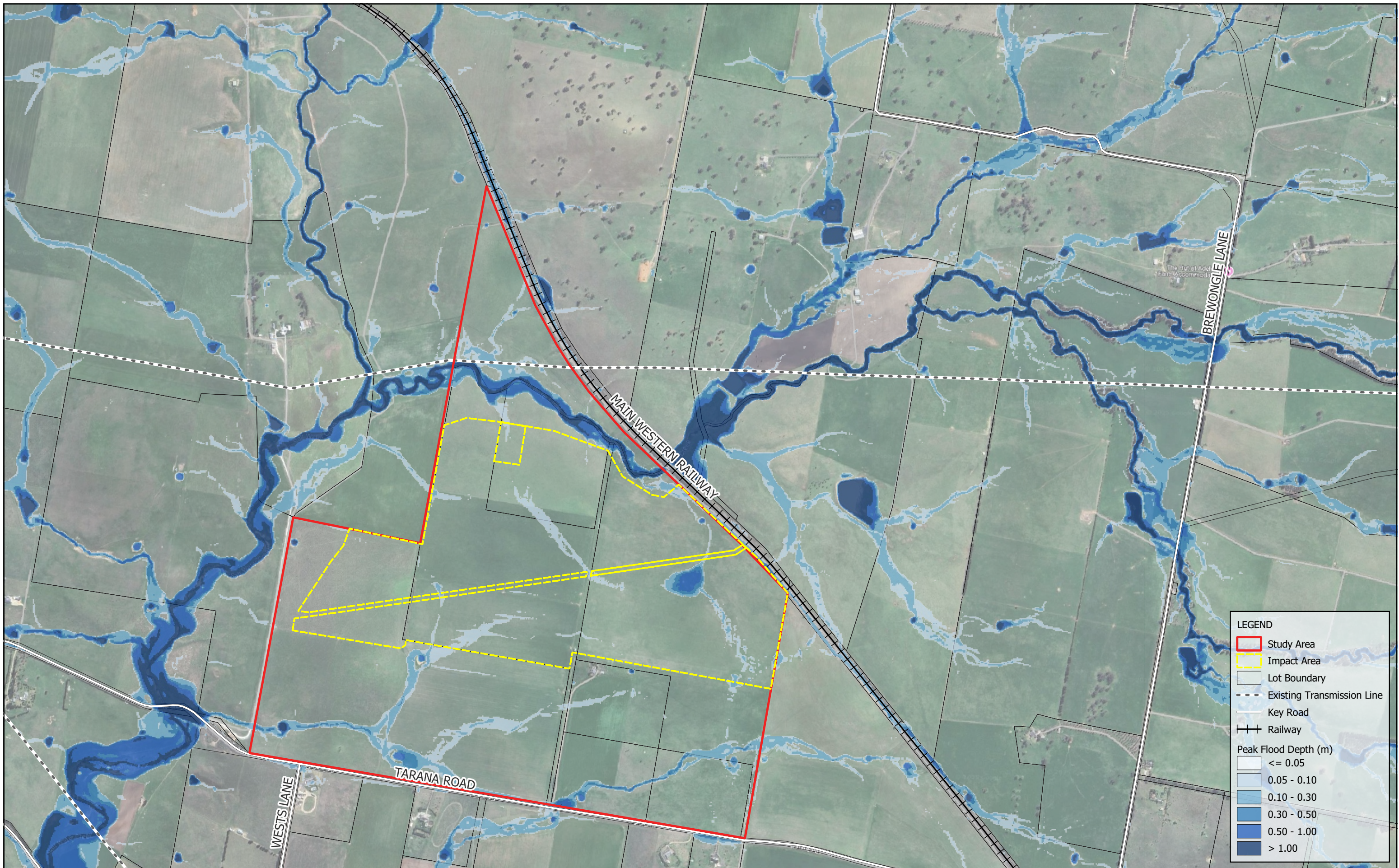
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# APPENDIX A: EXISTING CONDITION FLOOD MODEL RESULTS





**LEGEND**

- Study Area
- Impact Area
- Lot Boundary
- Existing Transmission Line
- Key Road
- Railway

Peak Flood Depth (m)


- <= 0.05
- 0.05 - 0.10
- 0.10 - 0.30
- 0.30 - 0.50
- 0.50 - 1.00
- > 1.00

R	DETAILS	DATE
1	Final Issue	-

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APPROVED	LV	DATE	19/02/25

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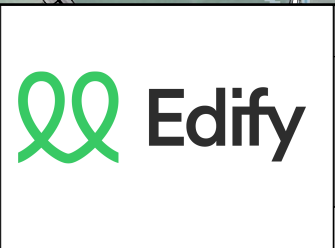


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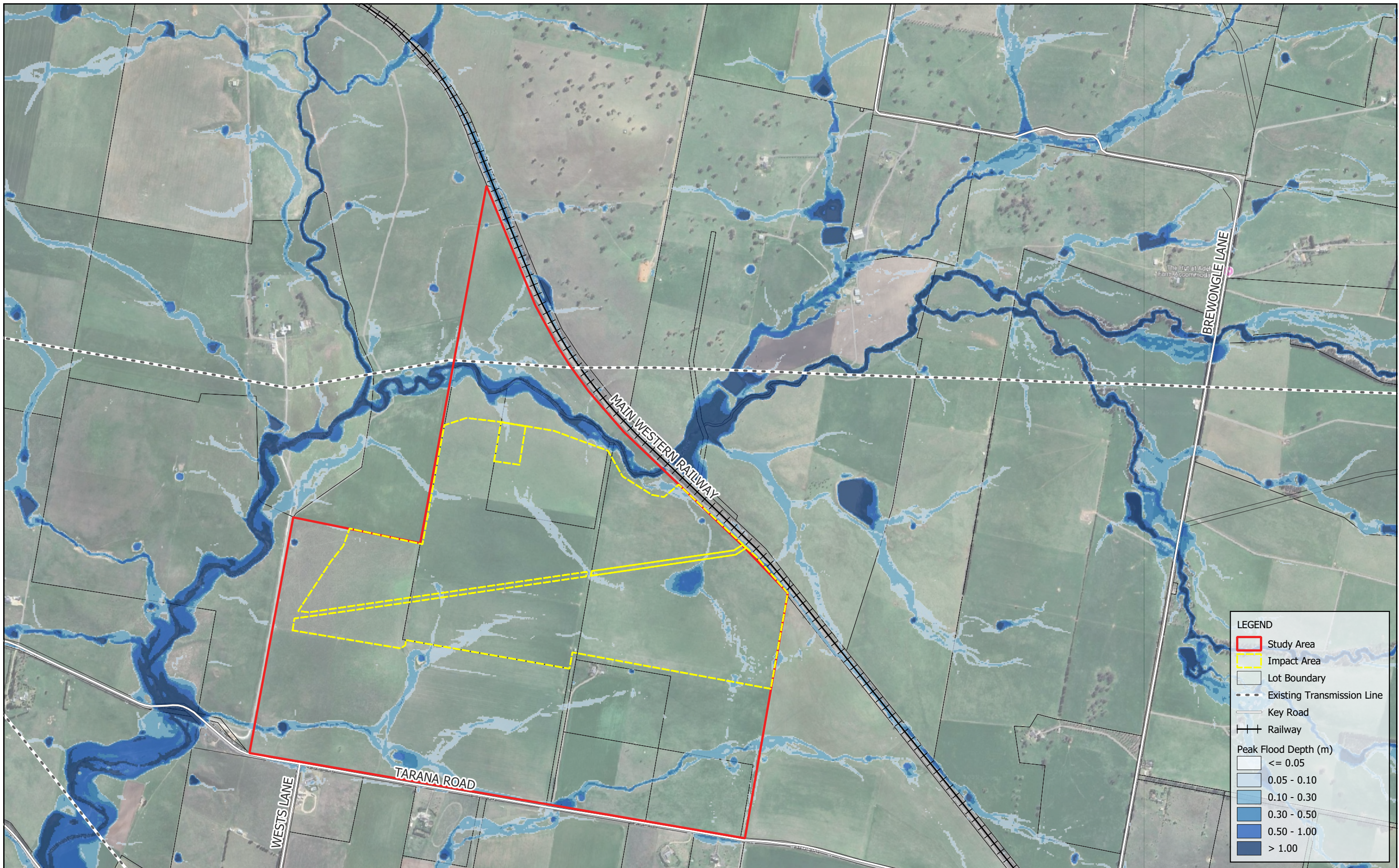
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DATA SOURCE  
Google Maps



Edify Brewongle Solar Farm	
Figure A1	- 5% AEP Peak Flood
Depth	
Drg Ref. NTL00206_0015-FIG-A1	

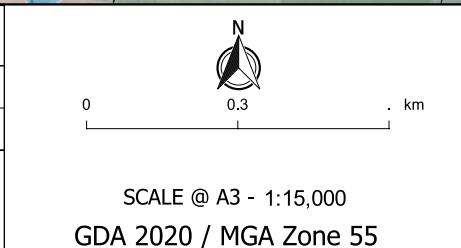


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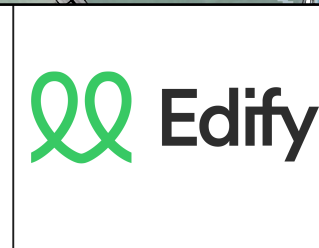
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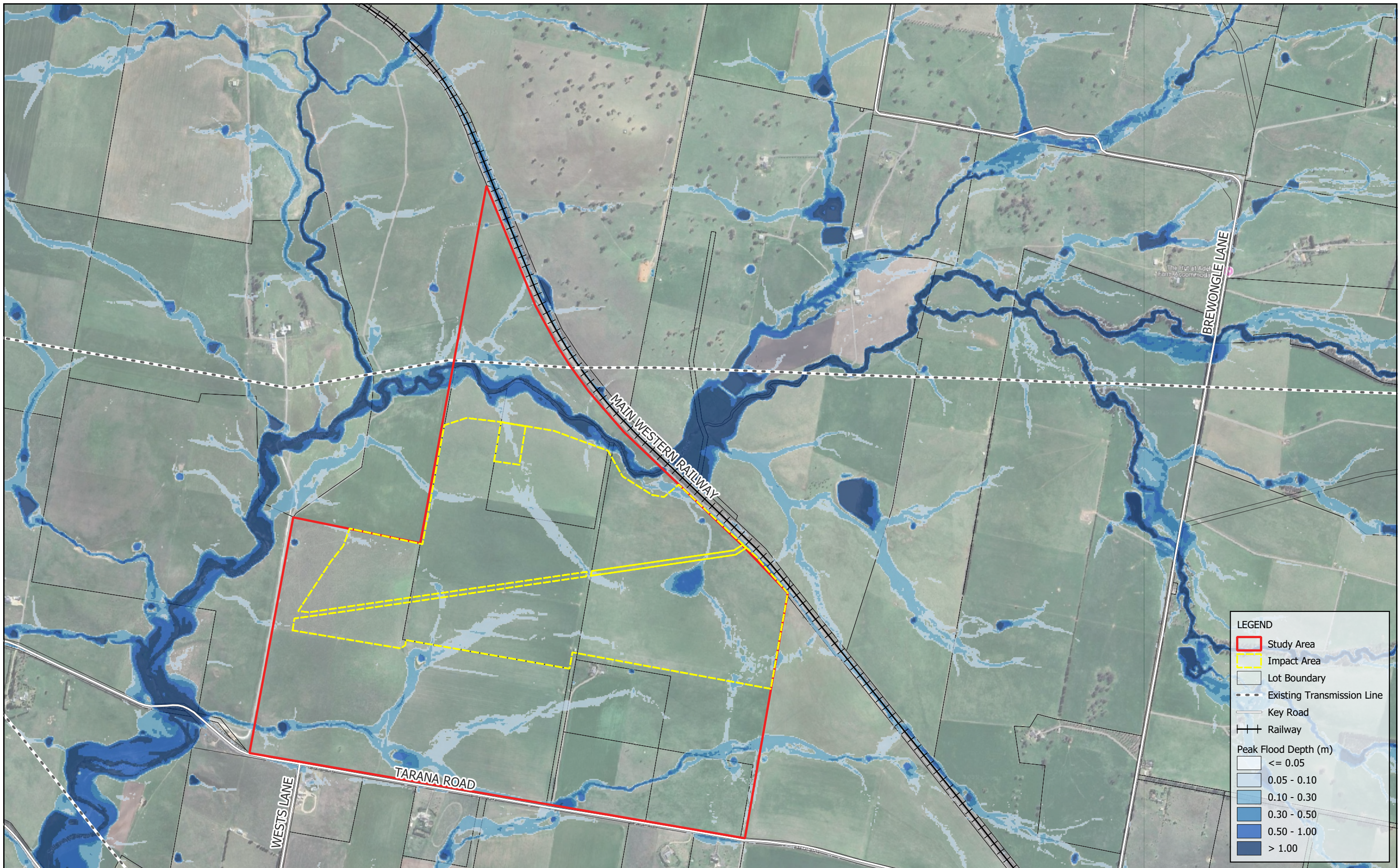


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Edify Brewongle Solar Farm	
Figure A1	- 5% AEP Peak Flood
Depth	
Drg Ref. NTL00206_0015-FIG-A1	

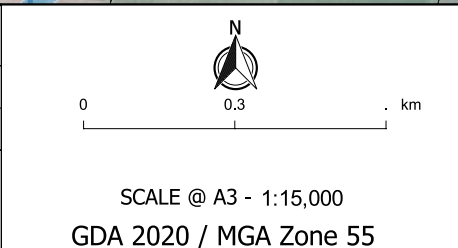


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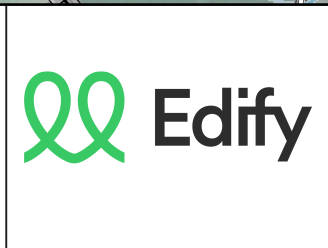
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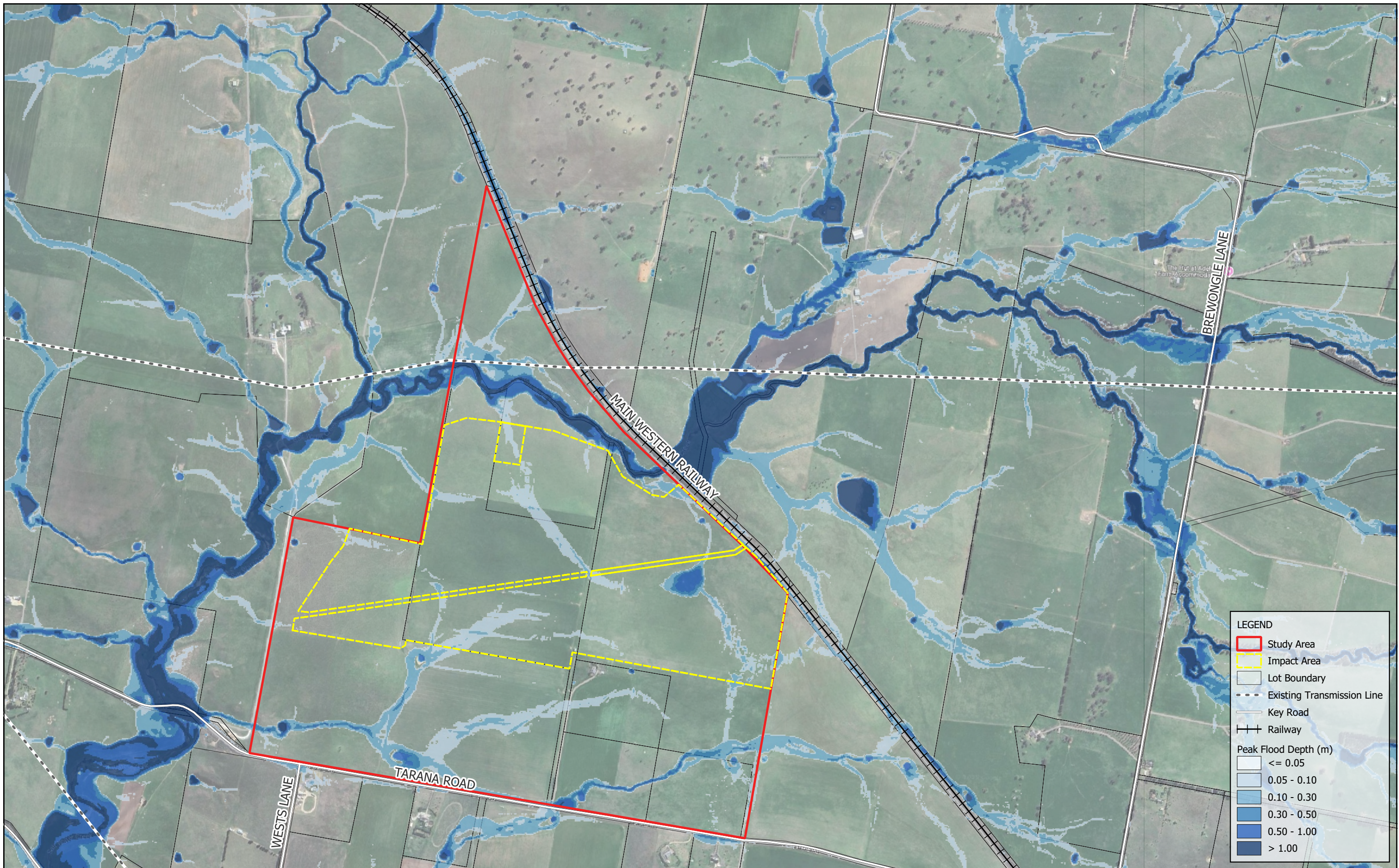


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Edify Brewongle Solar Farm	
Figure A2	- 1% AEP Peak Flood
Depth	
Drg Ref. NTL00206_0015-FIG-A2	



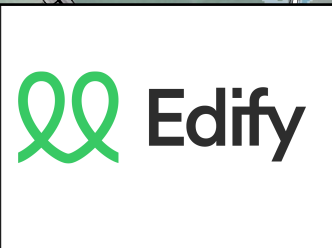
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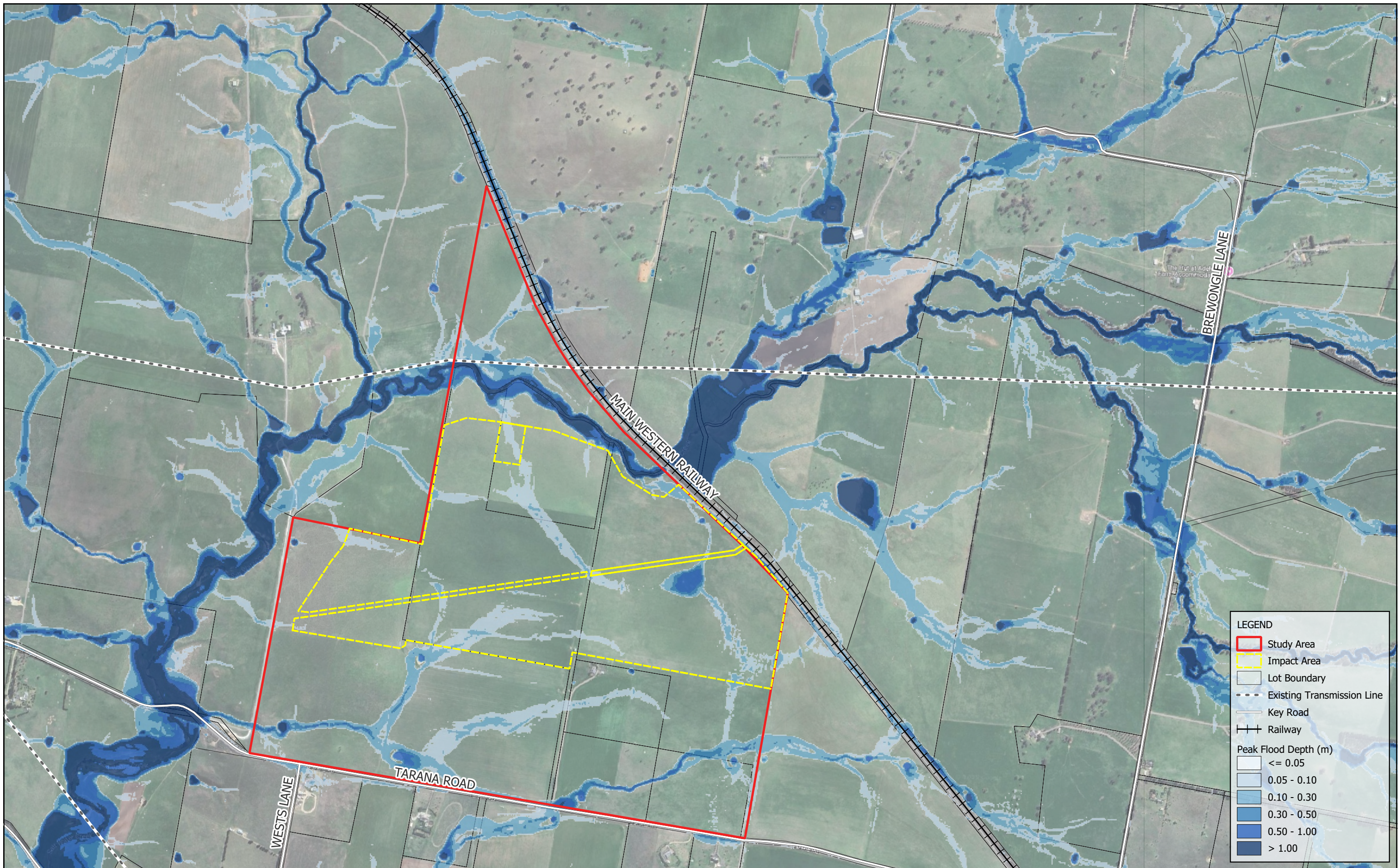
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Edify Brewongle Solar Farm  
 Figure A3  
 Existing Conditions - 0.5% AEP Peak Flood Depth  
 Drg Ref. NTL00206\_0015-FIG-A3



**LEGEND**

- Study Area
- Impact Area
- Lot Boundary
- Existing Transmission Line
- Key Road
- Railway

Peak Flood Depth (m)


- <= 0.05
- 0.05 - 0.10
- 0.10 - 0.30
- 0.30 - 0.50
- 0.50 - 1.00
- > 1.00

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APPROVED	LV	DATE	19/02/25

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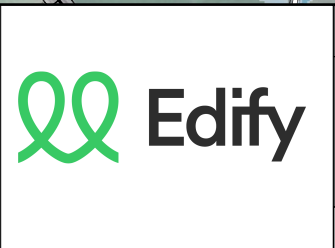


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SCALE @ A3 - 1:15,000  
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Figure A4  
Existing Conditions - 0.2% AEP Peak Flood Depth

Drg Ref. NTL00206\_0015-FIG-A4



**LEGEND**

- Study Area
- Impact Area
- Lot Boundary
- Existing Transmission Line
- Key Road
- Railway

**Peak Flood Depth (m)**

- $\le 0.05$
- 0.05 - 0.10
- 0.10 - 0.30
- 0.30 - 0.50
- 0.50 - 1.00
- > 1.00

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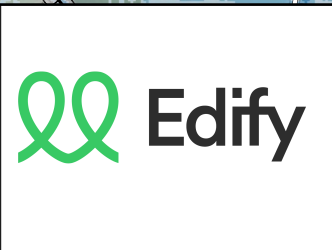
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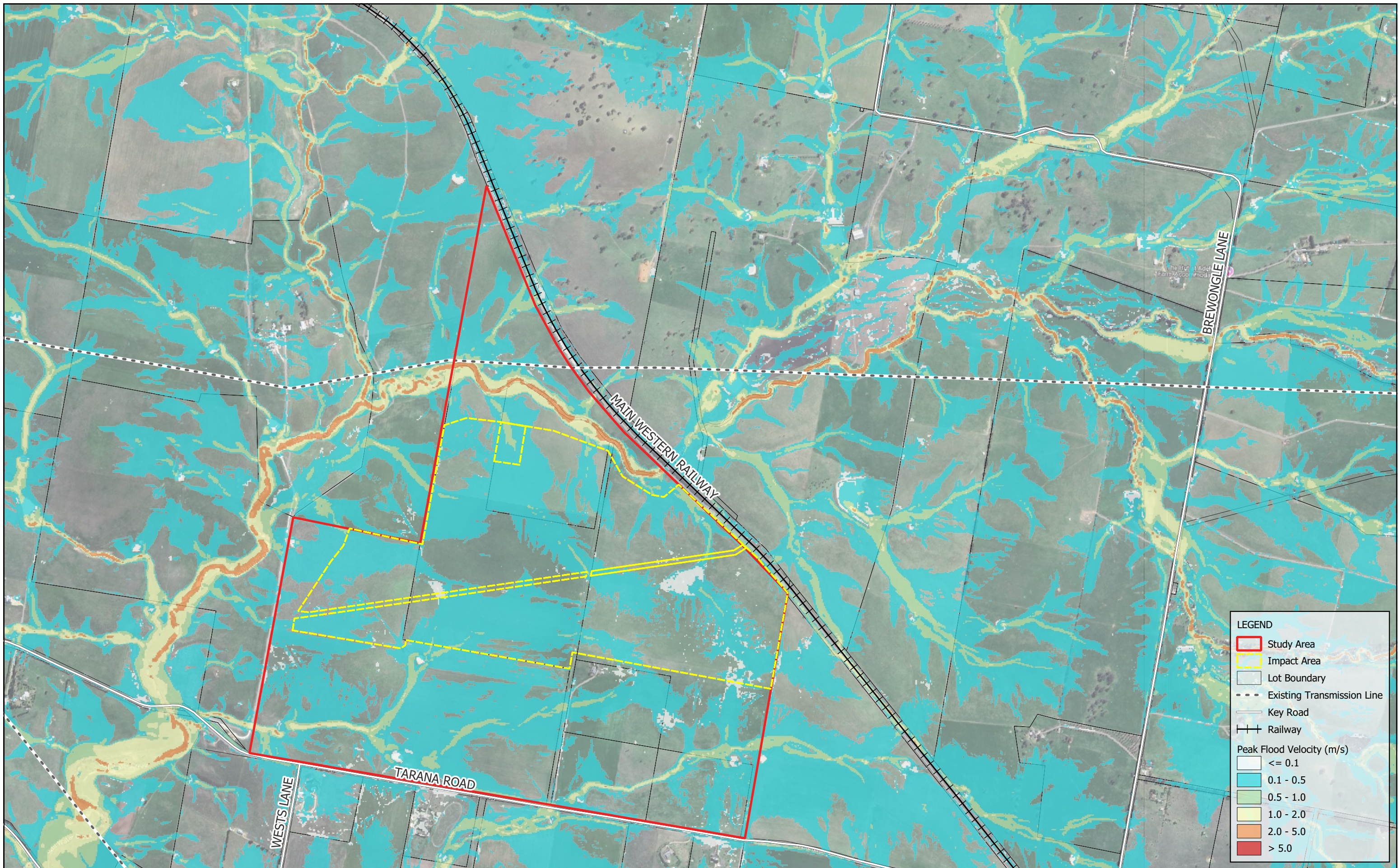
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Google Maps



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Figure A5  
Existing Conditions - Probable Maximum Flood (PMF) Peak Flood Depth

Drg Ref. NTL00206\_0015-FIG-A5

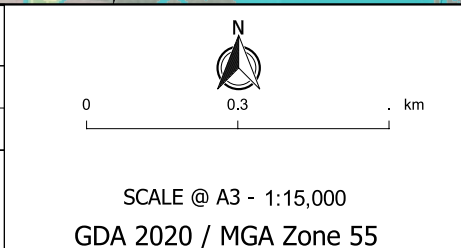


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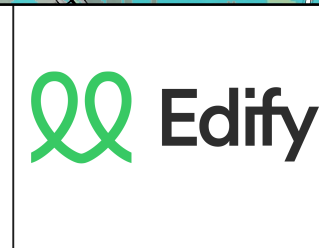
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APPROVED	LV	DATE	19/02/25

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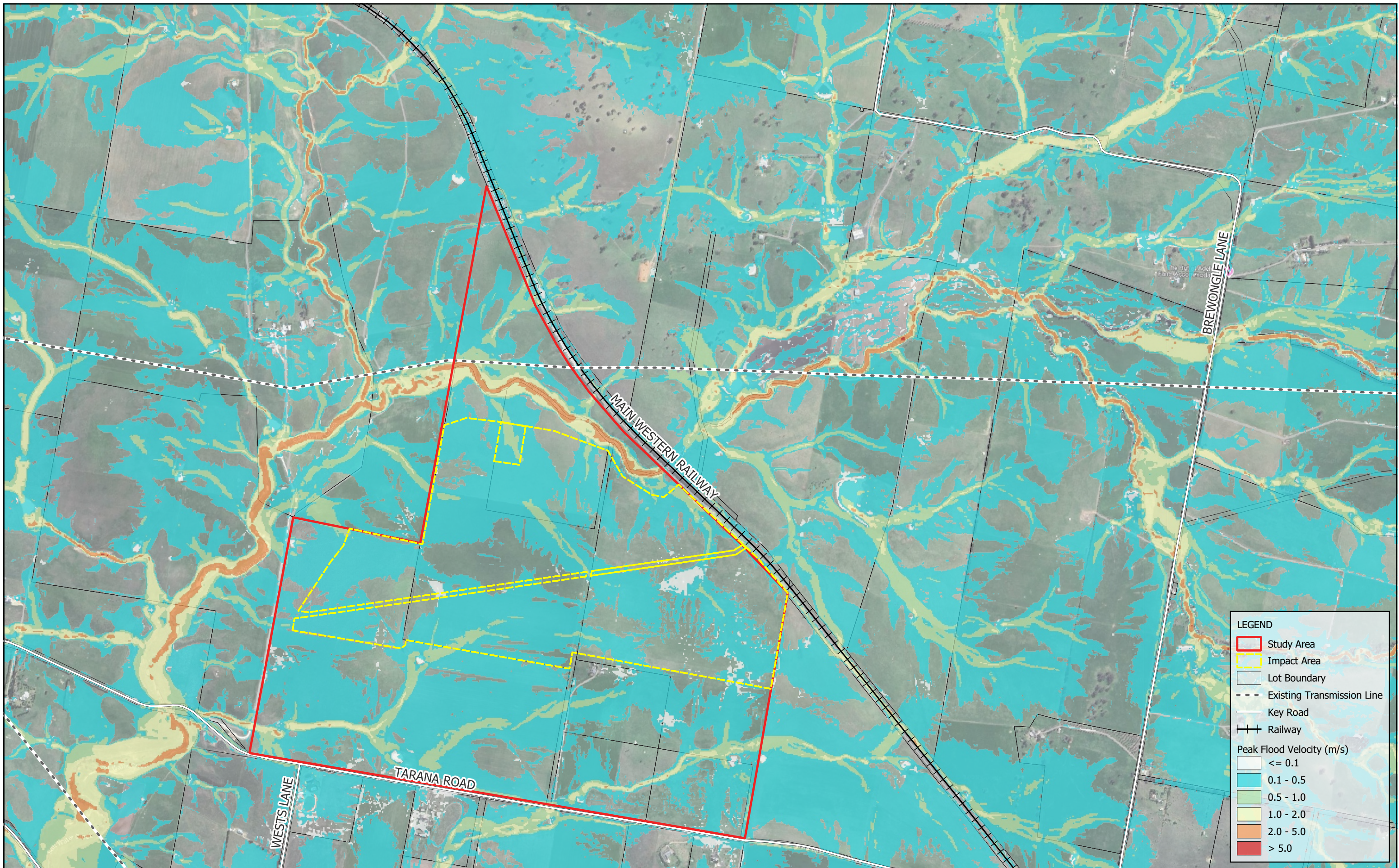


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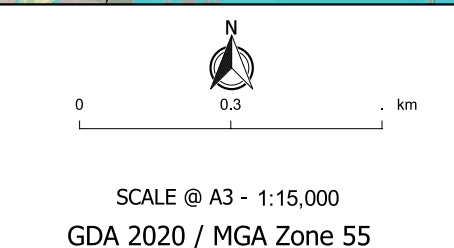
Edify Brewongle Solar Farm	
Figure A6	- 5% AEP Peak Flood
Velocity	
Drg Ref. NTL00206_0015-FIG-A6	



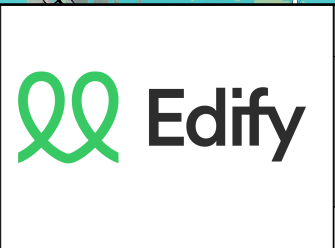
R	DETAILS	DATE
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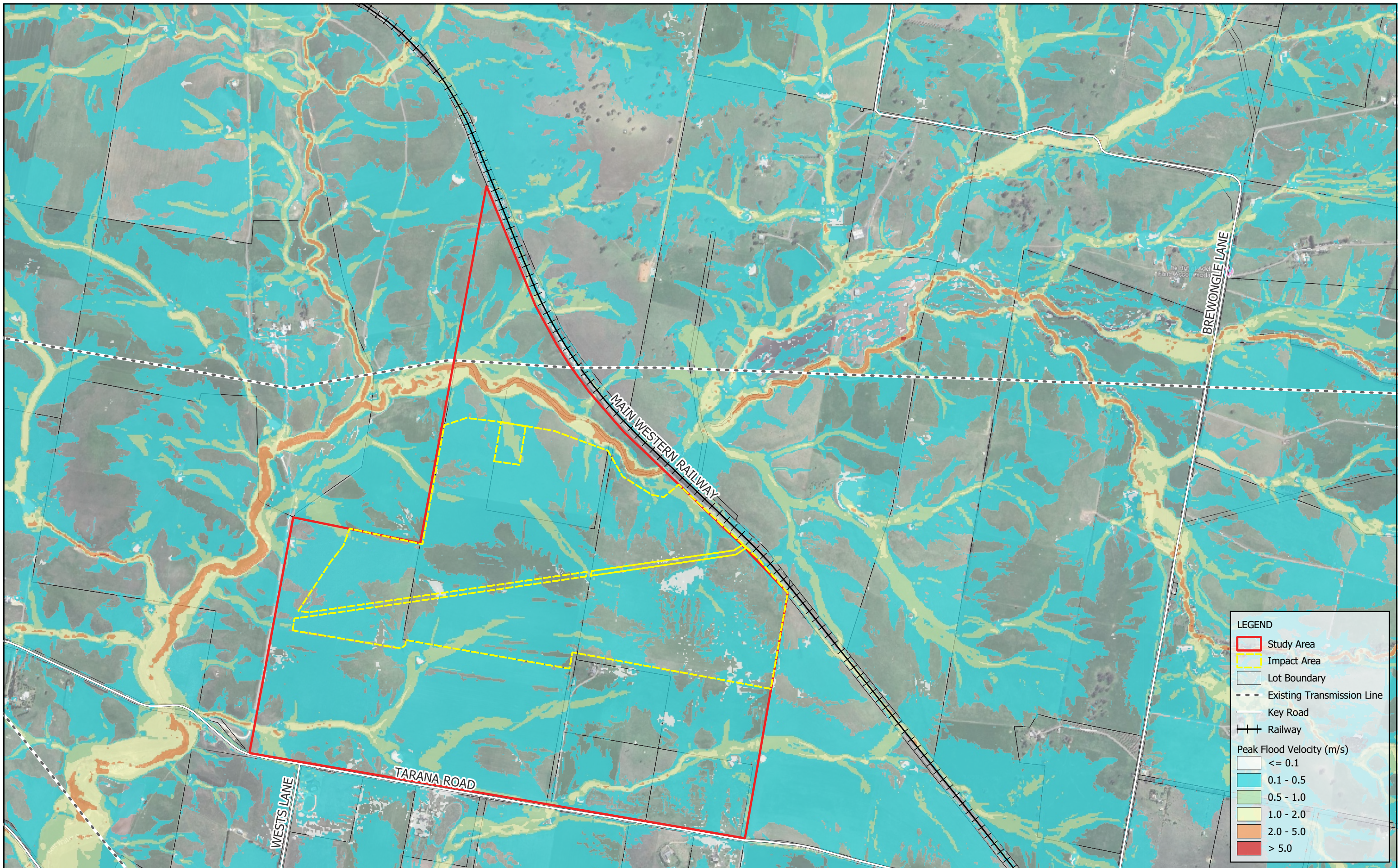
DRAWN	IR	CHECKED	LV
APPROVED	LV	DATE	19/02/25
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Figure A7	- 1% AEP Peak Flood
Velocity	
Drg Ref. NTL00206_0015-FIG-A7	

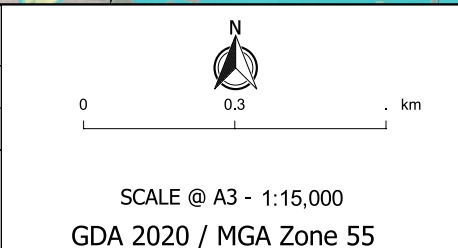


R	DETAILS	DATE
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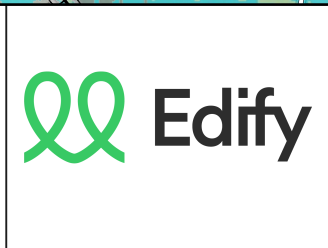
DRAWN	IR	CHECKED	LV
APPROVED	LV	DATE	19/02/25

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Figure A8  
Existing Conditions - 0.5% AEP Peak Flood Velocity

Drg Ref. NTL00206\_0015-FIG-A8

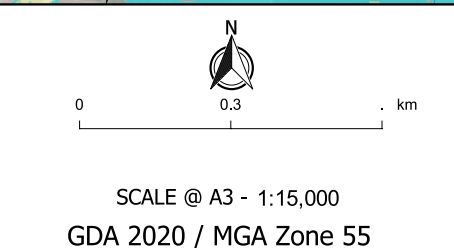


R	DETAILS	DATE
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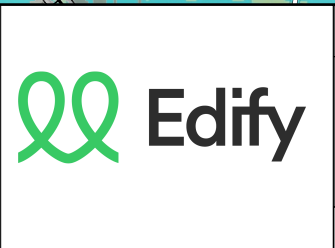
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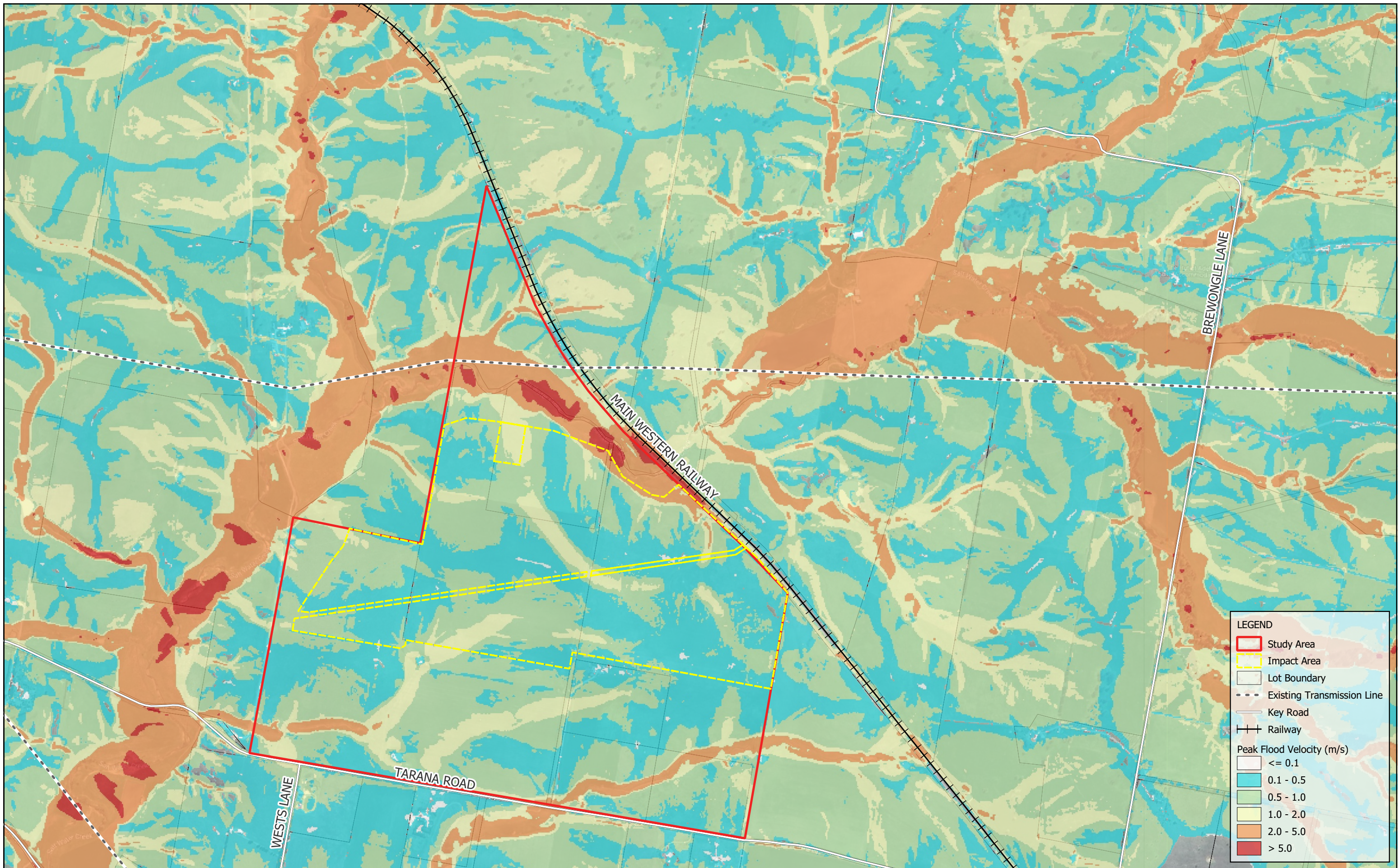
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Figure A9	- . AEP Peak Flood
Velocity	
Drg Ref. NTL00206_0015-FIG-A9	

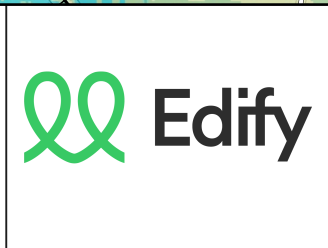


R	DETAILS	DATE
1	Final Issue	-

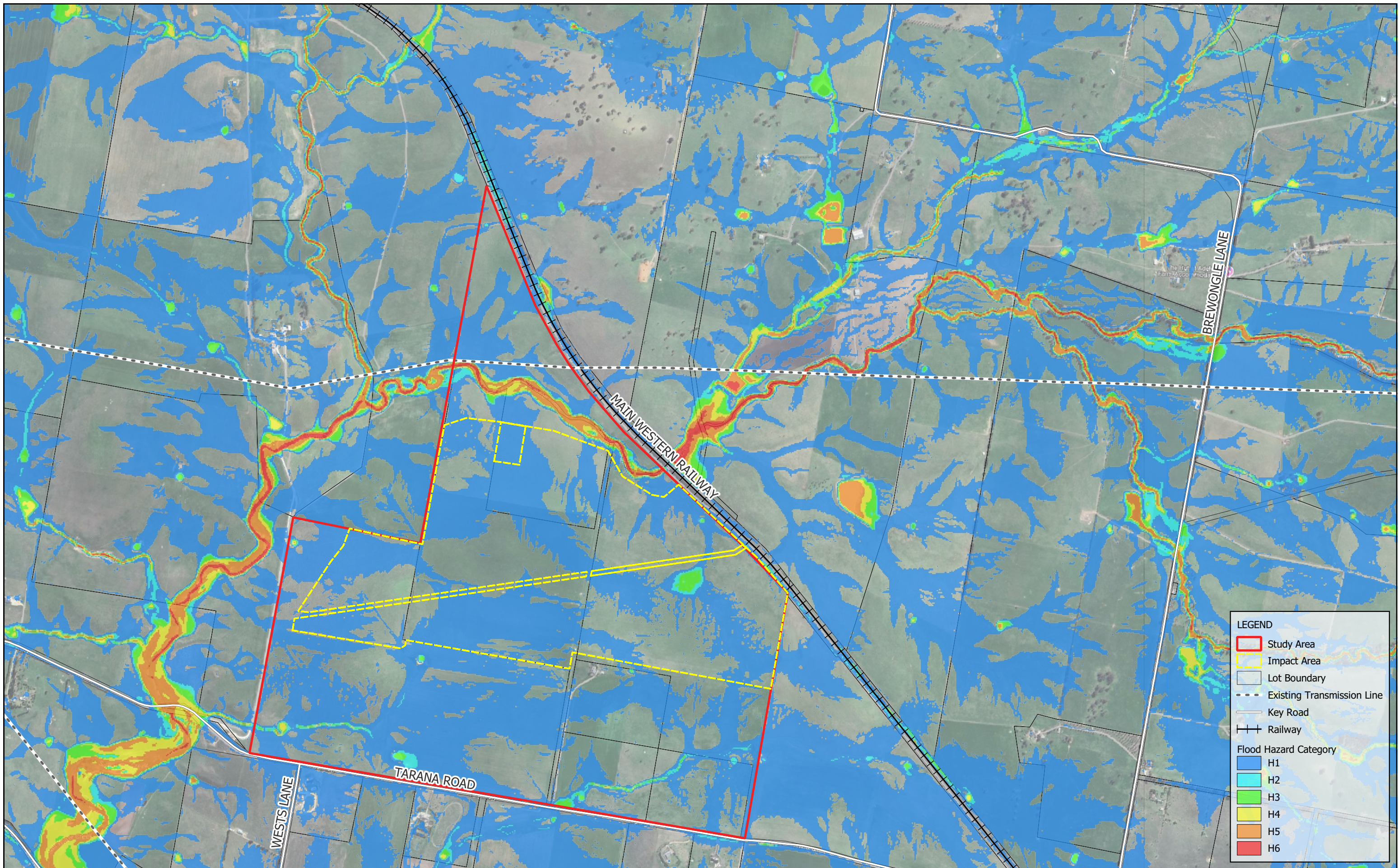
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NOTES:			

  
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 SCALE @ A3 - 1:15,000  
 GDA 2020 / MGA Zone 55

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 Figure A10  
 Existing Conditions - Probable Maximum Flood (PMF) Peak Flood Velocity  
 Drg Ref. NTL00206\_0015-FIG-A10



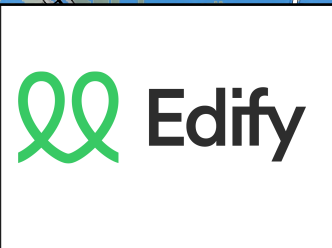
R	DETAILS	DATE
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APPROVED	LV	DATE	19/02/25
NOTES:			

  
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 SCALE @ A3 - 1:15,000  
 GDA 2020 / MGA Zone 55

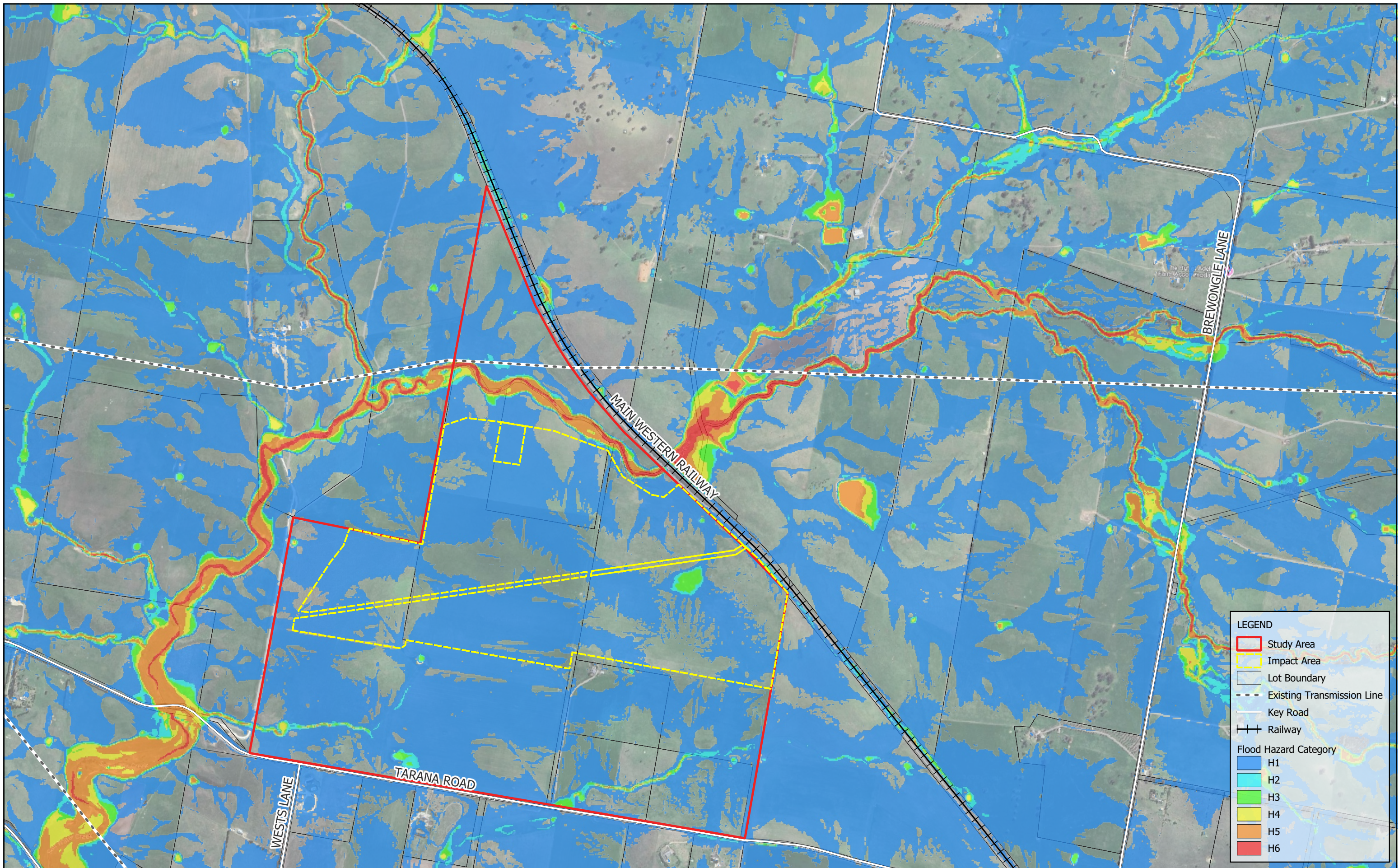
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Figure A11  
 Existing Conditions - 5% AEP Flood Hazard Categorisation


Drg Ref. NTL00206\_0015-FIG-A11



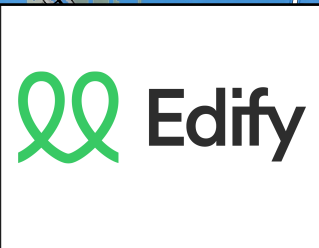
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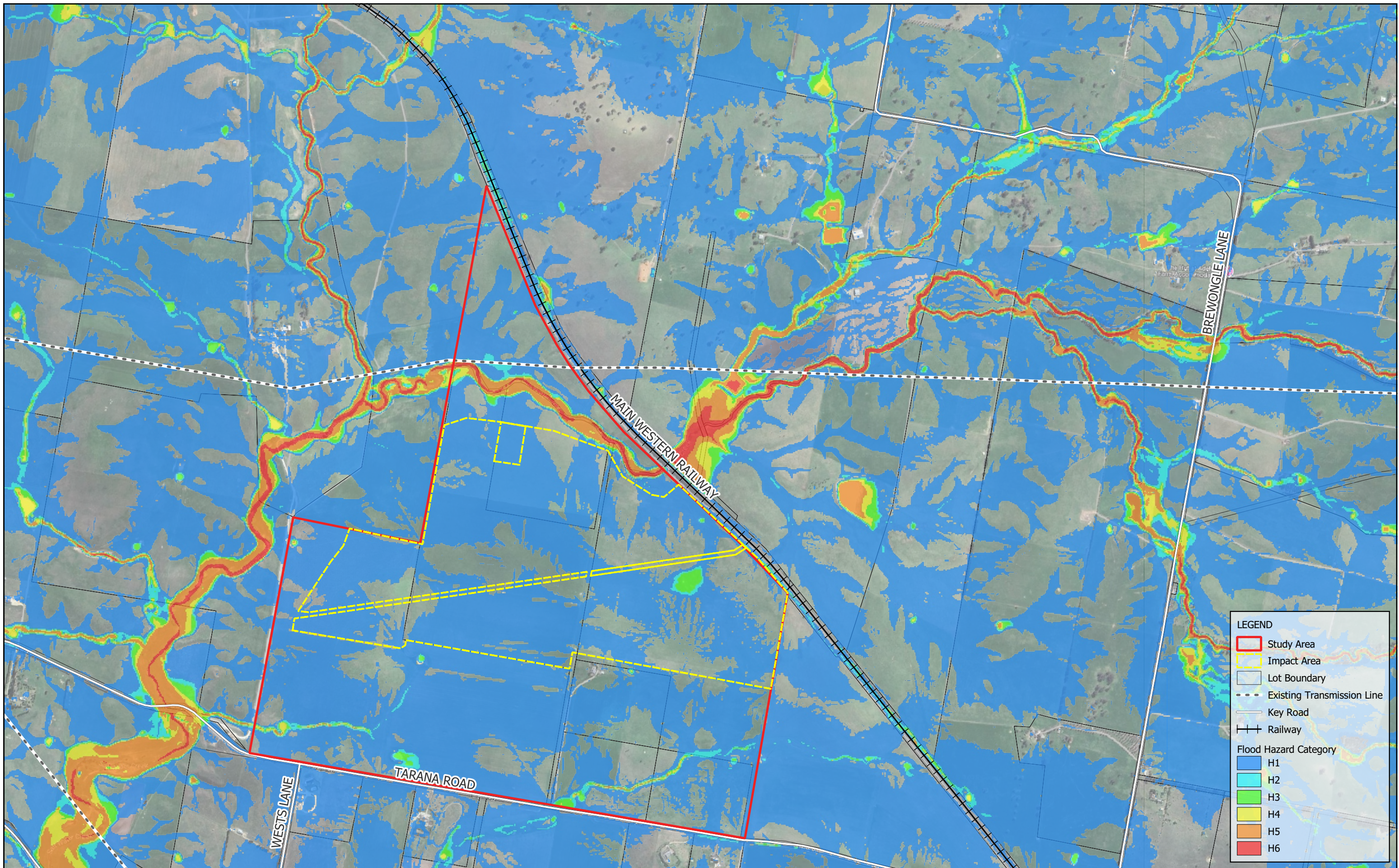
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APPROVED	LV	DATE	19/02/25
NOTES:			

  
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 SCALE @ A3 - 1:15,000  
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 Figure A12  
 Existing Conditions - 1% AEP Flood Hazard Categorisation  
 Drg Ref. NTL00206\_0015-FIG-A12



**LEGEND**

- Study Area
- Impact Area
- Lot Boundary
- Existing Transmission Line
- Key Road
- Railway

**Flood Hazard Category**

- H1
- H2
- H3
- H4
- H5
- H6

R	DETAILS	DATE
1	Final Issue	-

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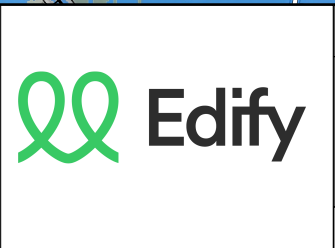
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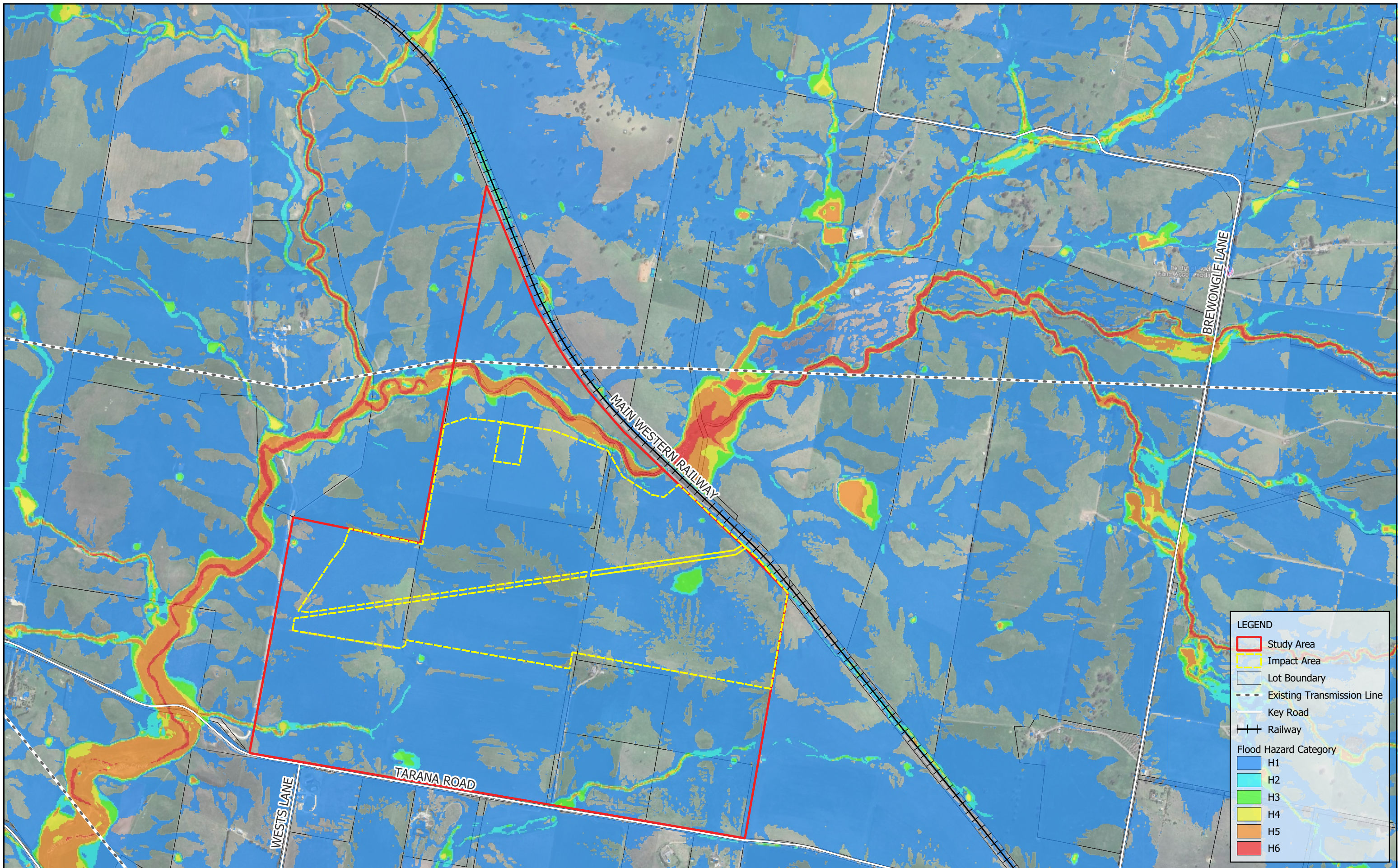
DATA SOURCE  
Google Maps



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Figure A13  
Existing Conditions - 0.5% AEP Flood Hazard Categorisation

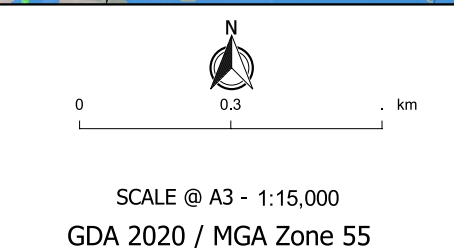
Drg Ref. NTL00206\_0015-FIG-A13



R	DETAILS	DATE
1	Final Issue	-

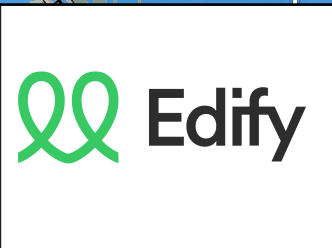
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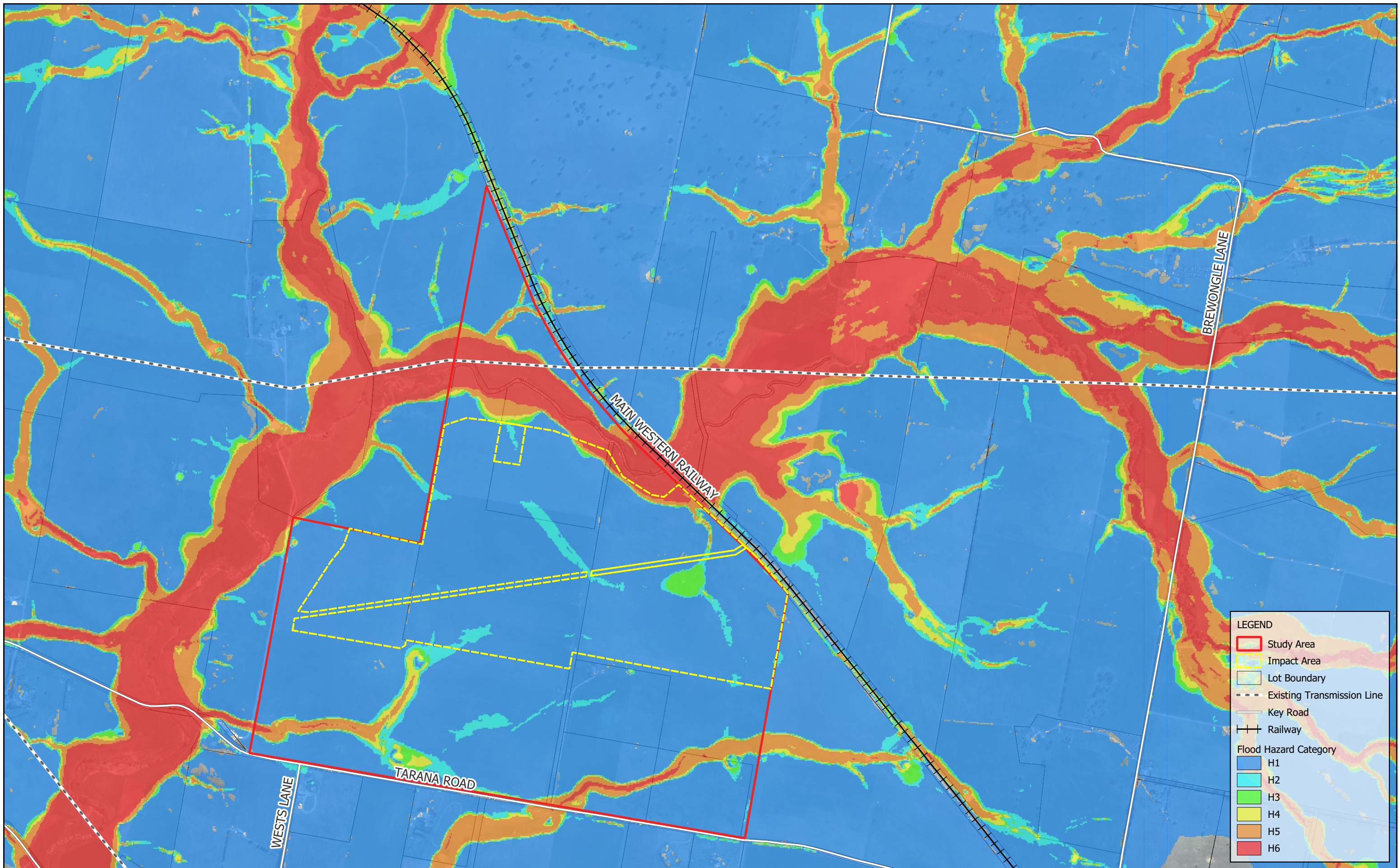
DATA SOURCE  
Google Maps



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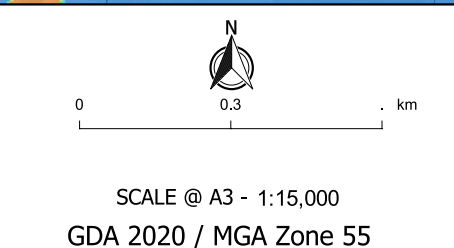
Figure A14  
Existing Conditions - 0.2% AEP Flood Hazard Categorisation

Drg Ref. NTL00206\_0015-FIG-A14



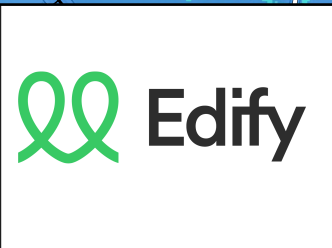
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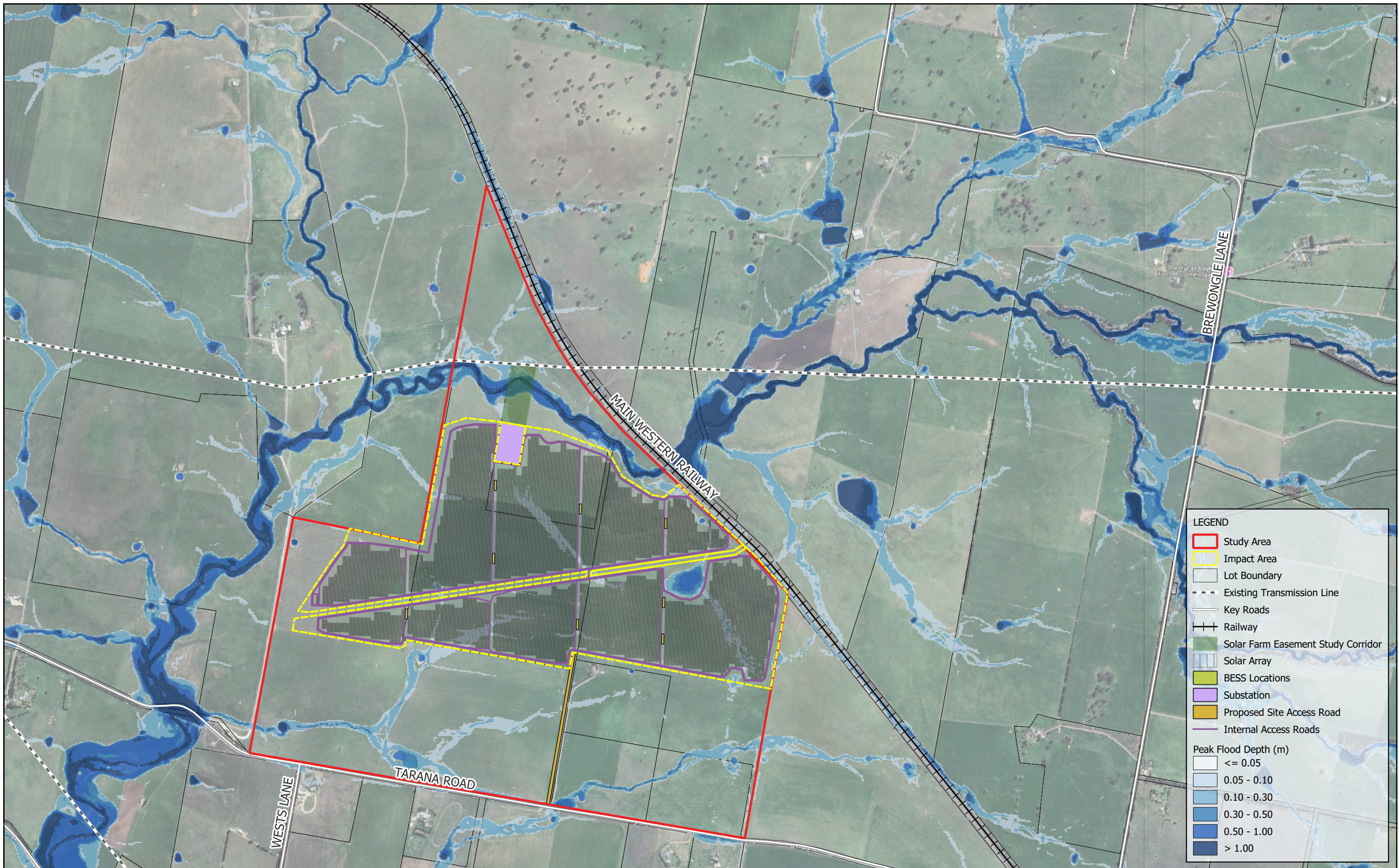
Figure A15  
Existing Conditions - Probable Maximum Flood (PMF) Flood Hazard Categorisation

Drg Ref. NTL00206\_0015-FIG-A15

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# APPENDIX B: DEVELOPED CONDITION FLOOD MODEL RESULTS





**LEGEND**

- Study Area
- Impact Area
- Lot Boundary
- Existing Transmission Line
- Key Roads
- Railway
- Solar Farm Easement Study Corridor
- Solar Array
- BESS Locations
- Substation
- Proposed Site Access Road
- Internal Access Roads

**Peak Flood Depth (m)**

- <= 0.05
- 0.05 - 0.10
- 0.10 - 0.30
- 0.30 - 0.50
- 0.50 - 1.00
- > 1.00

R	DETAILS	DATE
1	Final Issue	-

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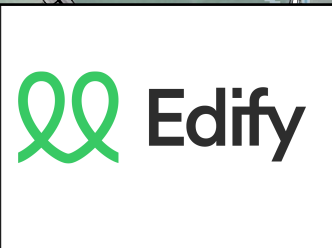
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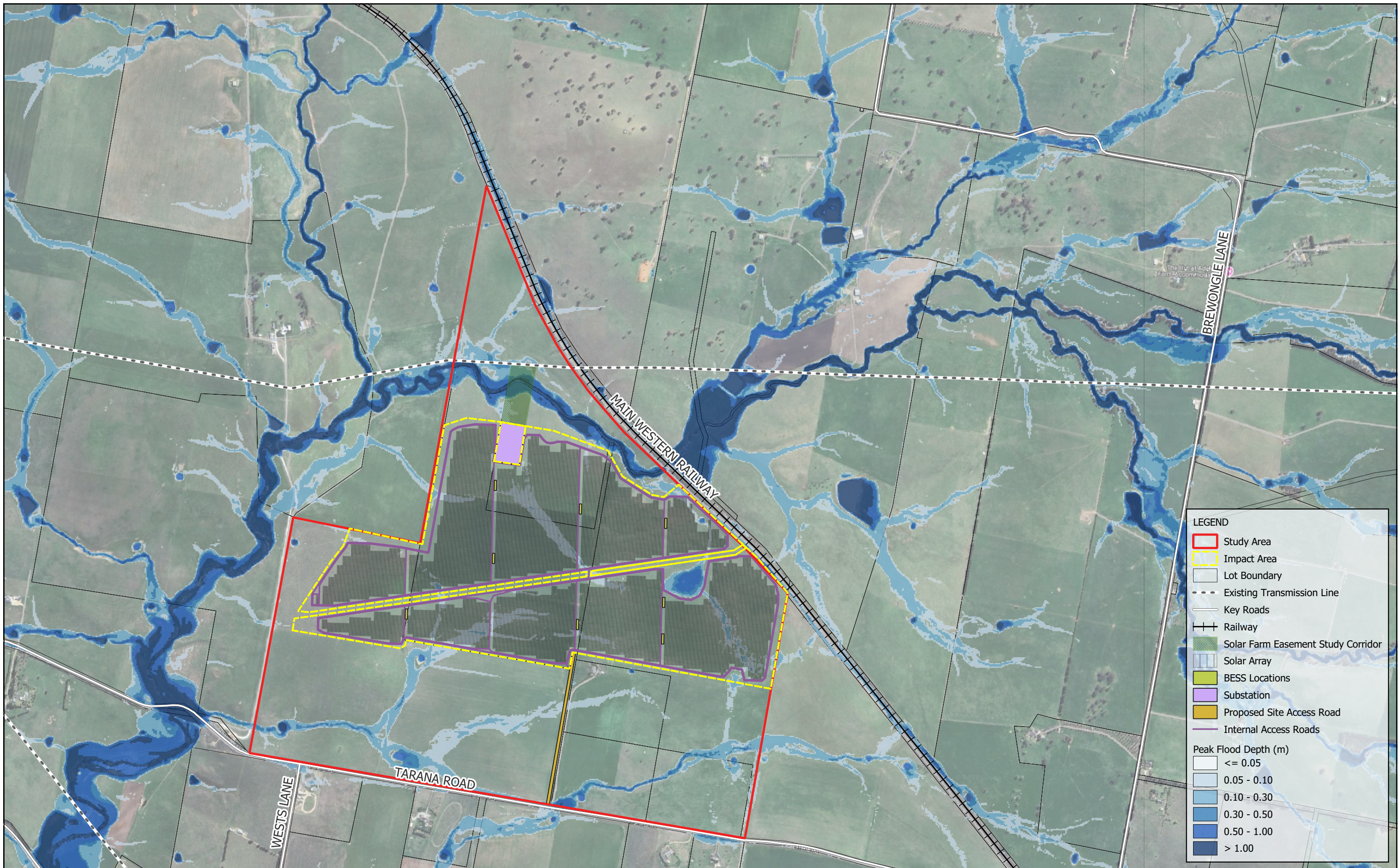
DATA SOURCE  
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Edify Brewongle Solar Farm

Figure B1  
Developed Conditions - 5% AEP Peak Flood Depth

Drg Ref. NTL00206\_0015-FIG-B1



**LEGEND**

- Study Area
- Impact Area
- Lot Boundary
- Existing Transmission Line
- Key Roads
- Railway
- Solar Farm Easement Study Corridor
- Solar Array
- BESS Locations
- Substation
- Proposed Site Access Road
- Internal Access Roads

**Peak Flood Depth (m)**

- <= 0.05
- 0.05 - 0.10
- 0.10 - 0.30
- 0.30 - 0.50
- 0.50 - 1.00
- > 1.00

R	DETAILS	DATE
1	Final Issue	-

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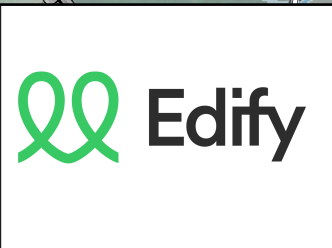
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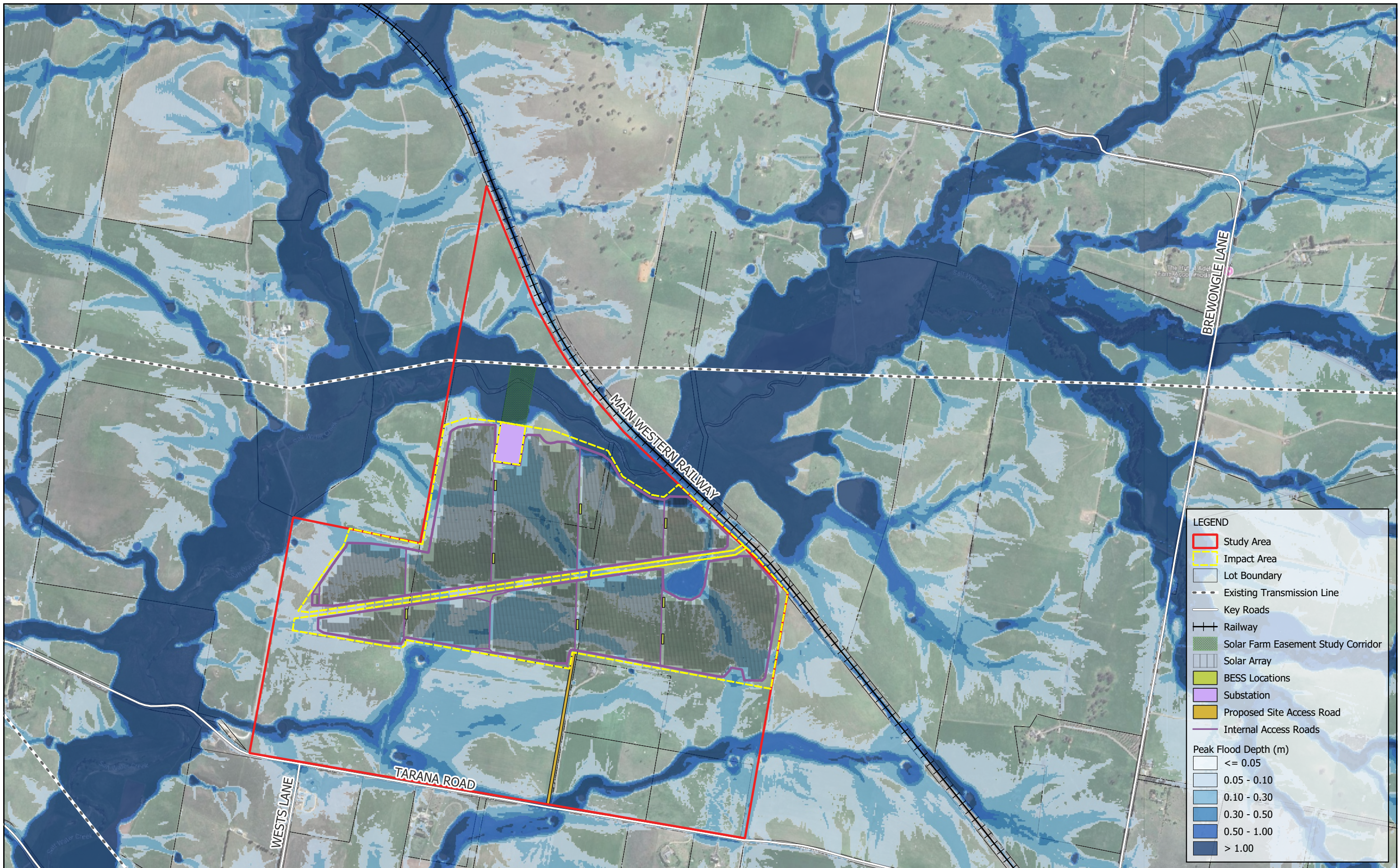
DATA SOURCE  
Google Maps



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Figure B2  
Developed Conditions - 1% AEP Peak Flood Depth

Drg Ref. NTL00206\_0015-FIG-B2

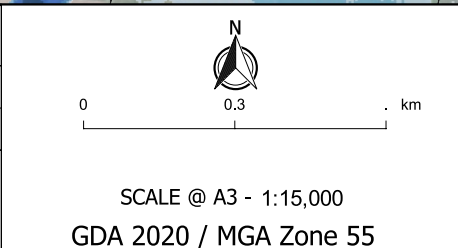


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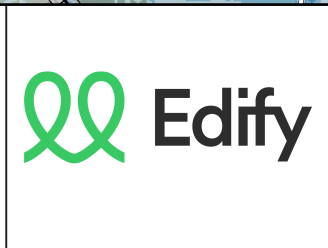
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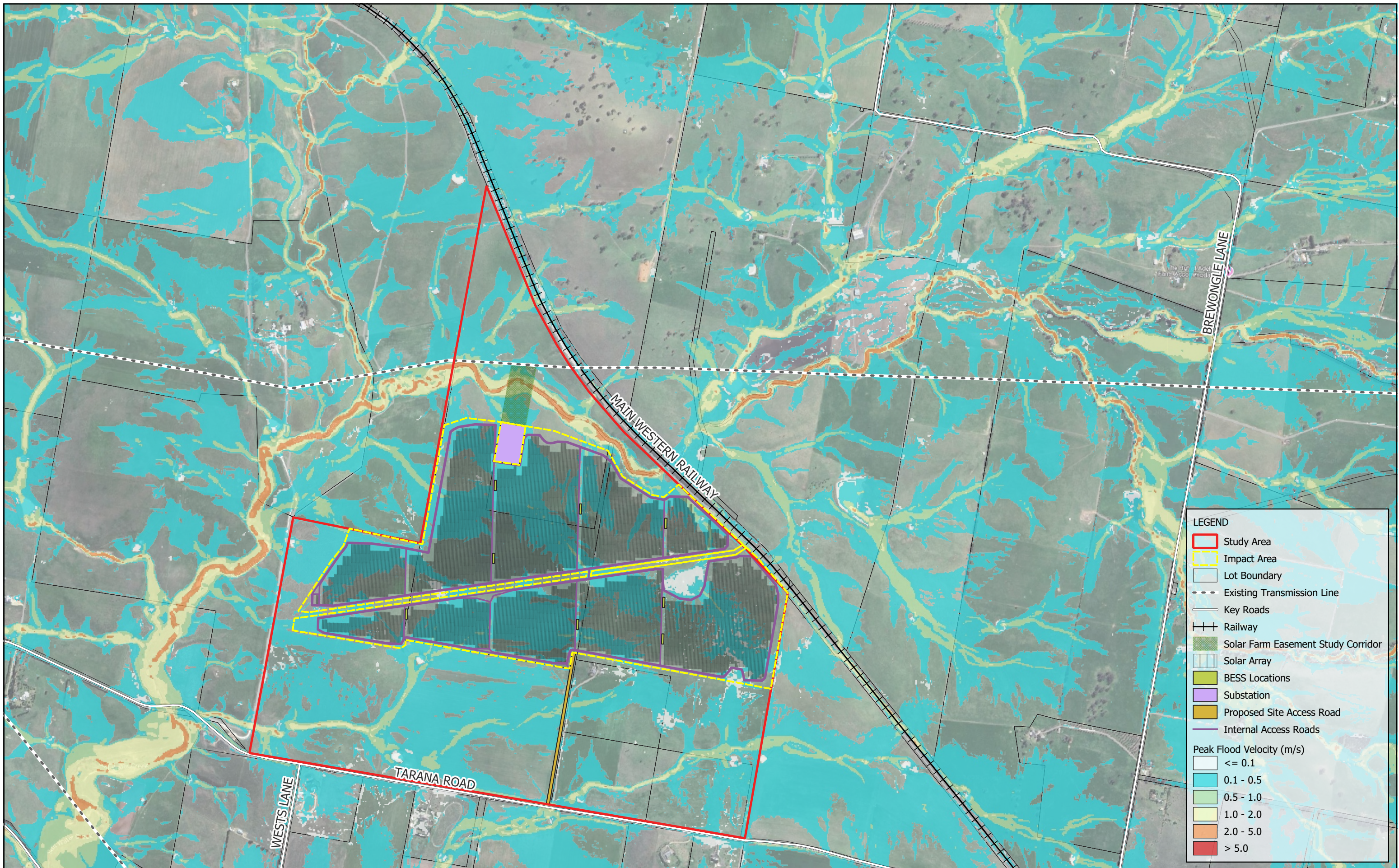
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Figure B3  
Developed Conditions - Probable Maximum Flood (PMF) Peak Flood Depth

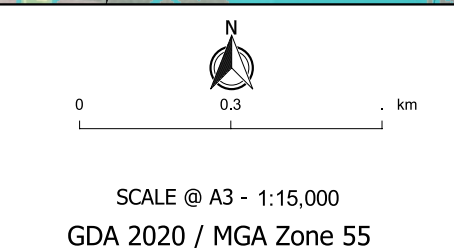
Drg Ref. NTL00206\_0015-FIG-B3



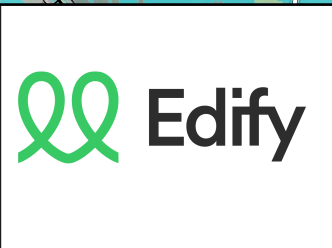
R	DETAILS	DATE
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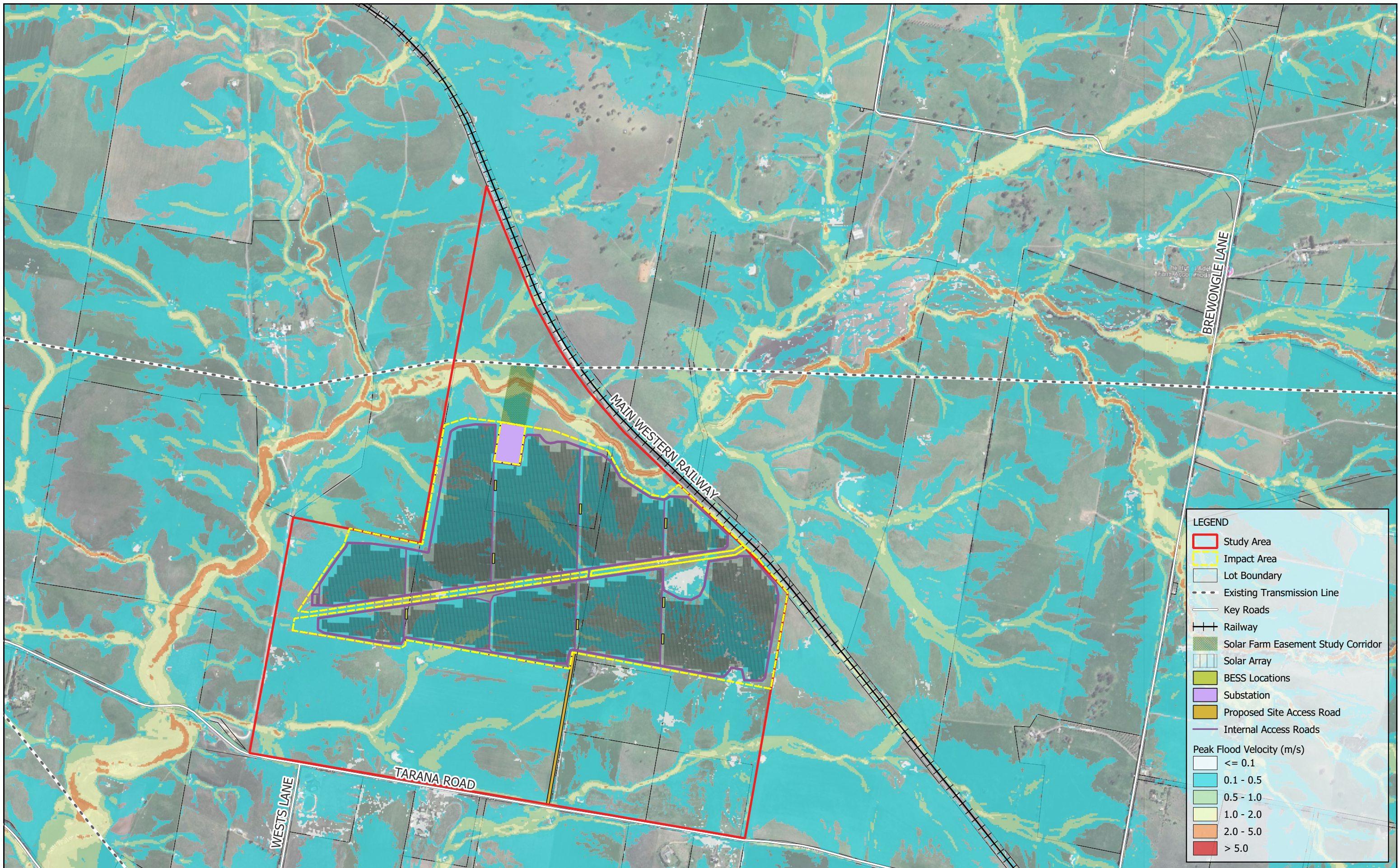
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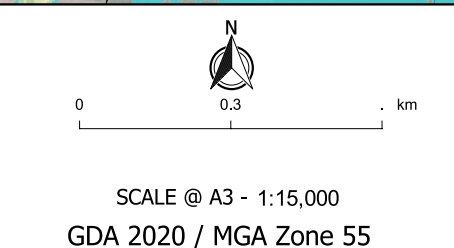


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Figure B4  
Developed Conditions - 5% AEP Peak Flood Velocity  
Drg Ref. NTL00206\_0015-FIG-B4

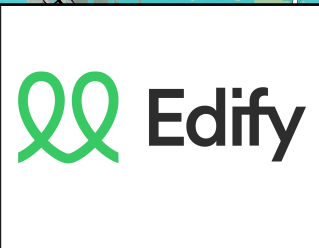


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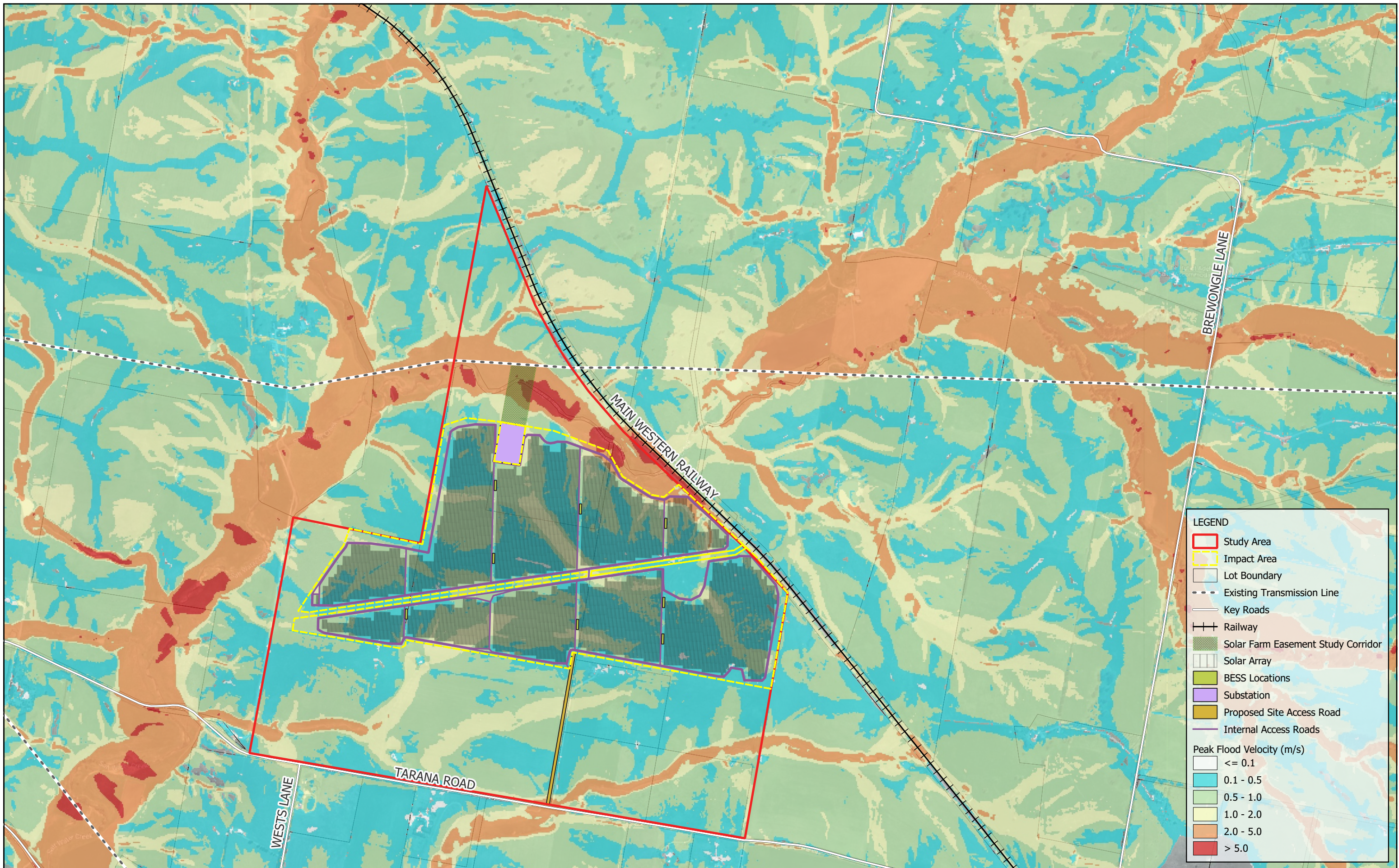
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Edify Brewongle Solar Farm
Figure B5 Developed Conditions - 1% AEP Peak Flood Velocity
Drg Ref. NTL00206_0015-FIG-B5



**LEGEND**

- Study Area
- Impact Area
- Lot Boundary
- Existing Transmission Line
- Key Roads
- Railway
- Solar Farm Easement Study Corridor
- Solar Array
- BESS Locations
- Substation
- Proposed Site Access Road
- Internal Access Roads

**Peak Flood Velocity (m/s)**

- <= 0.1
- 0.1 - 0.5
- 0.5 - 1.0
- 1.0 - 2.0
- 2.0 - 5.0
- > 5.0

R	DETAILS	DATE
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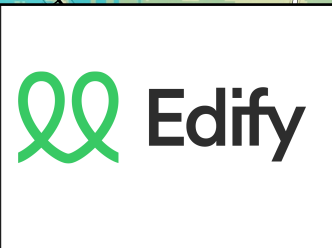
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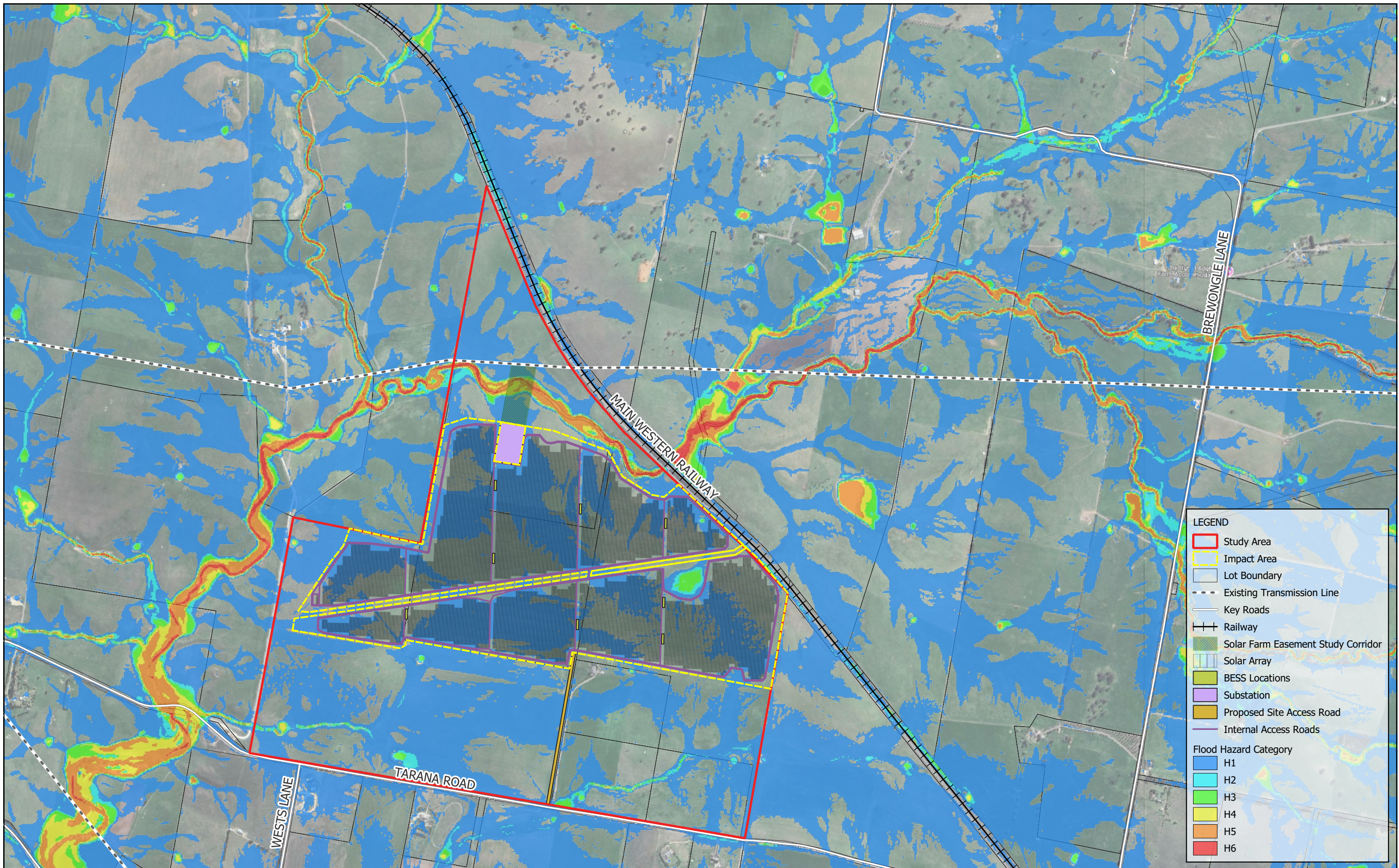
DATA SOURCE  
Google Maps



Edify Brewongle Solar Farm


Figure B6  
Developed Conditions - Probable Maximum Flood (PMF) Peak Flood Velocity

Drg Ref. NTL00206\_0015-FIG-B6

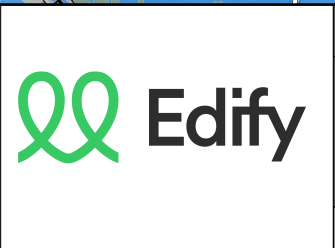


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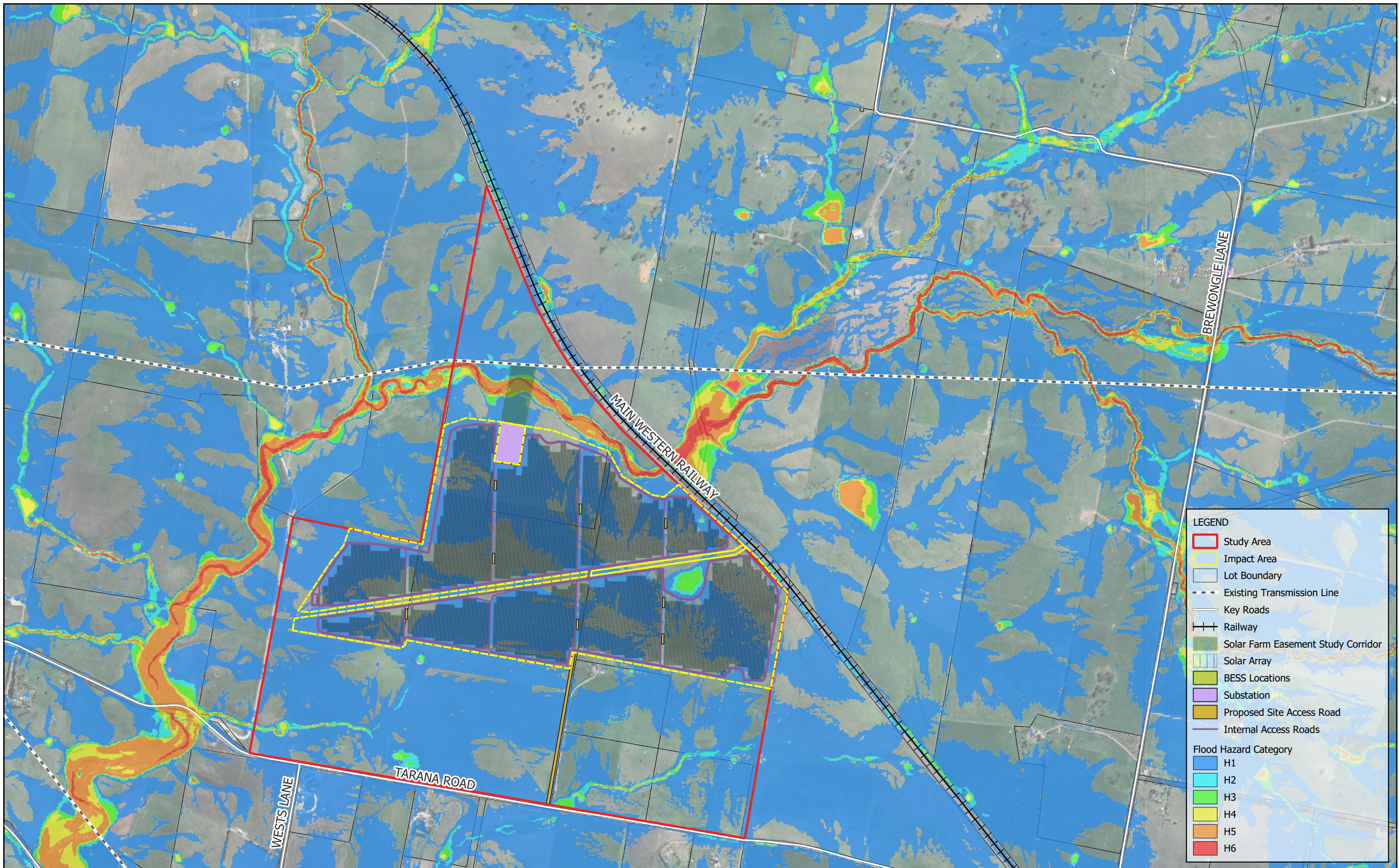
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DRAWN	IR	CHECKED	LV
APPROVED	LV	DATE	19/02/25
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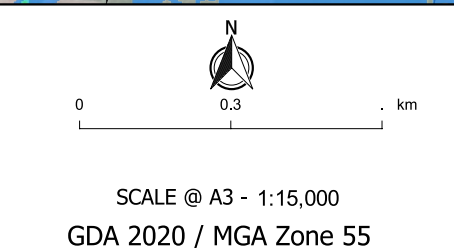


Edify Brewongle Solar Farm  
  
 Figure B7  
 Developed Conditions - 5% AEP Flood Hazard Categorisation  
  
 Drg Ref. NTL00206\_0015-FIG-B7



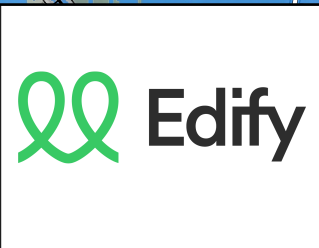
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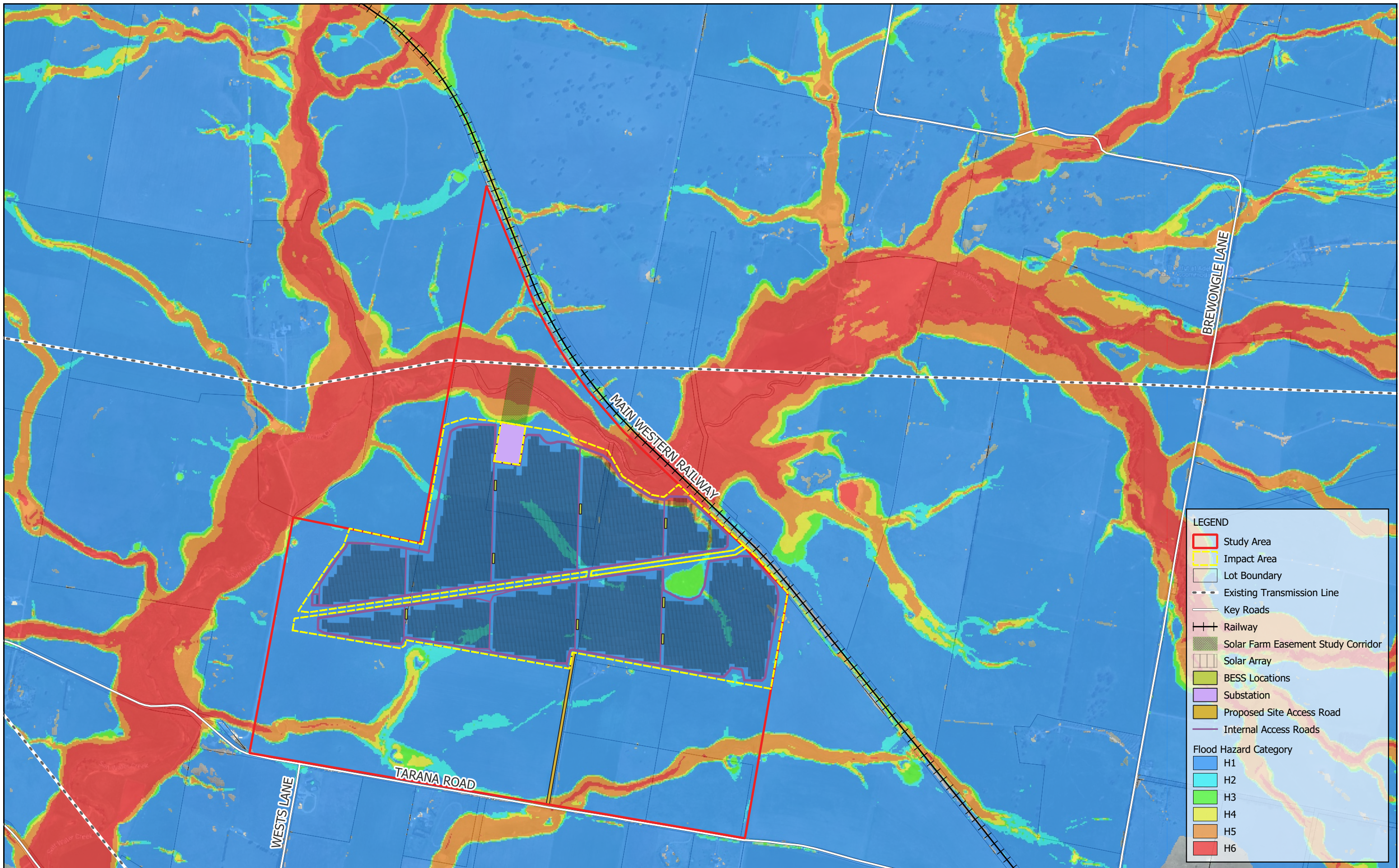
**DATA SOURCE**  
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Figure B8  
Developed Conditions - 1% AEP Flood Hazard Categorisation

Drg Ref. NTL00206\_0015-FIG-B8

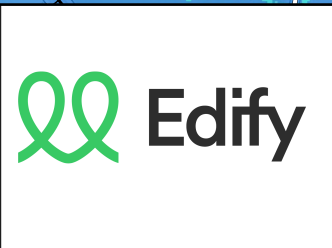


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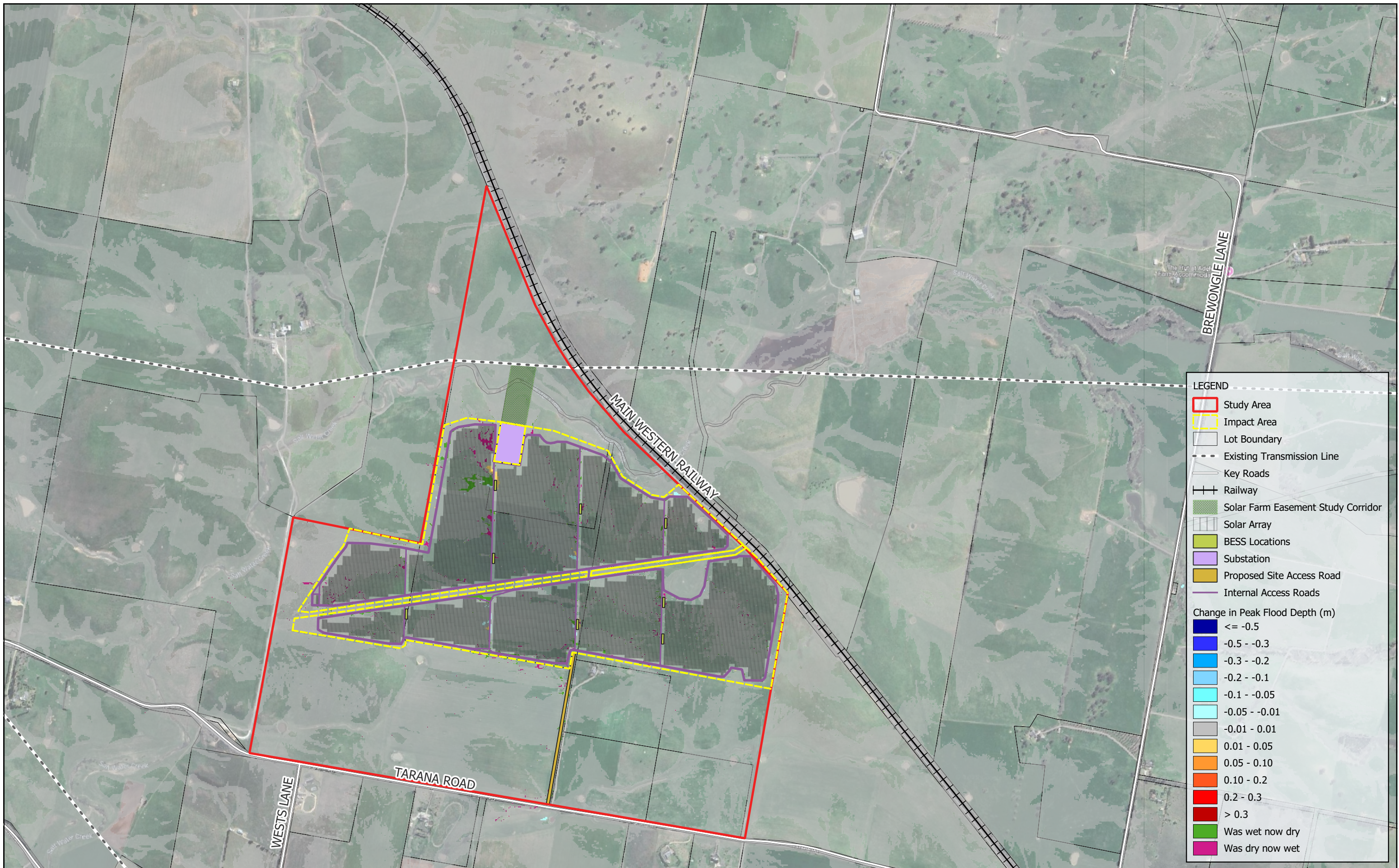
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**Edify Brewongle Solar Farm**  
 Figure B9  
 Developed Conditions - Probable Maximum Flood (PMF) Flood Hazard Categorisation  
 Drg Ref. NTL00206\_0015-FIG-B9



**LEGEND**

- Study Area
- Impact Area
- Lot Boundary
- Existing Transmission Line
- Key Roads
- Railway
- Solar Farm Easement Study Corridor
- Solar Array
- BESS Locations
- Substation
- Proposed Site Access Road
- Internal Access Roads

**Change in Peak Flood Depth (m)**

- <= -0.5
- 0.5 - -0.3
- 0.3 - -0.2
- 0.2 - -0.1
- 0.1 - -0.05
- 0.05 - -0.01
- 0.01 - 0.01
- 0.01 - 0.05
- 0.05 - 0.10
- 0.10 - 0.2
- 0.2 - 0.3
- > 0.3
- Was wet now dry
- Was dry now wet

R	DETAILS	DATE
1	Final Issue	-

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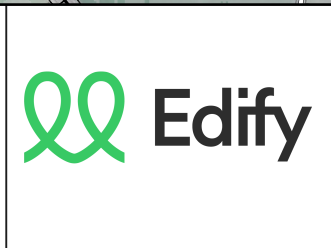
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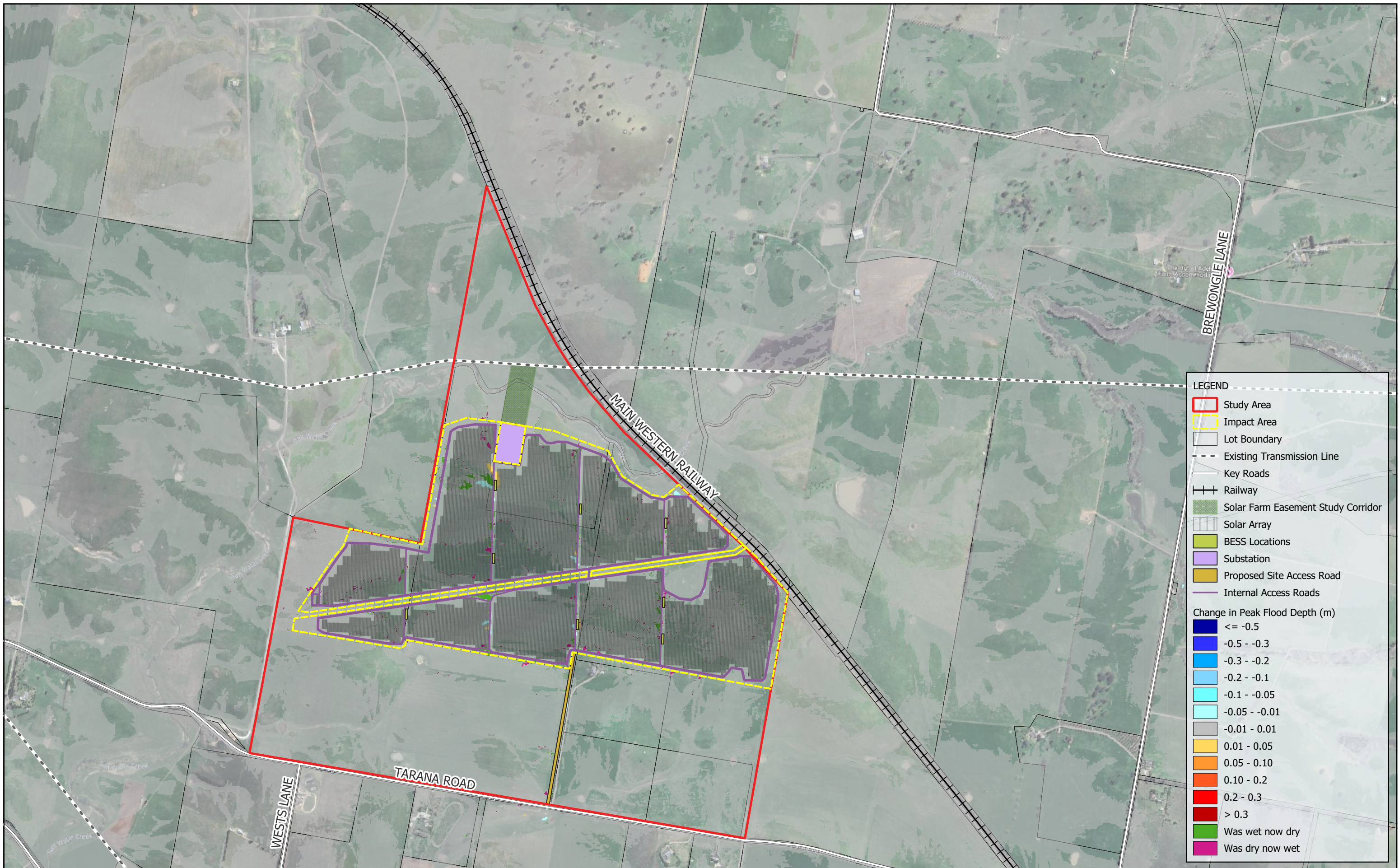
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Edify Brewongle Solar Farm

Figure B10  
Flood Afflux - 5% AEP Change in Peak Flood Depth

Drg Ref. NTL00206\_0015-FIG-B10



**LEGEND**

- Study Area
- Impact Area
- Lot Boundary
- Existing Transmission Line
- Key Roads
- Railway
- Solar Farm Easement Study Corridor
- Solar Array
- BESS Locations
- Substation
- Proposed Site Access Road
- Internal Access Roads

**Change in Peak Flood Depth (m)**

- <= -0.5
- 0.5 - -0.3
- 0.3 - -0.2
- 0.2 - -0.1
- 0.1 - -0.05
- 0.05 - -0.01
- 0.01 - 0.01
- 0.01 - 0.05
- 0.05 - 0.10
- 0.10 - 0.2
- 0.2 - 0.3
- > 0.3
- Was wet now dry
- Was dry now wet

R	DETAILS	DATE
1	Final Issue	-

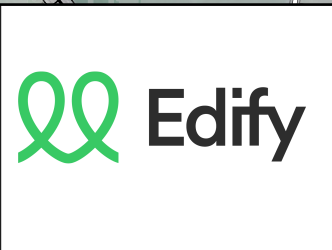
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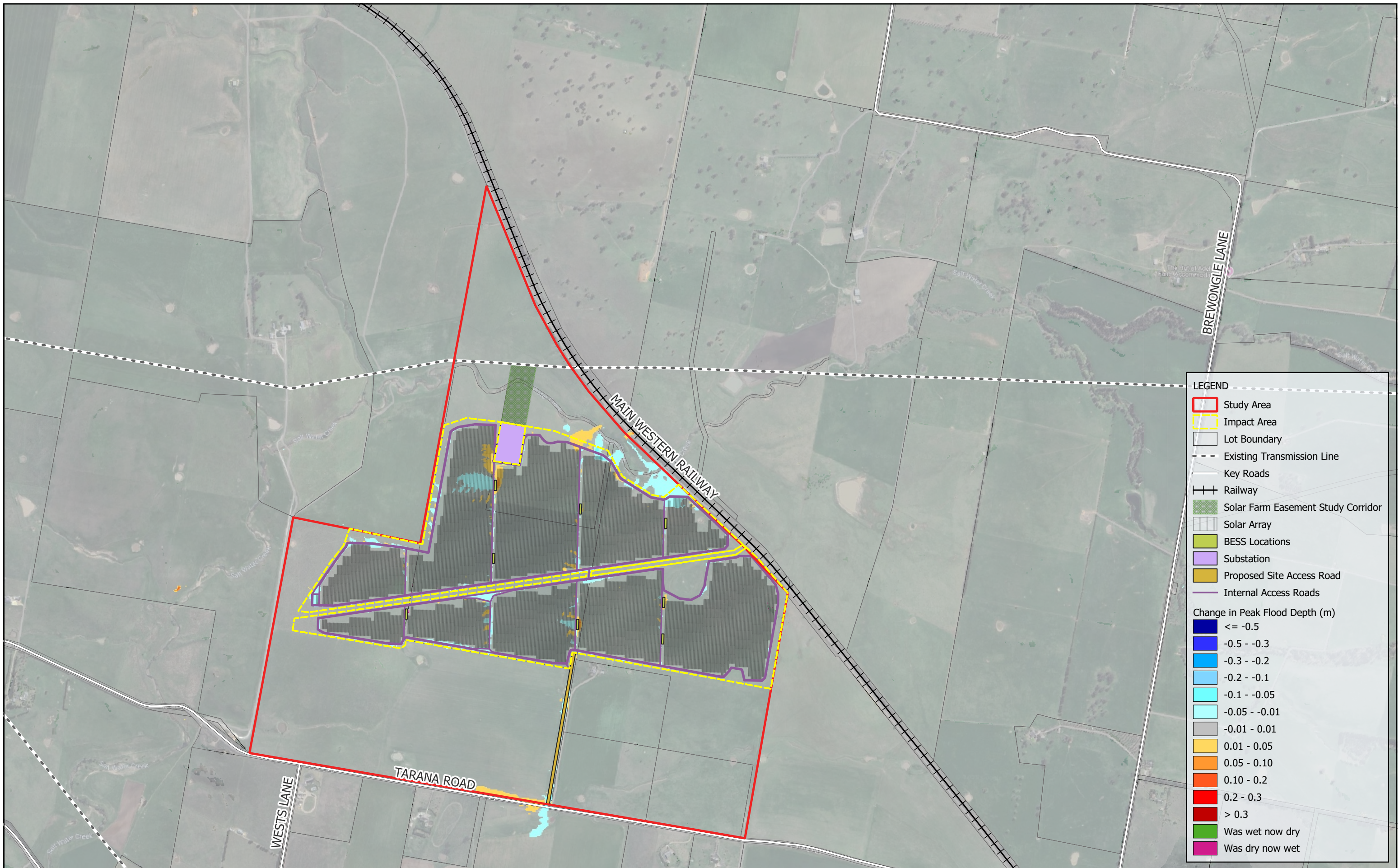
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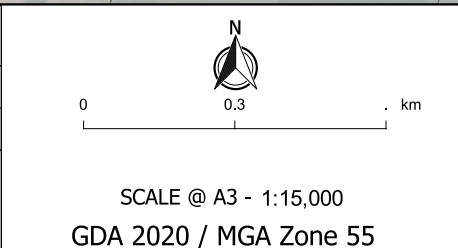
Figure B11  
Flood Afflux - 1% AEP Change in Peak Flood Depth

Drg Ref. NTL00206\_0015-FIG-B11

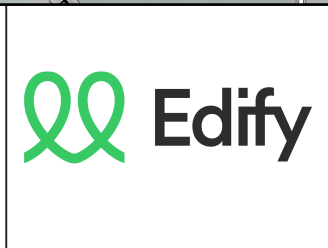


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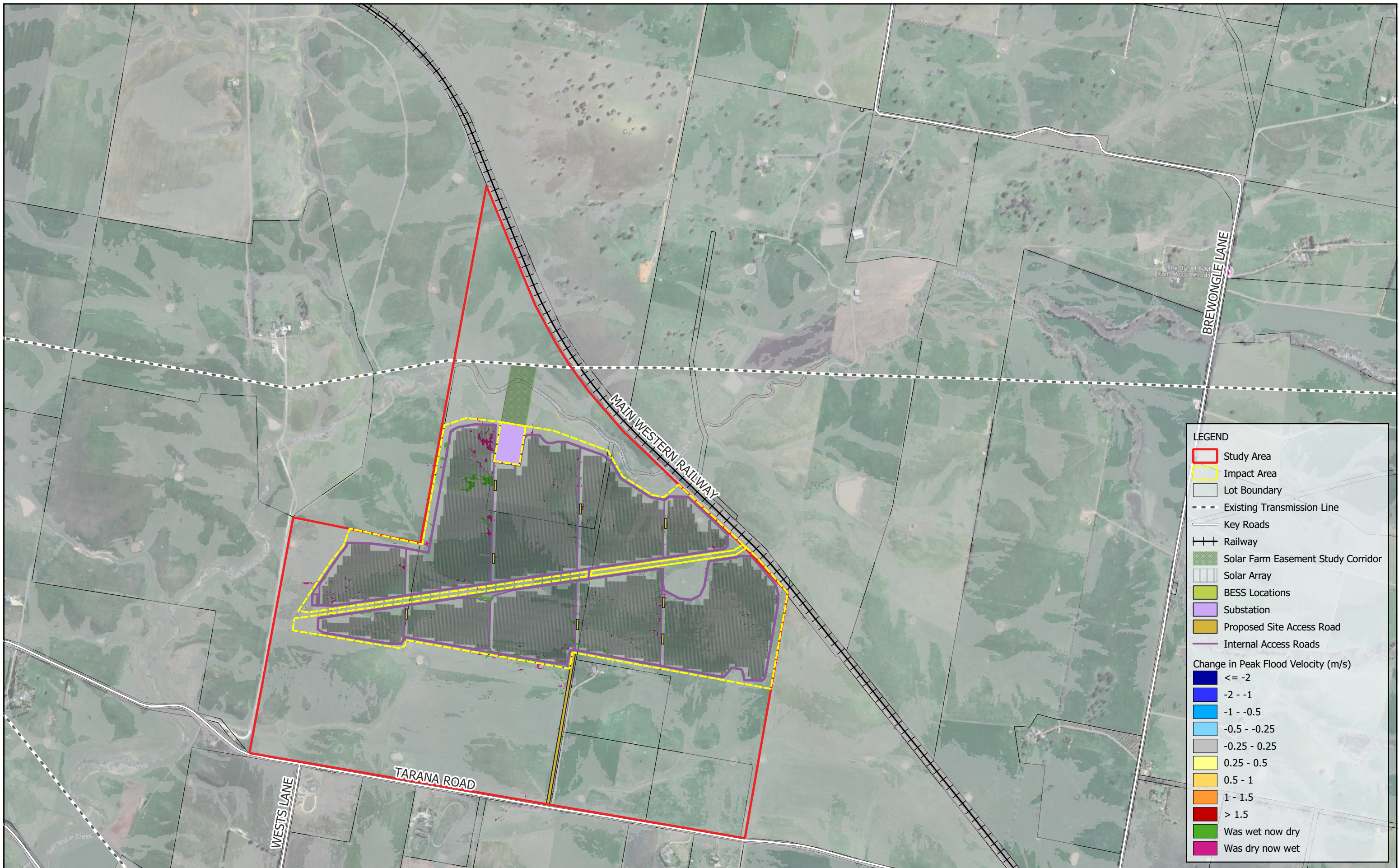
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Figure B12  
Flood - Probable Maximum Flood (PMF) Change in Peak Flood Depth  
Drg Ref. NTL00206\_0015-FIG-B12



**LEGEND**

- Study Area
- Impact Area
- Lot Boundary
- Existing Transmission Line
- Key Roads
- Railway
- Solar Farm Easement Study Corridor
- Solar Array
- BESS Locations
- Substation
- Proposed Site Access Road
- Internal Access Roads

**Change in Peak Flood Velocity (m/s)**

- <= -2
- 2 - -1
- 1 - -0.5
- 0.5 - -0.25
- 0.25 - 0.25
- 0.25 - 0.5
- 0.5 - 1
- 1 - 1.5
- > 1.5
- Was wet now dry
- Was dry now wet

R	DETAILS	DATE
1	Final Issue	-

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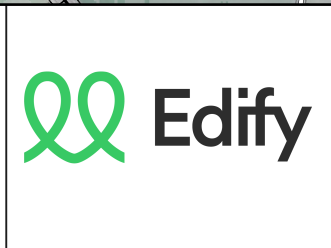
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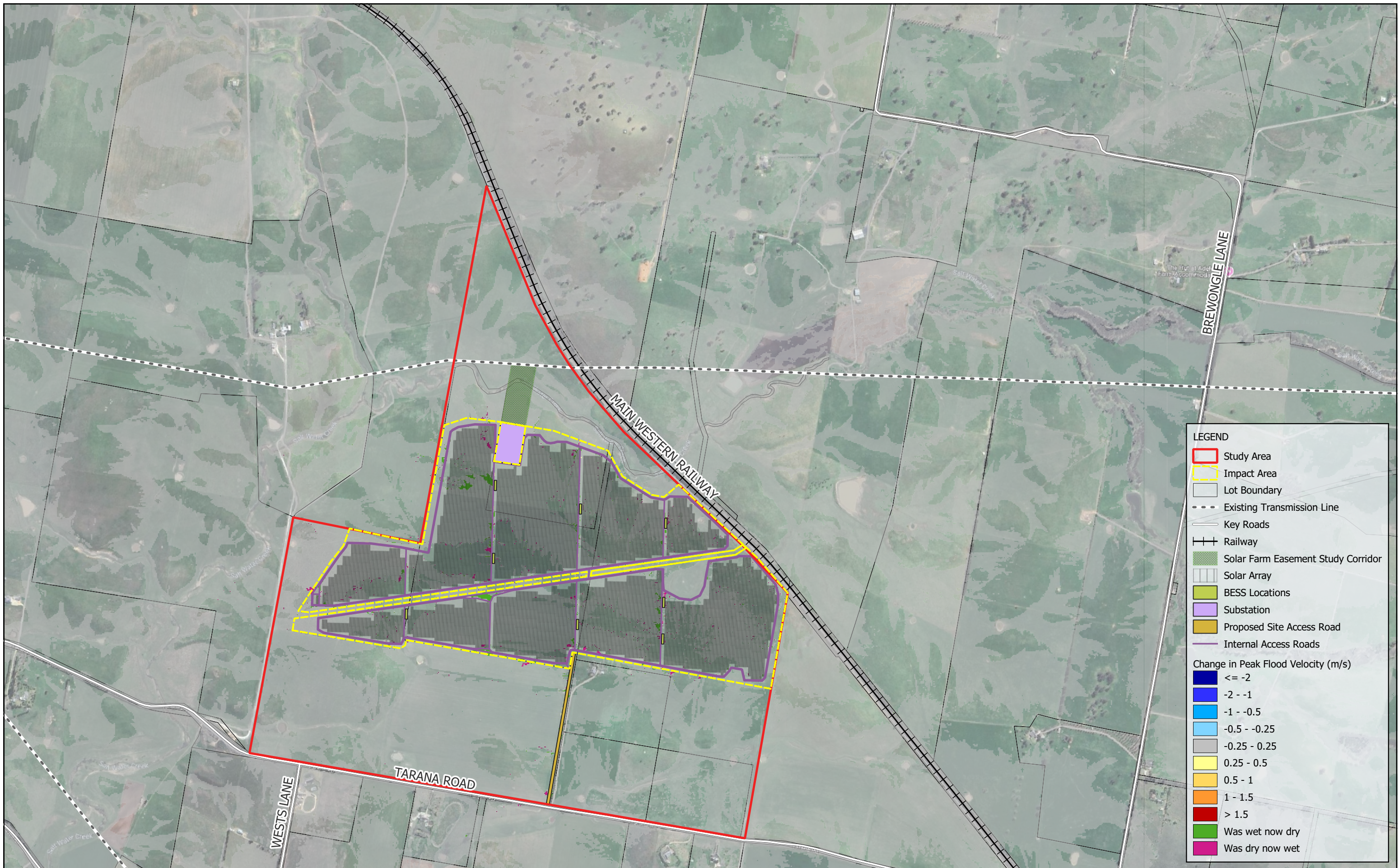
DATA SOURCE  
Google Maps



Edify Brewongle Solar Farm

Figure B13  
Flood Afflux - 5% AEP Change in Peak Flood Velocity

Drg Ref. NTL00206\_0015-FIG-B13



**LEGEND**

- Study Area
- Impact Area
- Lot Boundary
- Existing Transmission Line
- Key Roads
- Railway
- Solar Farm Easement Study Corridor
- Solar Array
- BESS Locations
- Substation
- Proposed Site Access Road
- Internal Access Roads


**Change in Peak Flood Velocity (m/s)**

- $\le -2$
- 2 - -1
- 1 - -0.5
- 0.5 - -0.25
- 0.25 - 0.25
- 0.25 - 0.5
- 0.5 - 1
- 1 - 1.5
- > 1.5
- Was wet now dry
- Was dry now wet

R	DETAILS	DATE
1	Final Issue	-

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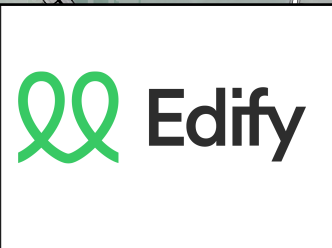
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APPROVED	LV	DATE	19/02/25
NOTES:			



0      0.3      km

SCALE @ A3 - 1:15,000  
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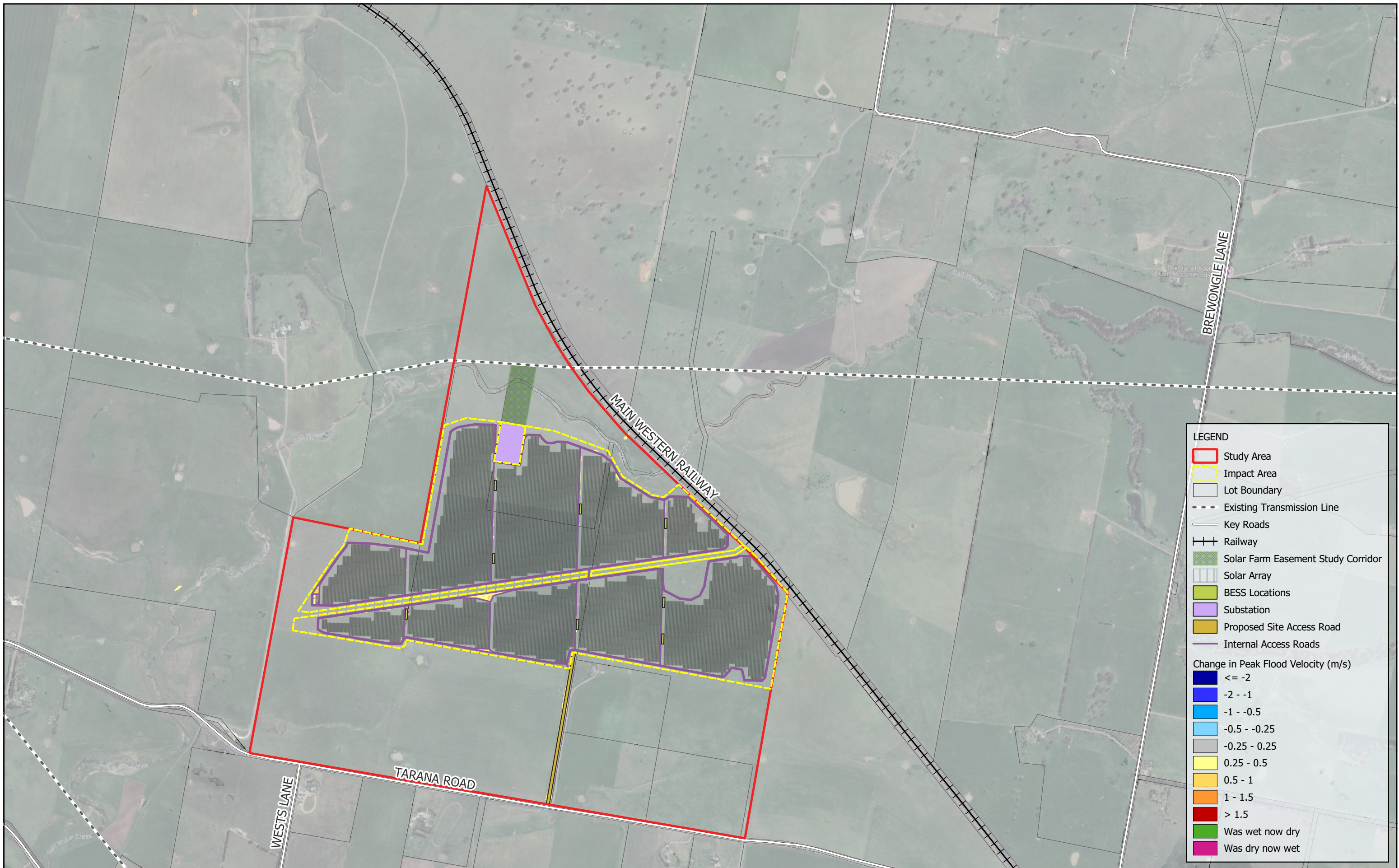
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Edify Brewongle Solar Farm

Figure B14  
Flood Afflux - 1% AEP Change in Peak Flood Velocity

Drg Ref. NTL00206\_0015-FIG-B14



**LEGEND**

- Study Area
- Impact Area
- Lot Boundary
- Existing Transmission Line
- Key Roads
- Railway
- Solar Farm Easement Study Corridor
- Solar Array
- BESS Locations
- Substation
- Proposed Site Access Road
- Internal Access Roads

**Change in Peak Flood Velocity (m/s)**

- $\le -2$
- $-2 - -1$
- $-1 - -0.5$
- $-0.5 - -0.25$
- $-0.25 - 0.25$
- $0.25 - 0.5$
- $0.5 - 1$
- $1 - 1.5$
- $> 1.5$
- Was wet now dry
- Was dry now wet

R	DETAILS	DATE
1	Final Issue	-

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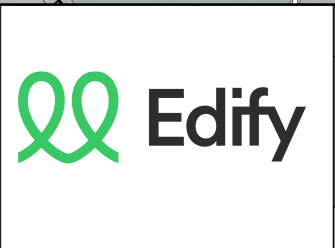
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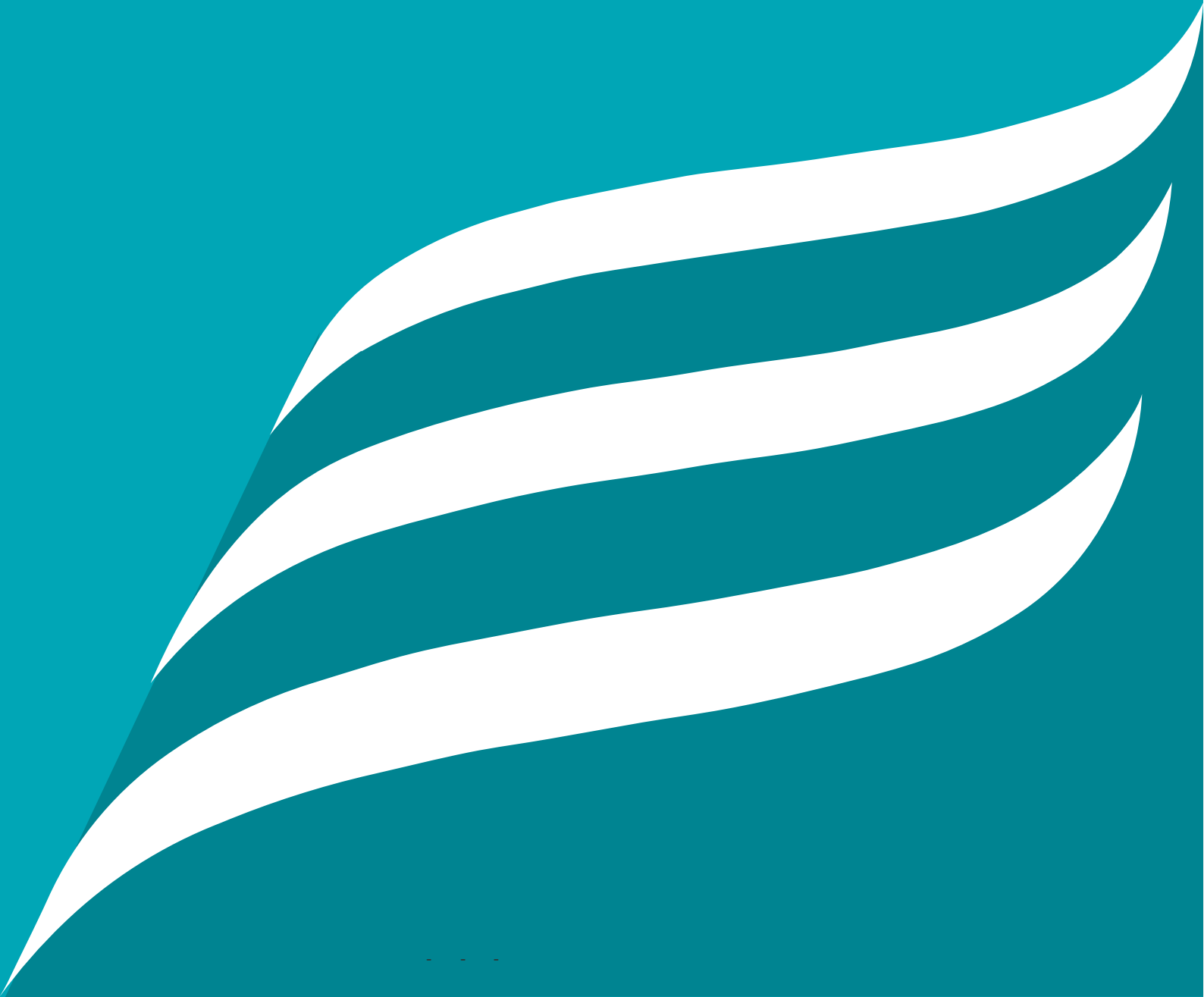
Edify Brewongle Solar Farm

Figure B15  
Flood - Probable Maximum Flood (PMF) Change in Peak Flood Velocity

Drg Ref. NTL00206\_0015-FIG-B15

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# APPENDIX C: WATER DEMAND ASSUMPTIONS



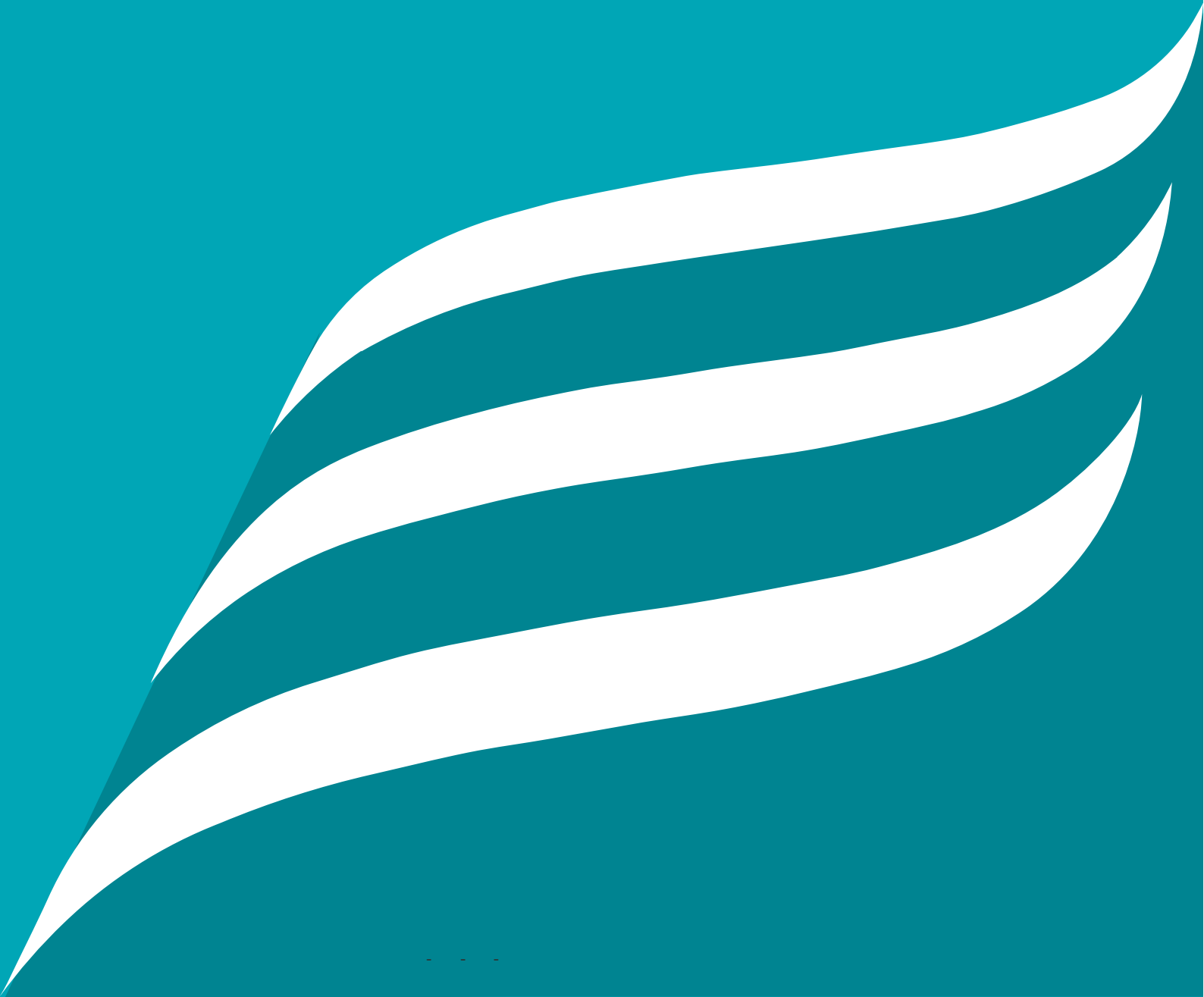
# Brewongle Solar Farm Water Demand Calcs



Demand Type	Assumption Description	Assumption	Units	Total Demand (m3)	Total Demand (ML)
Dust Suppression - General	Spray depth per pass	0.3	mm		
Dust Suppression - Roadways	Total length of Access Road	0.7	km	4,382	4.4
	Total length of Internal Vehicle Roads	12.4	km		
	Road width	6.0	m		
	Total road area	78,527	m2		
	Amount of roadway worked at any one time	10%	%		
	Active construction days (18 months, 6 days/week)	465	days		
	Number of passes per day on active work area	4	passes		
Road Construction / Compaction	Total length of road	13.1	km	9,549	9.5
	Road width	6.0	m		
	Total road area	78,527	m2		
	Water content added to condition initial rip	8%	%		
	Rip depth	500	mm		
	Dry Density	1,600	kg/m3		
	Total Weight for rip	62,821,968	kg		
	Water content added to condition fill	12%	%		
	Fill Depth	300	mm		
	Total Weight for fill	37,693,181	kg		
	BESS Hardstand Area	3,597	m2		
Hardstands - Battery Energy Storage (BESS)	Water content added to condition fill	12%	%	207	0.2
	Fill Depth	300	mm		
	Dry Density	1,600	kg/m3		
	Total Weight for fill	1,726,702	kg		
Vehicle and Equipment Washdown	Active construction days (18 months, 6 days/week)	465	days	4,650	4.7
	Washdown demand	10,000	L/day		
Workforce Breakdown	Site Mobilisation - Active construction days (2 months, 6 days/week)	50	days		
	Site Mobilisation - Active workforce (FTE)	60	FTE		
	Site Setup - Active days (5 months, 6 days/week)	130	days		
	Site setup - Active workforce (FTE)	180	FTE		
	Solar and BESS install - Active construction days (3 months, 6 days/week)	80	days		
	Solar and BESS install - Active workforce (FTE)	200	FTE		
	Install sub station - Active construction days (6 months, 6 days/week)	155	days		
	Install sub station - Active workforce (FTE)	90	FTE		
	Testing - Active days (2 months, 6 days/week)	50	days		
	Testing - Active workforce (FTE)	30	FTE		
Potable Water	Potable Demand Rate	50	L/d/site worker	2,893	2.9
	Site Mobilisation Potable Demand	150,000	L		
	Site Setup Potable Demand	1,170,000	L		
	Solar and BESS install Potable Demand	800,000	L		
	Sub station install Potable Demand	697,500	L		
	Testing Potable Demand	75,000	L		
<b>Total Construction Demand</b>				<b>21,680</b>	<b>21.7 ML/yr</b>
Potable Water - Operation	Potable Demand	50	L/d/site worker	65	0.1
	Days (1 year, 5 days/week)	261	days		
	Active workers	5	FTE		
<b>Annual Operational Demand</b>				<b>65</b>	<b>0.1 ML/yr</b> <b>0.3 kL/d</b>

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APPENDIX D: REGULATORY  
SUBMISSION TO SEARS AND WERE  
ADDRESSED



**TABLE D.1: REGULATORY SUBMISSION TO SEARS AND WHERE ADDRESSED**

Regulator	Reference and Issue	Section addressed in this report
DPE Water – Water Take and Licensing	A detailed and consolidated site water balance.	Section 3.1 (Water Balance)
	Description of all works/activities that may intercept, extract, use, divert or receive surface water and/or groundwater. This includes the description of any development, activities or structures that will intercept, interfere with or remove groundwater, both temporary and permanent.	Section 3 (Proposed Water Management)
	Details of all water take for the life of the project and post closure where applicable. This is to include water taken directly and indirectly, and the relevant water source where water entitlements are required to account for the water take. If the water is to be taken from an alternative source confirmation should be provided by the supplier that the appropriate volumes can be obtained.	Section 3.1 (Water Balance)
	Details of Water Access Licences (WALs) held to account for any take of water where required, or demonstration that WALs can be obtained prior to take of water occurring. This should include an assessment of the current market depth where water entitlement is required to be purchased. Any exemptions or exclusions to requiring approvals or licenses under the Water Management Act 2000 should be detailed by the proponent.	Section 2.7.7 (WALs available in water source)
DPE Water – Water Impacts	A description of groundwater conditions that provides an understanding of groundwater level across the site under a range of wet and dry conditions.	Not addressed in SWIA – refer to EIS
	Assessment of impacts on surface and ground water sources (both quality and quantity) including flooding, related infrastructure, adjacent licensed water users, basic landholder rights, watercourses, riparian land, groundwater dependent ecosystems, and ground water levels; including measures proposed to reduce and mitigate these impacts.	Section 5 (Surface Water Impact Assessment)
	Proposed surface and groundwater monitoring activities and methodologies.	Section 7 (Mitigation and Management Measures)
DPE Water – Assessment against Policy and Guidelines	Identification and impact assessment of all works/activities located on waterfront land including an assessment against Guidelines for Controlled Activities on Waterfront Land (DPE 2022).	Section 5.1.2 (Waterfront Land and Riparian Vegetation)
	Assessment of project against relevant policies and guidelines, including:  Water Sharing Plans, Floodplain Management Plans, NSW Aquifer Interference Policy, Guidelines for instream works on waterfront land (DPE, 2022), Groundwater Guidelines.	Section 2.7 (Water Regulatory Framework)

Regulator	Reference and Issue	Section addressed in this report
BCS - Water and Soils	<p>The EIS must map the following features relevant to water and soils including:</p> <ul style="list-style-type: none"> <li>(a) Acid sulfate soils (Class 1, 2, 3 or 4 on the Acid Sulfate Soil Planning Map).</li> <li>(b) Rivers, streams, wetlands, estuaries (as described in s4.2 of the Biodiversity Assessment Method).</li> <li>(c) Wetlands as described in s4.2 of the Biodiversity Assessment Method.</li> <li>(d) Groundwater.</li> <li>(e) Groundwater dependent ecosystems.</li> <li>(f) Proposed intake and discharge locations.</li> </ul>	Refer to EIS
	<p>The EIS must describe background conditions for any water resource likely to be affected by the development, including:</p> <ul style="list-style-type: none"> <li>(a) Existing surface and groundwater.</li> <li>(b) Hydrology, including volume, frequency and quality of discharges at proposed intake and discharge locations.</li> <li>(c) Water Quality Objectives (as endorsed by the NSW Government <a href="http://www.environment.nsw.gov.au/ieo/index.htm">http://www.environment.nsw.gov.au/ieo/index.htm</a>) including groundwater as appropriate that represent the community's uses and values for the receiving waters.</li> <li>(d) Where locally derived indicators and guideline values are not available for the relevant Water Quality Objectives, the EIS must refer to the <i>Australian and New Zealand Guidelines for Fresh and Marine Water Quality</i> (ANZG, 2018).</li> </ul>	Section 5 (Surface Water Impact Assessment)
	<p>The EIS must assess the impacts of the development on water quality, including:</p> <ul style="list-style-type: none"> <li>(a) The nature and degree of impact on receiving waters for both surface and groundwater, demonstrating how the development protects the Water Quality Objectives where they are currently being achieved, and contributes towards achievement of the Water Quality Objectives over time where they are currently not being achieved. This should include an assessment of the mitigating effects of proposed stormwater and wastewater management during and after construction, using the <i>Risk-based framework for considering waterway health outcomes in strategic land use planning decisions</i>.</li> <li>(b) Identification of proposed monitoring of water quality or required changes to existing monitoring programs.</li> <li>(c) How the development meets the objects of the Coastal Management Act 2016 and management objectives of relevant Coastal Management Areas defined under this Act.</li> <li>(d) Consistency with any relevant certified Coastal Management Program (or Coastal Zone Management Plan).</li> </ul>	Section 5.2 (Water Quality)

Regulator	Reference and Issue	Section addressed in this report
	<p>EIS must assess the impact of the development on hydrology, including:</p> <ul style="list-style-type: none"> <li>(a) Water balance including quantity, quality and source.</li> <li>(b) Effects to downstream rivers, wetlands, estuaries, marine waters (including marine protected areas) and floodplain areas.</li> <li>(c) Effects to downstream water-dependent fauna and flora including groundwater dependent ecosystems.</li> <li>(d) Impacts to natural processes and functions within rivers, wetlands, estuaries and floodplains that affect river system and landscape health such as nutrient flow, aquatic connectivity and access to habitat for spawning and refuge (e.g. river benches).</li> <li>(e) Changes to environmental water availability, both regulated/licensed and unregulated/rules based sources of such water.</li> <li>(f) Mitigating effects of proposed stormwater and wastewater management during and after construction on hydrological attributes such as volumes, flow rates, management methods and re-use options</li> <li>(g) Identification of proposed monitoring of hydrological attribute.</li> </ul>	<p>Section 3.1 (Water Balance) Section 5 (Surface Water Impact Assessment)</p>
<p>BCS - Flooding</p>	<p>The EIS shall include a flood impact and risk assessment (FIRA). As a minimum the FIRA must:</p> <ul style="list-style-type: none"> <li>(a) Consider the relevant provisions of the NSW Flood Risk Management Manual (2023) and associated guides, and existing council and government studies, information and requirements.</li> <li>(b) Identify and describe existing flood behaviour on the site and its surrounding areas for the full range of events, including 5% AEP, 1% AEP, PMF and 0.5% AEP or 0.2% AEP and provide an assessment of the compatibility of the development and its users with flood behaviour. This may require flood modelling where existing flood information is not available.</li> <li>(c) Determine and describe changes in post development flood behaviour, impacts of flooding on existing community and on the development and its future community for full range of events, 5% AEP, 1% AEP, PMF and 0.5% AEP or 0.2% AEP. This will typically require flood modelling.</li> <li>(d) Consider impacts of climate change due to both sea level rise and increase in rainfall intensities considering relevant Council and government advice. The 0.5% AEP or 0.2% AEP events can be used to provide an understanding of the scale of change of flood behaviour relative to the 1% AEP event.</li> <li>(e) Propose and assess the effectiveness of management measures required to minimise the impacts and risks of flooding to the development and its users and existing community.</li> </ul> <p>Note:</p> <ul style="list-style-type: none"> <li>• The scope of a FIRA is intended to be consistent with the Draft EHG FIRA Guide, which is being finalised currently.</li> <li>• The FIRA will need to be tailored to suit the project being considered, whilst maintaining consistency with the FIRA guide.</li> </ul>	<p>Section 4 (Flood Modelling)</p>