



REPORT

Temora 1C Solar Farm

Water Assessment

Submitted to:

ITP Development Pty Ltd

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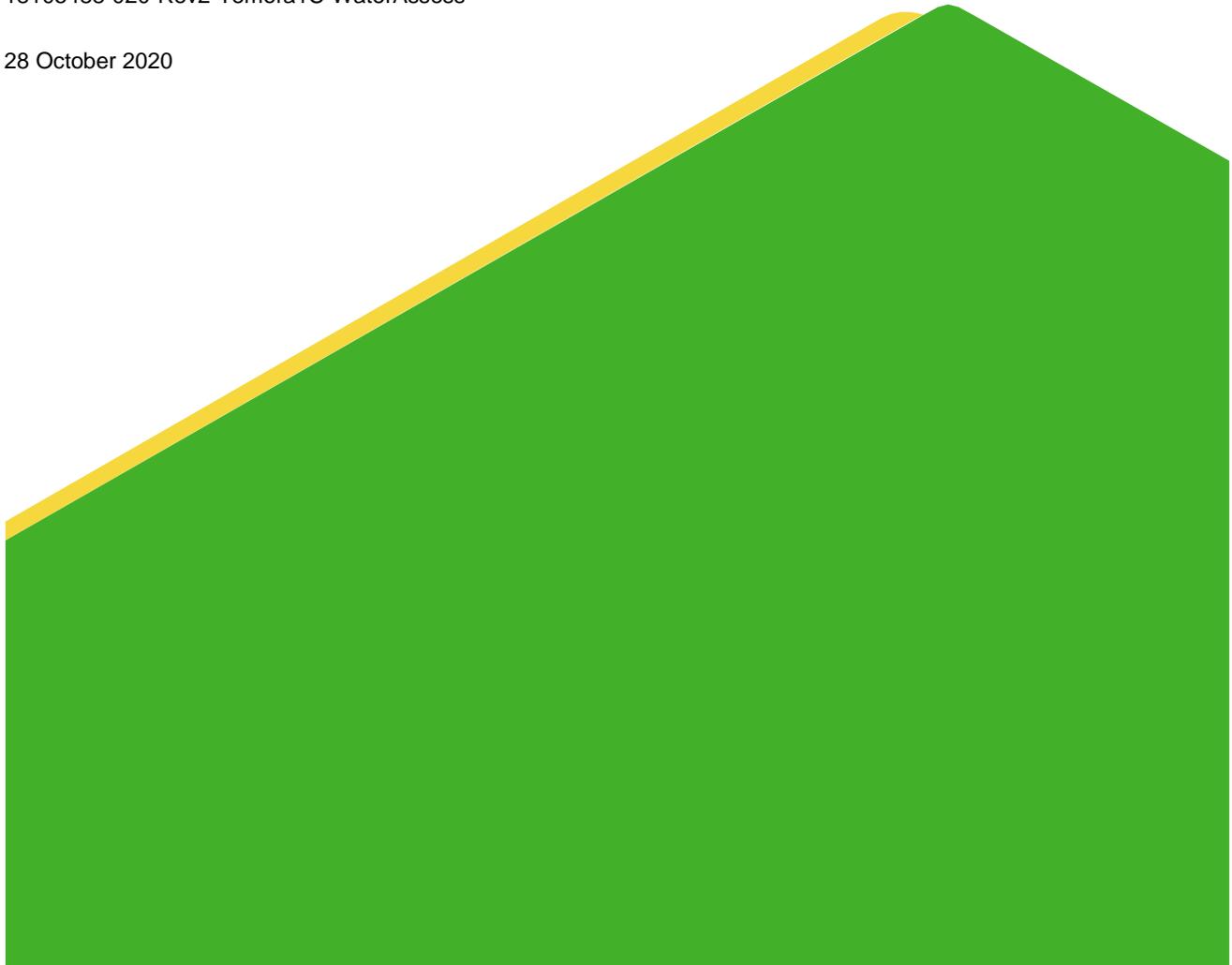
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Distribution List

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Table of Contents

1.0 INTRODUCTION	1
1.1 Limitations of assessment	1
1.2 Important information relating to this report	1
2.0 PROJECT DESCRIPTION	2
3.0 LEGISLATIVE CONTEXT	6
3.1 Local Government Act 1993	6
3.2 Environmental Planning and Assessment Act 1979	6
3.3 Water Management Act 2000	6
3.3.1 Surface water sharing plan	7
3.3.2 Groundwater sharing plan	7
3.3.3 Groundwater vulnerability mapping	7
3.4 Temora Local Environmental Plan 2010	8
3.4.1 Temora Shire Development Control Plan 2012	11
3.4.2 Temora Community Strategic Plan	12
3.5 State Environmental Planning Policy (Infrastructure) 2007	12
3.6 Protection of the Environment Operations (POEO) Act 1997	12
3.7 Soil Conservation Act 1938	13
4.0 CATCHMENT AND FLOOD HISTORY	14
4.1 Temora Shire Council Urban Stormwater Management Plan 2015	14
4.2 Temora Flood Study 2019	16
5.0 AVAILABLE DATA	18
5.1 Rainfall	18
5.2 Streamflow	18
5.3 Groundwater	19
6.0 POTENTIAL IMPACTS	23
6.1 Flooding	23
6.2 Water quality and erosion	23
7.0 PROPOSED MITIGATION MEASURES	24
7.1 Site accessibility and inundation	24

7.2	Downstream sedimentation.....	24
8.0	REFERENCES.....	26

TABLES

Table 1:	Stormwater management objectives	15
Table 2:	Rainfall	18
Table 3:	Average Monthly Rainfall ¹	18
Table 4:	Stream Gauging Stations	19
Table 5:	Proposed Mitigation Measures	24

FIGURES

Figure 1:	Project location	3
Figure 2:	Project area	4
Figure 3:	Project Area Elevation	5
Figure 4:	Floodplain risk management and planning process	6
Figure 5:	Flood planning area.....	9
Figure 6:	Sensitive Area – Water.....	9
Figure 7:	Sensitive Area – Biodiversity	10
Figure 8:	Sensitive Area - Land	11
Figure 9:	Temora Flood Study Area	17
Figure 10:	Lachlan Catchment Groundwater Aquifer Type (NSW Office of Water, 2011).....	20
Figure 11:	Location of monitoring bores used in the MDBA independent assessment	21
Figure 12:	Lachlan Fold Belt groundwater level at GW085113.....	22
Figure 13:	Barmedman Road west of Bribaree groundwater levels (levels recorded on 24 September 2020)	22

APPENDICES

APPENDIX A

Important Information Relating to this Report

APPENDIX B

Temora 1C Solar Farm Proposed Layout

APPENDIX C

Temora LEP Maps

1.0 INTRODUCTION

The proposed Temora 1C Solar Farm is located on Moroney's Lane, Temora, approximately 74 km north-east of Wagga Wagga and 3.5 km south-east of Temora, New South Wales (NSW). The Project site is within Lot 1 / DP 1110693, adjacent the eastern boundary of the Temora Golf Club. ITP Development Pty Ltd (ITP Development) propose to construct a 5 MW solar facility within the site that is currently used for alpaca grazing.

This report, which provides a desktop water assessment to support the Development Application for the Project, includes a:

- Desktop review of local hydrology and catchment and water quality data.
- Desktop review of surface and groundwater quality data.
- Desktop review of the flood risk potential against the Local Environmental Plan.
- Desktop impact assessment against NSW policies and referenced industry standards for solar arrays.
- Desktop management assessment with mitigation measures recommend for construction and operation.

1.1 Limitations of assessment

The assessment is based on publicly available information and data and does not include a site inspection, sampling, or any additional hydrological and/or hydraulic modelling.

1.2 Important information relating to this report

Your attention is drawn to the document titled - "Important Information Relating to this Report", which is included in Appendix A of this report. The statements presented in that document are intended to inform a reader of the report about its proper use. There are important limitations as to who can use the report and how it can be used. It is important that a reader of the report understands and has realistic expectations about those matters. The Important Information document does not alter the obligations Golder Associates has under the contract between it and its client.

2.0 PROJECT DESCRIPTION

The proposed Temora 1C Solar Farm is located at 197 Moroney's Lane, Temora, approximately 74 km north-east of Wagga Wagga and 3.5 km south-east of Temora township (Figure 1) within the Temora Shire Council local government area (LGA).

Temora is located on the western side of the Great Dividing Range, approximately 418 km south-west of Sydney in the north-east of the Riverina area and South West Slopes bioregion which is distinguished from other Australian regions by the combination of flat plains, warm to hot climate and an ample supply of water for irrigation.

The town of Temora is located in between Trigalong and Narraburra Creeks, two tributaries of Bland Creek which is significant in the region. Both Narraburra and Trigalong Creek run from south to north, with Trigalong Creek located to the west of the town and Narraburra to the east. Both waterbodies discharge into Lake Centenary, approximately 4.5 km north of the Temora township (Solutions Water Modelling, 2019).

Two open channels run through the town, known as the eastern drainage line and the western drainage line. These drainage lines generally convey stormwater from the south to the north via concrete-lined open channels (Solutions Water Modelling, 2019).

Temora is located in a small valley which gently falls to the north. There are two ridges that skirt the edges of the town and generally run in a north to south direction. These ridges form the top part of the town catchment. Fall occurs from the east and west ridges down towards the centre of the town. Run off is intercepted from the east by the eastern drain and from the west by the western drain. It is then carried north by these drains to a point at the northern end of the town where the drains converge. From here, fall is quite gentle with a low flat drainage depression carrying run off approximately 4 km north to Lake Centenary. Short, heavy downpours in the summer months can cause minor local short-term flooding to many areas of the LGA (Temora Shire Council, 2015).

The proposed facility is located 5 km east of Narraburra Creek and 4 km west of Trigalong Creek. A drainage line flows through the south-west corner of the Project site towards the Trigalong Dam before discharging into Narraburra Creek in the east. The Narraburra Creek flows north towards the town of Narraburra. A single farm dam is located at the southern end of the land parcel, intercepting the draining line. Both the drainage line and farm dam are outside the proposed Project footprint (Figure 2).

The Project area is relatively flat, with the land sloping approximately 8 m from north-west to south-east. The land in the north-west is 317 m AHD dropping to 309 m AHD in the south-east (Figure 3). The land is mostly cleared of native vegetation and is currently used for cropping.

ITP Development propose to construct a solar farm on the parcel of land (Lot 1 / DP 1110693). The system will have a DC array capacity of 6.4 MW_{DC} and an AC output of 5 MW_{AC} resulting in a 5 MW solar farm. Details are contained on the layout provided by ITP Development and attached in Appendix B.

There will be approximately 12,100 solar modules installed in 140 rows running north-south across the site. Each row of PV modules will rotate to track the sun across the sky from east to west each day. The solar farm will also consist of two 3 MW inverters, located in the centre of the array and mounted on a 12.19 m skid. The inverter stations will incorporate High/Medium voltage switchgear and transformers.

The mounting system will be constructed on piles that are driven into the ground approximately 1.5 m to 3.5 m. Trenching for low voltage is around 600 mm for low voltage and 1,200 mm for high voltage. Once operational the site will be unmanned with maintenance expected to be carried out quarterly by a crew of 2 – 3 people.



- LEGEND**
- BOM Stations
 - Streamflow Locations
 - Electricity Transmission Line
 - Cadastre
 - Lot 1 DP1110693
 - Denotes distance to streamflow station from site

Coordinate System: GDA 1994 MGA Zone 55
 Projection: Transverse Mercator
 Datum: GDA 1994



CLIENT
 ITP DEVELOPMENT PTY LTD

NOTE(S)
 Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

REFERENCE(S)
 Electricity Transmission Lines, Cadastre: © State of NSW (Spatial Services - Department of Finance, Services and Innovation) 2018
 Rainfall Stations: WaterNSW 2018

PROJECT
 TEMORA 1C SOLAR FARM

CONSULTANT	DD/MM/YYYY	29/09/2020
	DESIGNED	SD
	PREPARED	SD
	REVIEWED	JR
	APPROVED	JR

TITLE			
PROJECT LOCATION			
PROJECT NO.	CONTROL	REV.	FIGURE
18105488	020	1	1

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ISO/A3 25mm



- LEGEND**
- 10 m surface elevation contours
 - Roads
 - Electricity Transmission Line
 - Hydrolines
 - Hydroareas (i.e. dams etc.)
 - Lot 1 DP1110693
 - Solar Farm Extent

Coordinate System: GDA 1994 MGA Zone 55
 Projection: Transverse Mercator
 Datum: GDA 1994



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NOTE(S)
 Service Layer Credits: Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, and the GIS User Community

REFERENCE(S)
 <bol>Electricity Transmission Lines, Cadastre: ITP Developments 2020
 <bol>Rainfall Stations: </bol> WaterNSW 2018

PROJECT
 TEMORA 1C SOLAR FARM

CONSULTANT	DD/MM/YYYY	28/10/2020
	DESIGNED	SD
	PREPARED	SD
	REVIEWED	JR
	APPROVED	JR

TITLE		PROJECT AREA	
PROJECT NO.	CONTROL	REV.	FIGURE
18105488	020	1	2

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ISO/A3 25mm



Figure 3: Project Area Elevation

3.0 LEGISLATIVE CONTEXT

NSW has a comprehensive legislative and policy framework for the management of floodplain risk and flood prone areas of the state with clear areas of responsibility as outlined below in Figure 4.

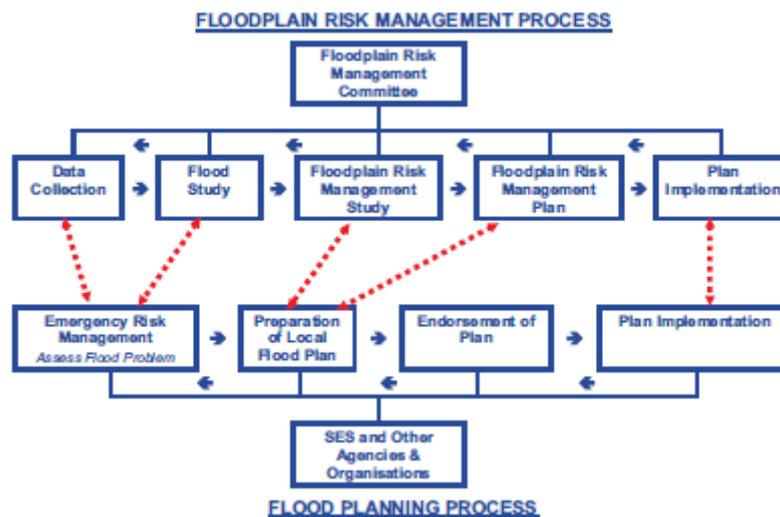


Figure 4: Floodplain risk management and planning process

3.1 Local Government Act 1993

This Act provides a legal framework for the NSW system of local government. The Floodplain Management Manual was gazetted in 2005 as the manual relating to the development of flood-liable land for the purposes of section 733. This section exempts councils from liability in relation to flood prone land provided they have undertaken assessments substantially in accordance with the latest manual.

The Floodplain Development Manual (NSW Government, 2005) is the approved Section 733 manual for flood prone land. The manual supports the NSW Government's Flood Prone Land Policy in providing for the development of sustainable strategies for the management of floodplains specifically in relation to human occupation. It provides a framework for councils to implement the policy and a process for managing floodplain risk.

3.2 Environmental Planning and Assessment Act 1979

This is an Act to institute an environmental planning system and assessment arrangements for NSW. In 2017 there were major amendments passed with a view to improving the planning system through simpler processes, improved strategic planning and community participation in order to enable more balanced and transparent decision making. Clause 3.43 makes provision for the preparation of development control plans by relevant authorities (outlined further in Section 3.4.1).

3.3 Water Management Act 2000

The Act provides for the sustainable and integrated management of the water sources of the State for the benefit of both present and future generations. Water management principles intended to guide decision making under the Act in relation to floodplain management require the existing and future risk to human life and property arising from occupation of the floodplain to be minimised.

3.3.1 Surface water sharing plan

The Water Management Act 2000 applies to areas of NSW that have a water sharing plan (WSP). The Project site is located within the lower extent of the area covered by the Water Sharing Plan for the Lachlan Unregulated Water Sources 2012.

Water sharing plans relate to the protection of surface water and alluvial groundwater resources. The WSP for the Lachlan Unregulated Water Sources 2012 covers 23 unregulated surface water sources and two groundwater sources.

The surface water source for the area is listed as being the Western Blank Creek water source within the major catchment of Lachlan.

As this plan relates to licencing and use of water resources under the *Water Management Act 2000*, it is not relevant for the Project (as no water extraction is proposed).

3.3.2 Groundwater sharing plan

The relevant groundwater sharing plan for the Project area is the Water Sharing Plan for the NSW Murray Darling Basin Fractured Rock Groundwater Sources 2020. The Project site is within the Lachlan Fold Belt MDB groundwater source. This water sharing plan for the sets out the provisions for managing water within this aquifer.

As this plan relates to licencing and use of water resources under the *Water Management Act 2000*, it is not relevant for the Project (as no water extraction is proposed).

3.3.3 Groundwater vulnerability mapping

The Lachlan Catchment groundwater vulnerability map has been produced as part of the implementation of the *Water Management Act 2000*, introduced in an effort to achieve more sustainable water use. Groundwater vulnerability mapping is used as a guide in determining which areas are more susceptible to groundwater contamination within the mapped area.

These groundwater vulnerability maps show the vulnerability (or level of risk) of aquifers to contamination relating to physical characteristics of the location, such as the depth to the water table and soil type. The maps were prepared for use by groundwater managers, planners, developers, and regulating agencies to make better informed judgements on where to locate potentially polluting activities so as to minimise the risk to groundwater.

The Project site is mapped as having a moderate groundwater vulnerability rating, however given the Project does not intend on taking or interfering with groundwater, it does not trigger the *Water Management Act 2000* thus is not relevant for the Project (as no water extraction is proposed).

Commonly, groundwater vulnerability mapping is adopted by councils and incorporated into their Local Environmental Plans. However, Temora Shire Council has considered groundwater in its Sensitive Area – Water mapping rather than include groundwater vulnerability maps separately. As described further in Section 3.4, there are no mapped sensitive areas for water, inclusive of groundwater, within proximity to the Project site.

3.4 Temora Local Environmental Plan 2010

The Temora Local Environmental Plan 2010 (hereby referred to as the Plan) aims to make local environmental planning provisions for land in Temora in accordance with the relevant standard environmental planning instrument. The regional area includes towns of Temora, Aria Park and Springdale Village.

The Plan provides the prohibited and permitted types of development within the local area. Some types of development are also regulated by particular state environmental planning policies.

The Plan (Part 6.6) provides specific management requirements for flood planning which applies to land identified to occur within a “flood planning area’ on the Flood Planning Map. It requires that development consent cannot be granted unless the proposed development is compatible with the flow conveyance function and flood hazard of the land, will not cause significantly adverse impacts to other developments, the environment and the community and incorporates measures to manage risk to life. According to the accompanying Flood Planning Map, the Project site is not considered to occur within a flood planning area (see Figure 5 with the Project area marked in red and Appendix C for the full Flood Planning Maps - Sheet FLD_004A to FLD_004D from the Local Environmental Plan). The closest flood planning area is located 2 km to the north of the Project area which is indicated by blue shading on flood planning map FLD_004D and in Figure 5.

Riparian land and watercourse provisions aim to protect the water quality and ecological processes within watercourses and riparian areas. This includes the stability of beds and banks. These provisions apply to areas mapped as occurring in or within 40 m of the bank or shore of a waterway identified as a Sensitive Area on the Natural Resource Sensitivity – Water Map of the LEP. This mapping indicates that there are no sensitive waters located within or adjacent to the Project site. The nearest sensitive waters are identified as Narraburra Creek and Trigalong Creek, respectively located 5 km east and 4 km west of the Project site (Figure 6).

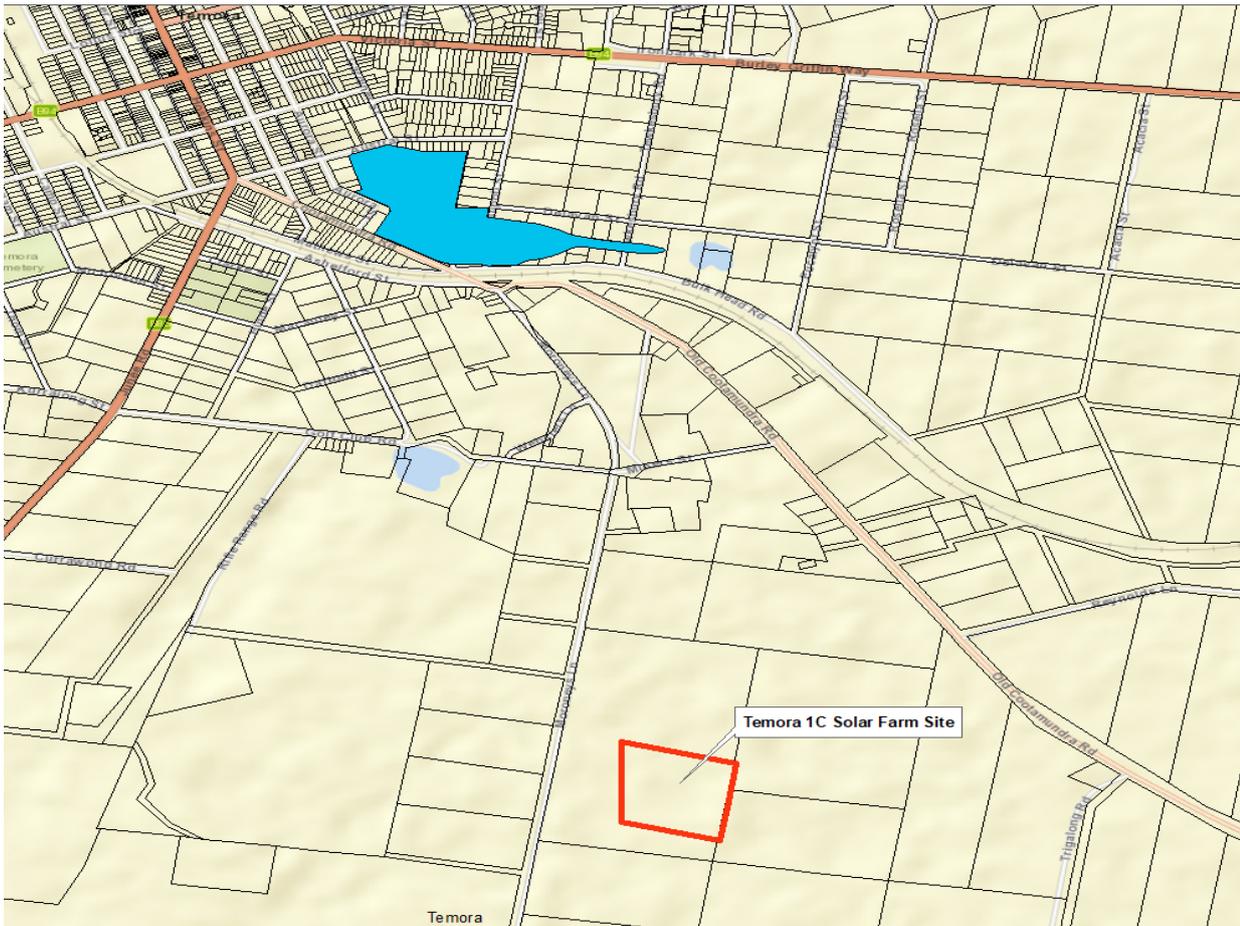


Figure 5: Flood planning area

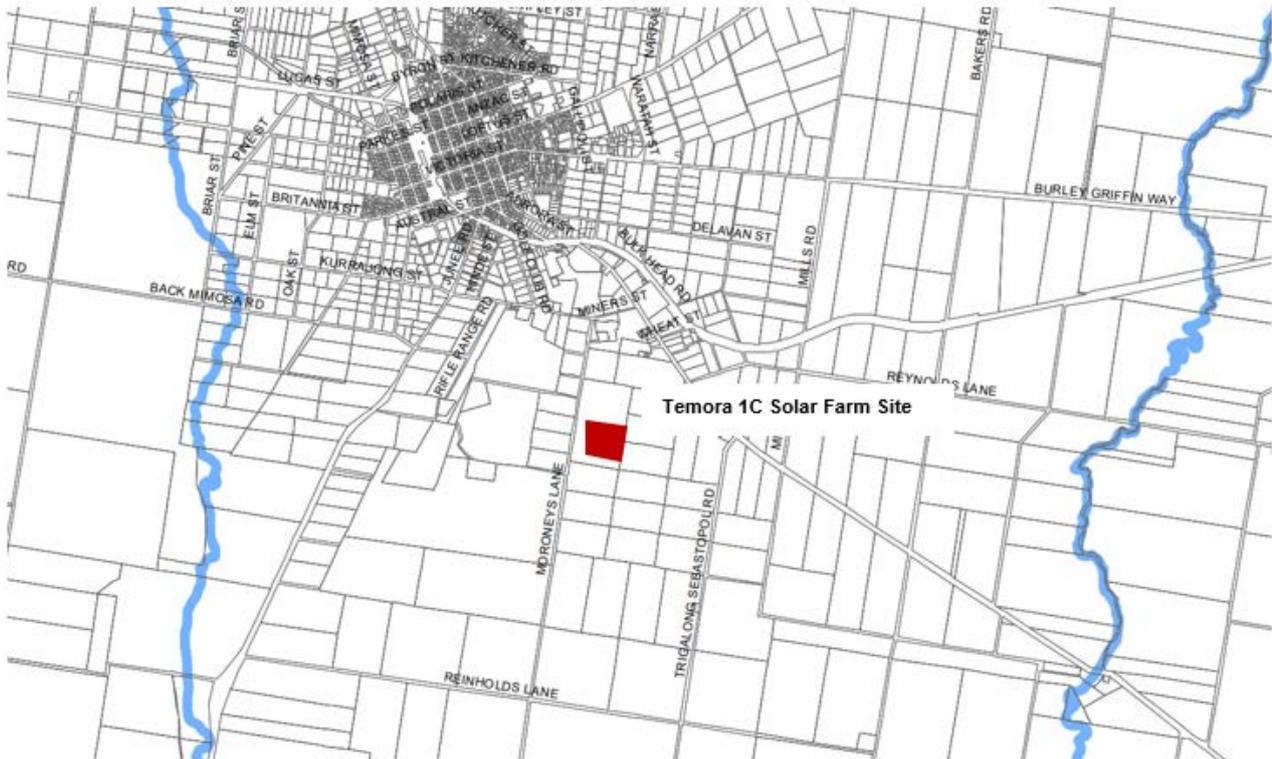


Figure 6: Sensitive Area – Water

Biodiversity provisions aim to protect the native vegetation, native fauna and their habitats from adverse impacts of proposed developments, including within wetland areas. These provisions apply to areas mapped as occurring within land identified as a Sensitive Area on the Natural Resource Sensitivity – Biodiversity Map of the LEP. This mapping indicates that there are no sensitive biodiversity areas located within the proposed development footprint, however the lot on plan of the Project site does contain sensitive biodiversity areas in the north-west corner and southern boundary (Figure 7). The Plan provides additional provisions for earthworks to ensure that earthworks for which development consent is required will not have a detrimental impact on environmental functions and processes, neighbouring uses, cultural or heritage items or features of the surrounding land.

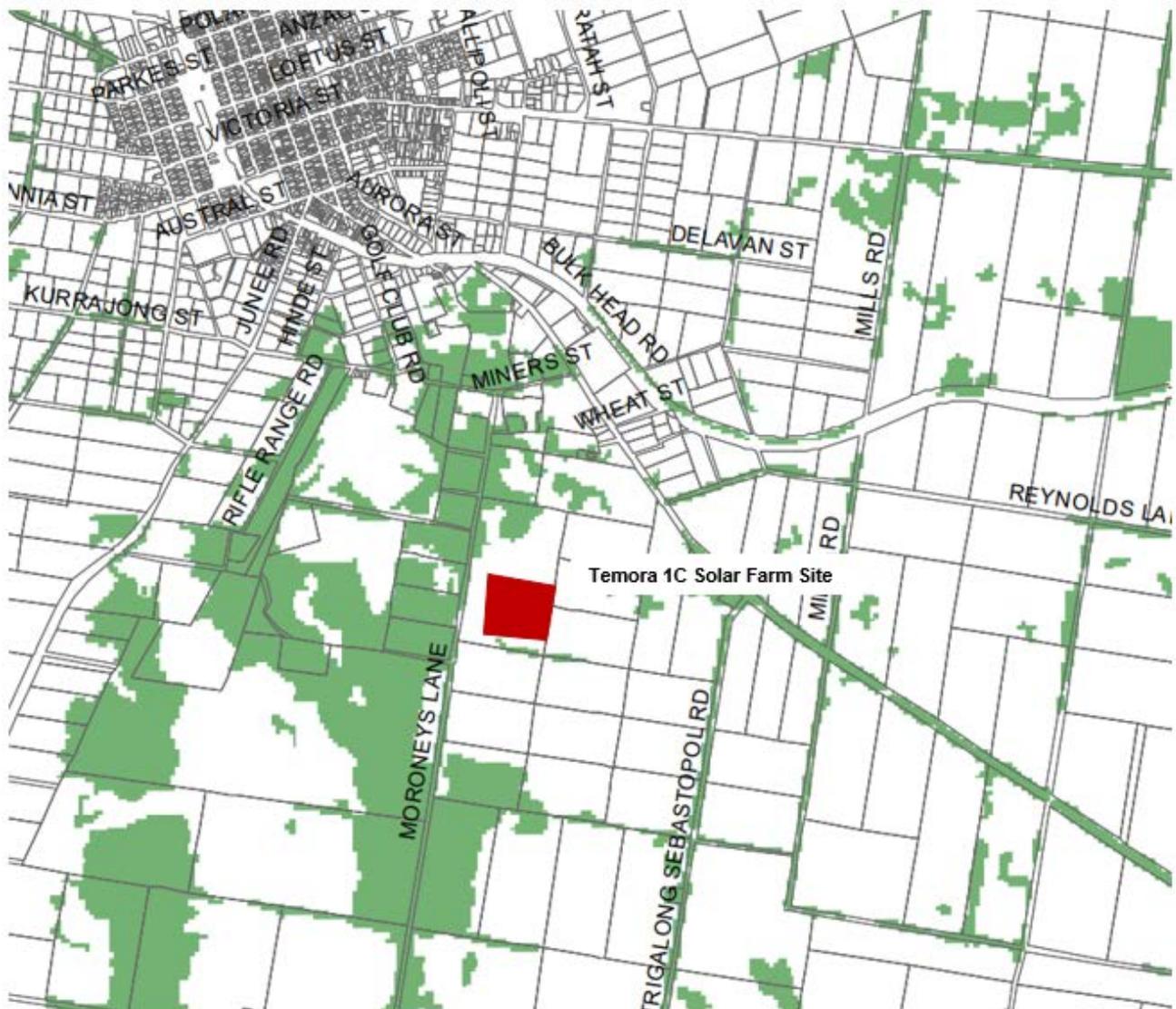


Figure 7: Sensitive Area – Biodiversity

The Plan also includes provisions to protect, maintain or improve the diversity and stability of landscapes. These provisions apply to areas mapped as occurring within land identified as a Sensitive Area on the Natural Resource Sensitivity – Land map of the LEP. This mapping indicates that there are no sensitive land areas located within or adjacent the Project site (Figure 8). The nearest mapped sensitive land areas are identified approximately 1.8 km south and west of the Project site.

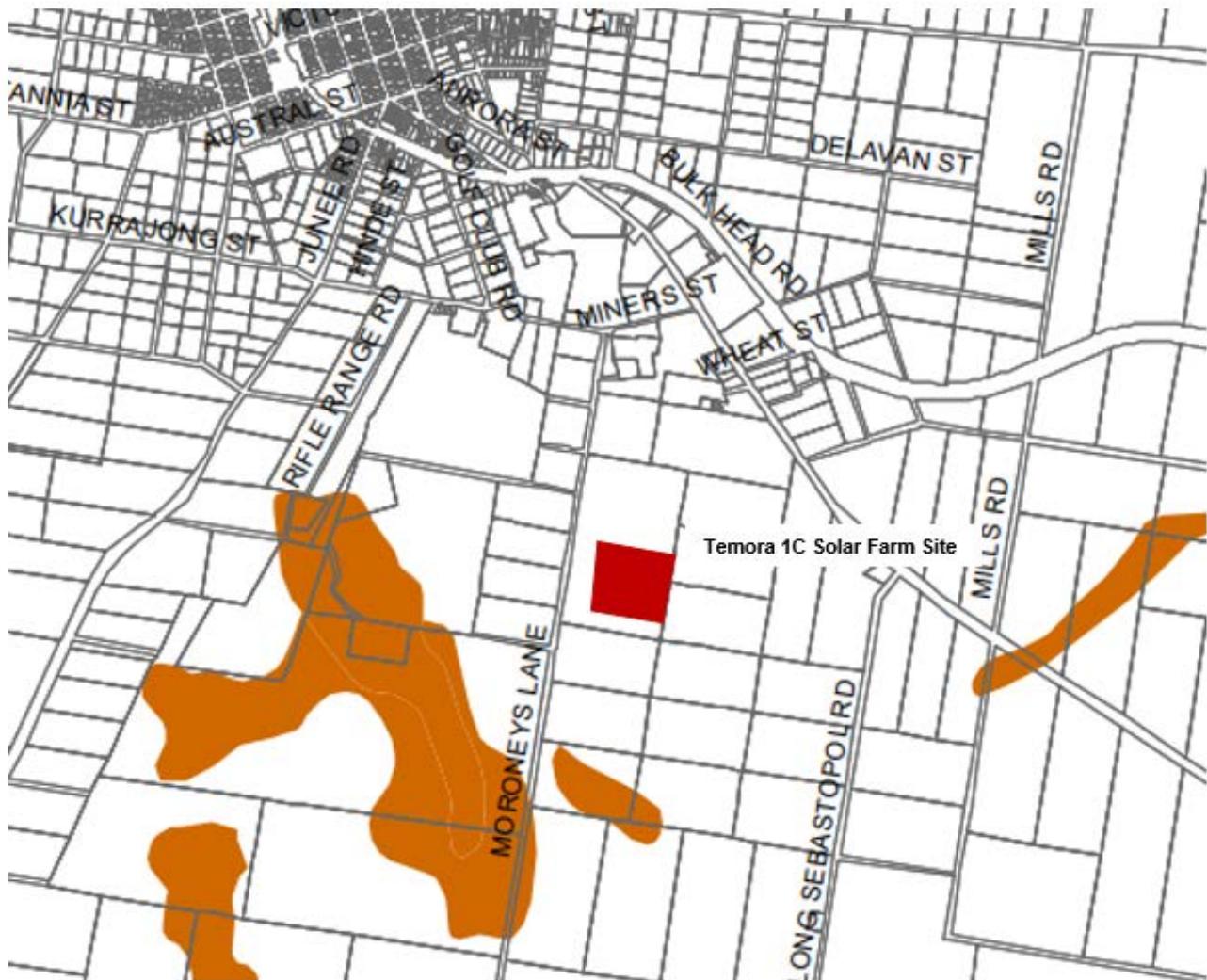


Figure 8: Sensitive Area - Land

3.4.1 Temora Shire Development Control Plan 2012

The Temora Shire Development Control Plan 2012 (DCP) provides guidance for developments and supports the statutory planning controls of the LEP. The guidance provides proponents assistance with criteria to address in development applications, however this relates mostly to housing developments.

The DCP is divided into topic chapters, with separate chapters for environmentally sensitive areas, erosion and sediment control, flood prone land and flood premises fit out and construction, with the latter two topic chapters providing guidance on flood compatible building materials and development controls relevant to flood prone land.

The provision within the environmentally sensitive areas topic chapter of the DCP apply to those areas mapped as sensitive areas – biodiversity, land and water of the LEP. The DCP sets out objectives specific to waterways, water bodies, riparian corridors, wetlands and groundwater, which include:

- To maintain and enhance the ecological values of waterways and wetlands, including water quality, stream integrity, biodiversity and habitat within the Shire.
- To protect and enhance the water quality of groundwater systems as well as identifying and protecting vulnerable groundwater resources from contamination as a result of inappropriate development.

- To maintain and enhance riparian buffers to preserve the environmental values associated with waterway and wetlands, having specific regard to fauna and flora habitats and ecosystems, stream integrity (including erosion management), land use impacts and recreational/visual amenity.

Specific controls to achieve these outcomes are prescribed in the DCP.

3.4.2 Temora Community Strategic Plan

The Temora Community Strategic Plan is planned and executed under six key themes:

- Retaining out quality of life
- Engaging and supporting the community
- Building our shire economy
- Preserving our beautiful surrounds
- Embracing and developing aviation
- Maintenance of infrastructure to support agriculture

Under the 'Preserving our beautiful surrounds' theme, a key strategy to improve drainage within the shire area has been identified. Specific flood and water management aspects that have been identified as actions for the council include:

- Improvement of drainage within Temora Shire – Development of a Floodplain Risk Management Plan including 10-year rolling works program. A flood study and integrated water cycle management plan has been developed to inform this process.
- Ensure sustainable operation and usage of precious water – Achievement of NSW Office of Water Best Practice. An integrated water cycle management plan has been developed to inform this process.

3.5 State Environmental Planning Policy (Infrastructure) 2007

Division 4 of the State Environmental Planning Policy (Infrastructure) 2007 relates to 'Electricity generating works or solar energy systems'. The policy relates to the approval process for solar energy systems, and there are specific details required for flood liable land which means land that is susceptible to flooding by the probable maximum flood event. The policy states consultation with the relevant council is required if the proposal will alter flood patterns other than to a minor extent and their response must be taken into consideration.

The Project area is not in an area mapped as being within the flood planning area under the Local Environmental Plan.

3.6 Protection of the Environment Operations (POEO) Act 1997

The POEO Act aims to protect and restore and enhance the quality of the environment in NSW, while still having regard to ecologically sustainable development.

With relevance to the site, the Act aims to reduce risks to human health and to prevent degradation of the environment by promoting pollution prevention and the reduction in the use of materials and the re-use, recovery or recycling of materials. The Act contains the requirements for the management of water discharges and also the offences that relate to pollution. Section 148 requires that any pollution incidents or those that threaten material harm to the environment must be notified to the relevant authority (e.g., NSW Environment Protection Authority).

3.7 Soil Conservation Act 1938

This Act makes provision for the conservation of soil resources and for the mitigation of erosion. The act allows the Minister for Primary Industries¹ to issue soil conservation notices, declare areas to be sites of erosion hazard, proclaim works in catchment areas and outlines specific regulations regarding the Rural Assistance Act 1989.

Of general relevance to this Project is the promotion of sustainable use and prevention of loss of soil resources from a site.

¹ Except Parts 2A, 3 and 4, and sections 15 and 30A in so far as they relate to Parts 2A, 3 and 4, jointly with the Minister for the Environment

4.0 CATCHMENT AND FLOOD HISTORY

The Project is located in the Temora Shire Council LGA, approximately 3.5 km south-east of the Temora township centre. The proposed facility is located 5 km west of Narraburra Creek and 4 km east of Trigalong Creek. A drainage line flows through the south-west corner of the Project site towards the Trigalong Dam before discharging into Narraburra Creek to the east. The Narraburra Creek flows north towards the town of Narraburra.

The Project area is relatively flat, with the land sloping from north-west to south-east. The land in the north-west is 317 m AHD dropping to 309 m AHD in the south-east (



Figure 3).

4.1 Temora Shire Council Urban Stormwater Management Plan 2015

The Temora Shire Council Urban Stormwater Management Plan (2015) focuses on providing an effective framework for stormwater management and providing a clear implementation path to address priority issues. The plan focuses on the management of stormwater quality, stormwater quantity and stormwater reuse issues, with the aim of improving water quality and river health by identifying solutions to mitigate the environmental impacts of urban stormwater discharges.

The plan focuses on land that is drained by the reticulated stormwater system but does not address specific drainage or flooding issues which may be managed by Flood Management Plans.

Historically, stormwater runoff within Temora Township, Aria Park and Springdale has been managed solely to minimise the impact of flooding on developed areas. This emphasis has led to the construction of engineered drainage systems designed to drain stormwater from urban areas as quickly and efficiently as possible.

Within Temora township there are two main drainage channels, with the channel on the east side of town known as “eastern drain” and that on the west side of town as the ‘western drain’. These drainage channels run approximately in a north/south direction, converging at the northern end of town. From this convergence point, a single drainage depression meanders across private land to Lake Centenary approximately 4 km to the north of the township. At the northern end of the lake, a spillway discharges into Trigalong Creek.

Stormwater management objectives for new developments aim to define stormwater outcomes which Council and/or developers will seek to achieve in the development or redevelopment of land. The purpose of prescribing such objectives is to minimise the impact of new development (including redevelopment) upon receiving waterways.

Council recognises the potential for stormwater pollution during the construction phase of development. Stormwater management objectives are therefore to be adopted for both the construction-phase and post-construction phase of new development. The SMP outlines stormwater management objectives for new developments to aid developers to minimise impacts on receiving waterways. Long and short-term stormwater management objectives taken from the SMP are provide in Table 1.

Table 1: Stormwater management objectives

Waterway Values	Stormwater Management Objective	
	Long-Term	Short-Term
<i>Ecological values</i>		
Habitat for birds, fish and animals	<ul style="list-style-type: none"> ■ Establish wetland or other nutrient reducing system immediately north of Temora Township and before flows reach lake Centenary 	<ul style="list-style-type: none"> ■ Educate landowners on benefits of native vegetation ■ Educate local community on water quality ■ Seek grant funds for establishment of wetland or other nutrient reducing system
Water quality of Trigalong Creek and other receiving waters	<ul style="list-style-type: none"> ■ Raise community awareness of their role in improving water quality ■ Improve quality of water leaving Temora township and the villages of Ariaah park and Springdale ■ Improve quality of water leaving Lake Centenary 	<ul style="list-style-type: none"> ■ Audit all commercial premises to identify potential pollution problems ■ Introduce site controls for new development work ■ Educate council staff in use of site controls for construction work ■ Carry out baseline monitoring of water quality
<i>Social values</i>		

Waterway Values	Stormwater Management Objective	
	Long-Term	Short-Term
Fishing	<ul style="list-style-type: none"> ■ Improve recreational access to Trigalong Creek for fishing activities 	
Aesthetics	<ul style="list-style-type: none"> ■ Improve visual amenity of low-lying land north of Temora ■ Reduce gross pollutants reaching and leaving towns and villages 	<ul style="list-style-type: none"> ■ Install gross pollutant traps in Temora Township (GPT)
Downstream users	<ul style="list-style-type: none"> ■ Ensure no reduction in water quality as a result of township and village discharges 	<ul style="list-style-type: none"> ■ Educate local community on water quality ■ Audit all commercial premises to identify potential pollution problems ■ Introduce site controls for new development work ■ Install gross pollutant traps in Temora Township (GPT)

4.2 Temora Flood Study 2019

The Temora Flood Study (Solutions Water Modelling, 2019) was developed by Council as part of the implementation of the NSW Government's Floodplain Management Program. The primary objective of the policy and manual is to reduce the impacts of flooding and flood liability on individual owners and occupiers.

As a result of flooding experienced in 2012 and 2016, the Temora Flood Study was commissioned and funded by Temora Shire Council and the NSW Office of Environment and Heritage.

The Project area (indicated in red) is outside of the Temora Flood Study area (Figure 9). Council has commenced flood planning through studies of Temora town, and Aria Park and Springdale villages. The completion of the Temora Floodplain Risk Management Plan is expected to occur by the end of 2022 (Temora Shire Council, 2020).

5.0 AVAILABLE DATA

Climatic data and water quantity and quality monitoring information is available in the region as outlined in the following sections.

5.1 Rainfall

The Bureau of Meteorology (BOM) has two stations within Temora; one at Temora Airport approximately 7 km from the Project site, with the closest being at the Temora Ambulance Station, approximately 3 km north of the Project site. Temora Research Station, which is no longer operational, is located approximately 7.5 km north-west of the Project site. Table 2 outlines the average annual, maximum annual, maximum daily and maximum monthly rainfall. Average monthly values for the three rainfall stations are in Table 3.

Table 2: Rainfall

Station Number	Station Name	Period of Record	Rainfall (mm)			
			Average Annual	Highest Annual	Highest Daily	Highest Monthly
073037	Temora Ambulance Station	1880 - 2020	537.0	977.0	148.6	287.8
073038	Temora Research Station	1934 - 2011	523.5	929.0	126.4	257.0
073151	Temora Airport	2005 - 2020	454.9	748.8	106.0	204.8

Table 3: Average Monthly Rainfall¹

Station Number	Rainfall (mm)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
073037	46.1	37.8	41.9	41.3	44.9	51.5	47.6	47.5	44.5	51.8	46.4	43.4
073038	46.0	40.2	40.4	41.1	41.8	43.1	46.3	45.0	42.0	52.2	46.2	41.3
073151	37.0	47.9	34.3	27.2	28.9	51.3	37.9	36.2	39.1	32.2	51.7	43.6

¹ Summary statistics for all years of recordkeeping

Flood producing weather systems across the region include inland troughs, cold fronts, and thunderstorms. Consequently, each rainfall event is a function of the prevailing meteorological conditions. Therefore, the rainfall data provides useful information about expected seasonal rainfall in the area.

5.2 Streamflow

There is one government surface water monitoring site located in the southern extent of the Lachlan River Basin, located approximately 35 km south-east of the Project site. Streamflow records (Table 4) for this site is available from the WaterNSW portal.

Table 4: Stream Gauging Stations

Station Number	Station Name	Available/Relevant Data	Distance from project area
412134	Wattle Creek at Dadauman	Rainfall, level, discharge	35 km south-east

Generally, data from the available stream gauges do not provide specific information on local site flooding but are more useful in the context of assessing major regional flooding events which may impact on site access. Information is publicly available from WaterNSW Real-time data portal and could be incorporated into site management plans.

5.3 Groundwater

The Project area falls within the Lachlan catchment area where groundwater sources include:

- Alluvial aquifers, divided into 11 groundwater management areas
- Fractured rock aquifers, consisting of three groundwater management areas.

The fractured rock, known as the Lachlan Fold Belt MDB, covers the width of the Murray Darling Basin (MDB) in NSW and therefore extends beyond the Lachlan catchment. This formation underlies the Belubula Valley Alluvium, the Upper Lachlan Alluvium, and parts of the Lower Lachlan Alluvium and Lower Murrumbidgee Alluvium.

The Lachlan Fold Belt MDB consists of strongly deformed/metamorphosed marine sedimentary rocks, cherts, siltstones, and mafic to intermediate volcanic and plutonic rocks of early Cambrian to Devonian age from 541 to 359 million years ago. This is the most extensive of the groundwater systems and ranges from the Great Dividing Range through to the western rangelands around Cobar. It provides stock and domestic groundwater supplies across its extent. The salinity of the groundwater tends to increase westward as the climate becomes more arid and the topography has less relief.

The Lachlan Alluvium is a continuous sequence of unconsolidated sediments deposited as valley fill in the upper areas of the catchment. Groundwater through flow is uninterrupted down valley and there is hydraulic connection across contiguous boundaries between the Lachlan Alluvium and the Murray Geological Basin sediments. The Lachlan Alluvium sits over and adjacent to the fractured rock management units of the Lachlan Fold Belt. The permeability of the underlying fractured rocks is many orders of magnitude lower than that of the alluvium. Groundwater exchange between the alluvium and the underlying rock is expected to be insignificant in the context of the groundwater resources of the alluvium. Consequently, these fractured rock systems are not considered hydraulically connected in a resource management sense to the groundwater resources in the alluvium (NSW DIP, 2018).

The alluvial aquifers of the Lachlan catchment are the main groundwater sources for irrigation and town supply in the subregion (DECCW, 2010). As indicated in Figure 10, the site (located 122 km south-west of Forbes) is underlain by the fractured rock unit (DECCW, 2010).

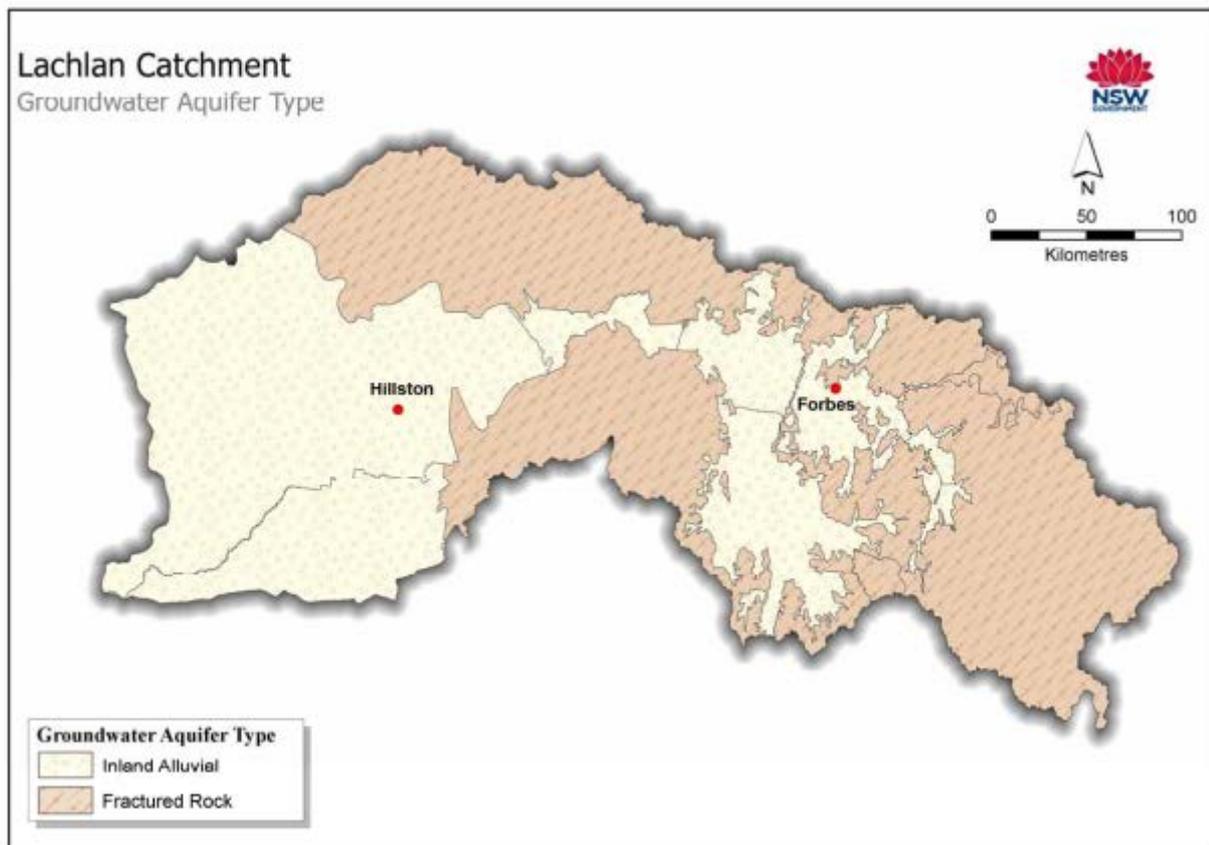


Figure 10: Lachlan Catchment Groundwater Aquifer Type (NSW Office of Water, 2011)

The Murray Darling Basin Authority (MDBA) commissioned an independent assessment of approaches to achieve sustainable use and management of basin groundwater resources which includes the Lachlan Fold Belt (Anderson et al, 2013). The closest MDBA monitoring bore (GW085113) that is screened within the Lachlan Fold Belt MDB aquifer is located approximately 140 km south-east of the Project site near the township of Yass (Figure 11). Water level variations in this bore are shown in Figure 12, which indicates that groundwater levels are strongly influenced by climatic variations and generally fluctuate between 11 m and 18 m depending on the depth of the water bearing zone. It also depicts a relatively long-term and stable water level in this government monitoring bore for the groundwater unit which confirms there is unlikely to be rising groundwater and salinization associated with groundwater from this geological unit (DPIW, 2017).

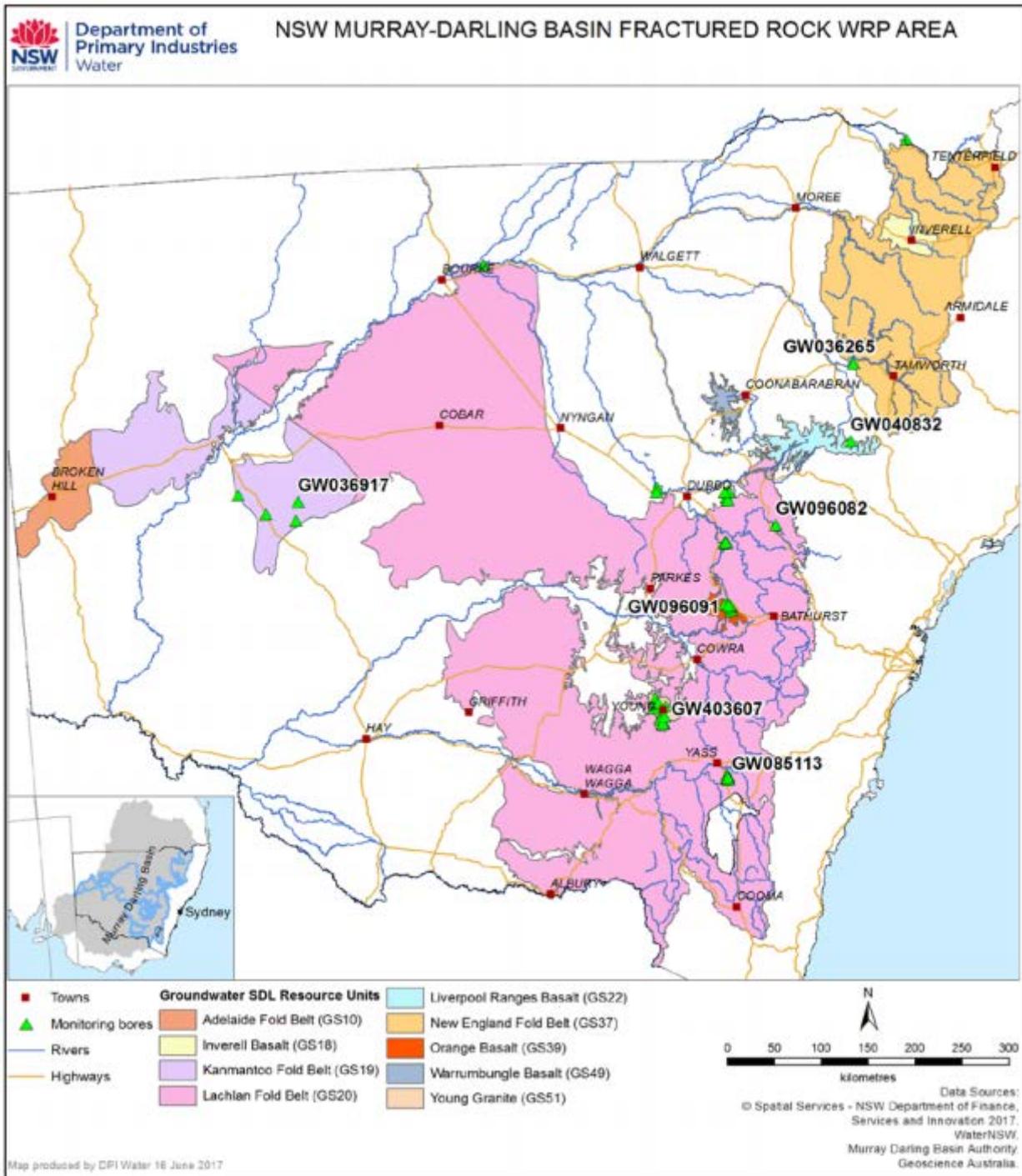


Figure 11: Location of monitoring bores used in the MDBA independent assessment

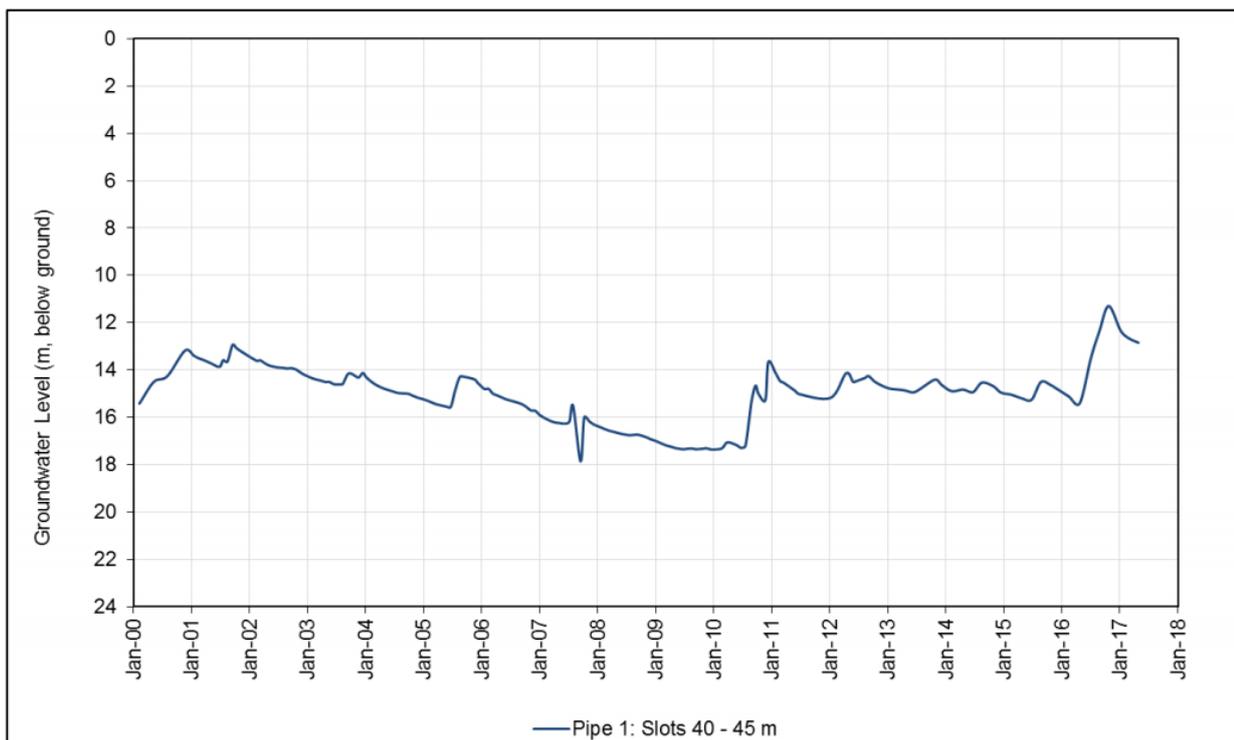


Figure 12: Lachlan Fold Belt groundwater level at GW085113

The nearest real time Groundwater Monitoring Site on the WaterNSW database (WaterNSW 2019) is located approximately 30 km north-east of Temora at Mudgee - Barmedman Rd west of Bribaree (Site no. GW036632.1.1). The levels recorded on 24 September 2020 indicated that the bore level below MP was 47.347 m, the groundwater level was 195.173 m AHD, and the groundwater depth below ground level was 46.727 (Figure 13).



Figure 13: Barmedman Road west of Bribaree groundwater levels (levels recorded on 24 September 2020)

6.0 POTENTIAL IMPACTS

The site is not located within or adjacent to any mapped Sensitive Areas - Water as prescribed in the LEP, accordingly the proposed on site activity is not expected to materially contribute to any regional groundwater issues, particularly those associated with nearby irrigation districts. Proposed trenching would be to a maximum 1,200 mm deep and piling would extend to a maximum depth of 3.5 m, which is expected to be above the local groundwater level.

Based on the current available information, potential adverse surface water-related impacts to the site include:

- Site accessibility and inundation
- Managing downstream sedimentation.

As there will be no extraction of groundwater or interference with the groundwater table during Project activities, potential for impacts have not been considered further.

6.1 Flooding

Flood planning maps referenced by the LEP indicate that site is not within an area likely to flood. However, heavy rainfall during storm events (or flash flooding) may cause disruption during construction activities or for material suppliers.

As a 1st order drainage line exists within the land parcel, to the west and south of the Project footprint, there is potential for overland flow during rainfall. The water will flow into the existing dam and could overflow towards the Narraburra Creek in the south-east.

6.2 Water quality and erosion

The Project has the potential to alter existing water quality conditions within the site. The impervious area of solar facilities is typically only marginally increased owing to associated hardstand and building areas. However, the panels may impact the nature of vegetation/grass coverage on the site, which has the potential to increase surface runoff and peak discharge. Increased flow concentration off the panels also has the potential to erode soil at the base of solar panels (Cook & McCuen, 2013).

Furthermore, as the site has been historically used for cropping there is very little natural ground cover vegetation.

The Project site occurs on soils that are characterised as brown podzolic soils. These soils are freely draining acid mineral soils, derived from sandstone / shale / granite parent material. They are slowly permeable with moderate erosion potential and are usually present in rolling lowlands and highly suitable for broadleaves and conifers (Office of Environment and Heritage, 2017).

There is the potential that site runoff will contain sediments and increase turbidity or other water quality parameters in downstream water ways. The existing farm dam should capture surface flow from the site and reduce sedimentation downstream.

7.0 PROPOSED MITIGATION MEASURES

7.1 Site accessibility and inundation

The site accessibility and potential for inundation issues may be managed in the Project's risk management register(s) owing to the regional nature of the events and the potential to impact whole of site works. There should be procedures in place to halt construction during heavy rainfall to reduce impacts to the Project construction and also to increase sedimentation downstream.

7.2 Downstream sedimentation

Impacts associated with erosion and sedimentation resulting from construction activities can be minimised by undertaking works in accordance with provisions of the NSW government's best practice sediment and erosion control series Managing Urban Stormwater: Soils and Construction (DECC, 2008).

Proposed mitigation measures associated with managing downstream actionable nuisance (sedimentation) are outlined in Table 5.

Table 5: Proposed Mitigation Measures

Stage	Measure	Activities/Approach
Design	Site drainage and water quality controls	<p>Design Basis</p> <ul style="list-style-type: none"> ■ Undertake hydrological assessment of the sites catchment in accordance with relevant methods outlined in Australian Rainfall and Runoff. ■ Determine sediment management targets and drainage control standards in accordance with Managing Urban Stormwater: Soils and Construction Vol 1 (Blue Book) (DECC, 2008). ■ Develop a site erosion and sediment control plan in accordance with the Blue Book. ■ Develop site drainage design incorporating detention basins and sedimentation management structures where relevant. ■ Permanent site drainage should coincide with temporary arrangements where possible.
Construction and/or Demolition	Site drainage and water quality controls	<p>General site works:</p> <ul style="list-style-type: none"> ■ Catch drains to be located downslope of any proposed road works. ■ Install location appropriate sediment fences or other applicable control measures depending on whether the feature is upstream or downstream of a disturbed part of the site or will need to be trafficable. ■ All stormwater collection points need to have appropriate sedimentation and erosion controls. ■ Undertake ongoing inspections of stormwater facilities and water control measures to assess their effectiveness.

Stage	Measure	Activities/Approach
		<ul style="list-style-type: none"> ■ Vibration grids or wash bays at all construction exits. ■ Level spreaders at locations where concentrated flow is discharged offsite to ensure sheet flow like conditions are maintained. ■ Flat land erosion control options include erosion control blankets, gravelling, mulching, soil binder, turving and revegetation.
Construction and/or Demolition	Stormwater point source control	<p>In the event of concrete works:</p> <ul style="list-style-type: none"> ■ Do not undertake works if chance of heavy rain. ■ Store rinsate² water, if applicable, separately to other water on site and dispose of offsite as appropriate. ■ Block on site drains in the area of the works and remove any contaminated runoff. <p>In the event that dewatering practices are required:</p> <ul style="list-style-type: none"> ■ Pump hose intakes for withdrawing water from excavations will be elevated to minimise sediment pumping and directed to a containment area for settling prior to discharge. ■ Limit direct discharge off site (consistent with the design requirements for sediment pond discharge). ■ Stormwater collected on site should be reused where possible. Controls should be inspected and maintained on a regular basis. All water released from sediment basins should be clear or disposed off site by vehicle. ■ Material and waste storage areas should be designed and operated to minimise interaction with surface waters. ■ Vehicle washdown areas should be located away from water courses.

² A dilute solution of chemical resulting from washing the container and equipment with water, as defined by NSW EPA accessed 20 December 2018 <https://www.epa.nsw.gov.au/licensing-and-regulation/licensing/environment-protection-licences/authorised-officers/glossary#r>

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SD/JR/sd

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APPENDIX A

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this Report**

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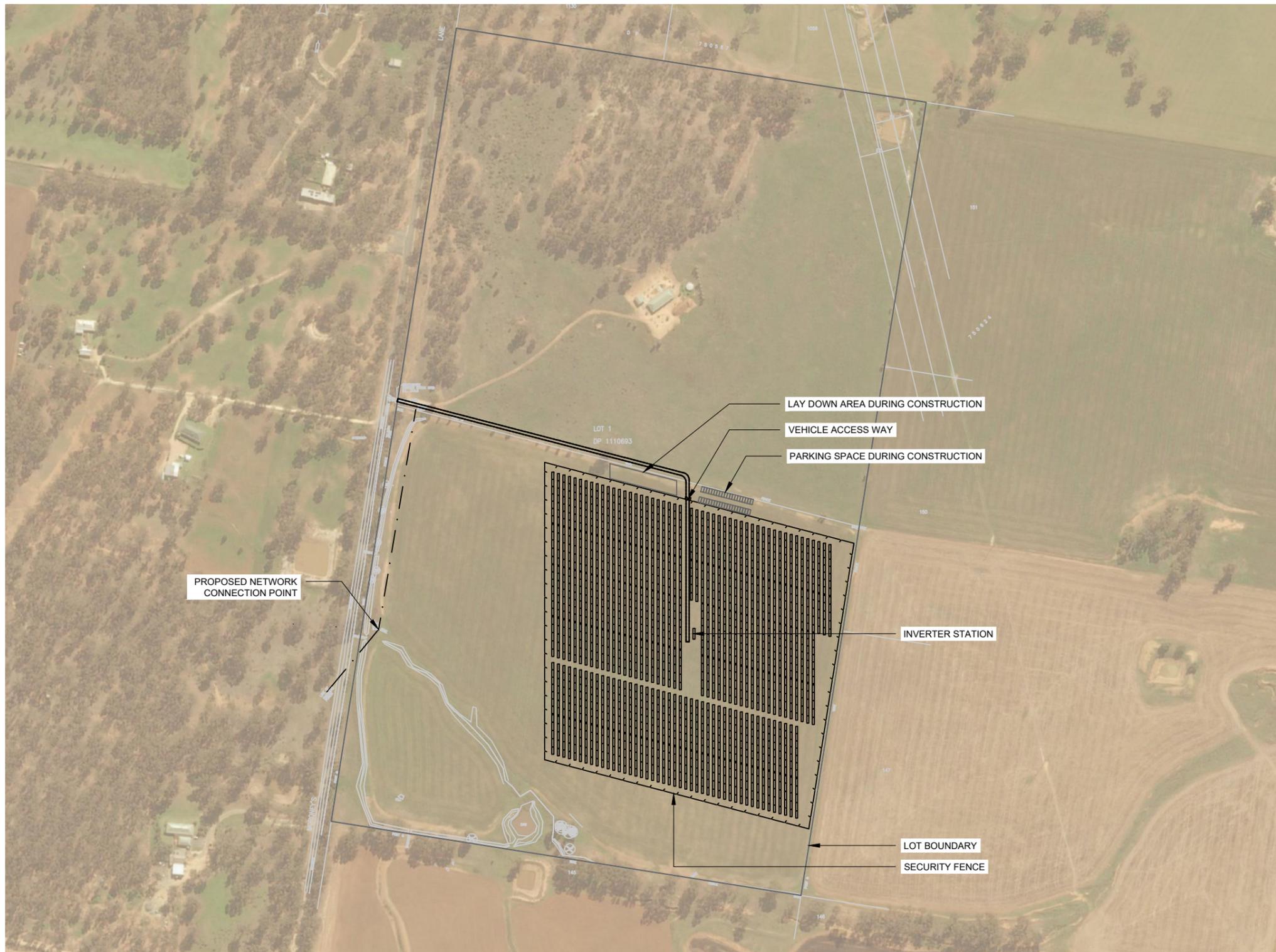
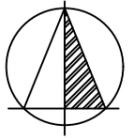
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Any uncertainty as to the extent to which this Report can be used or relied upon in any respect should be referred to Golder for clarification

APPENDIX B

**Proposed Temora 1C Solar Farm
Layout**



SITE INFORMATION	
LOT / DP	1/1110693
ADDRESS	197 MORONEYS LANE, TEMORA, 2666
LGA	TEMORA SHIRE COUNCIL
LAT / LONG	-34.47573 / 147.54952
ELEVATION	310 m
LOT AREA	48.5 ha
FENCED AREA	10.8 ha
DNSP	ESSENTIAL ENERGY

PROJECT INFORMATION	
AC CAPACITY	5.0 MW
INVERTERS	2 x 3.0 MW AC
TRACKER SPACING (N-S)	MIN. 1 m
ARRAY PITCH	6.25 m
CONNECTION VOLTAGE	11 kV
CONNECTION FEEDER	ESSENTIAL ENERGY TEM3B2
CONNECTION SUBSTATION	ESSENTIAL ENERGY TEMORA TOWN 66/11
SECURITY FENCE SETBACK	MIN. 3 m FROM OPTION BOUNDARY
ARRAY SETBACK	MIN. 8 m FROM SECURITY FENCE
ACCESS ROAD WIDTH	3.5 m

1 GENERAL ARRANGEMENT PLAN
SCALE: 1:5000

PRELIMINARY DESIGN

NO.	STAGE	DATE	NOTES	PARTNERS	DRAWN	CHECKED	APPROVED	DRAWING	PROJECT	CLIENT ADDRESS	SCALE	SHEET SIZE	ORIG. DATE	REV. DATE	REV. NO.
1	ISSUED FOR SPECIALIST STUDIES	07/09/20			NL	SR	SD	GENERAL ARRANGEMENT PLAN	TEMORA 1C 5MW SOLAR FARM	ITP DEVELOPMENT 197 MORONEYS LANE TEMORA, 2666	AS NOTED	A3	28/8/20	2/9/20	1
2	----	----													
3	----	----													
4	----	----													
5	----	----													
6	----	----													



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DRAWING NO. **TEM1C-G-210**

APPENDIX C

Temora LEP Maps



Temora Local Environmental Plan 2010

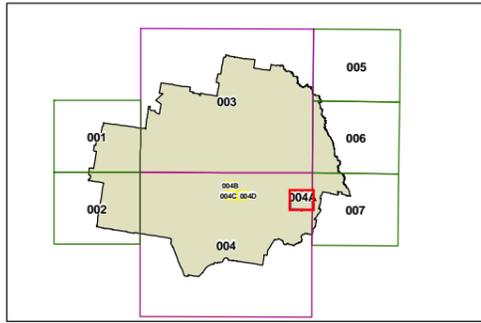
Flood Planning Map - Sheet FLD_004A

Flood Planning Area

 Flood planning area

Cadastre

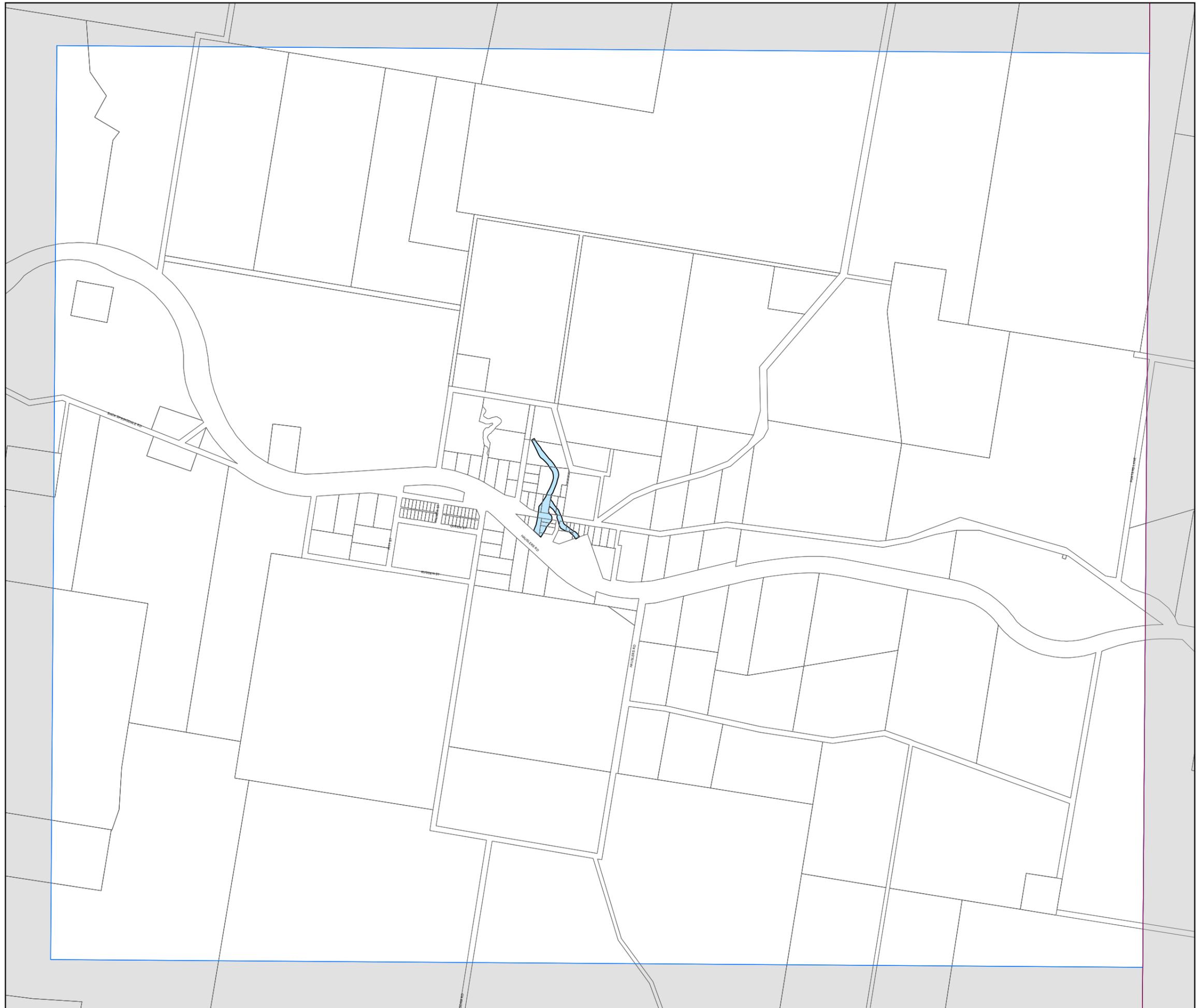
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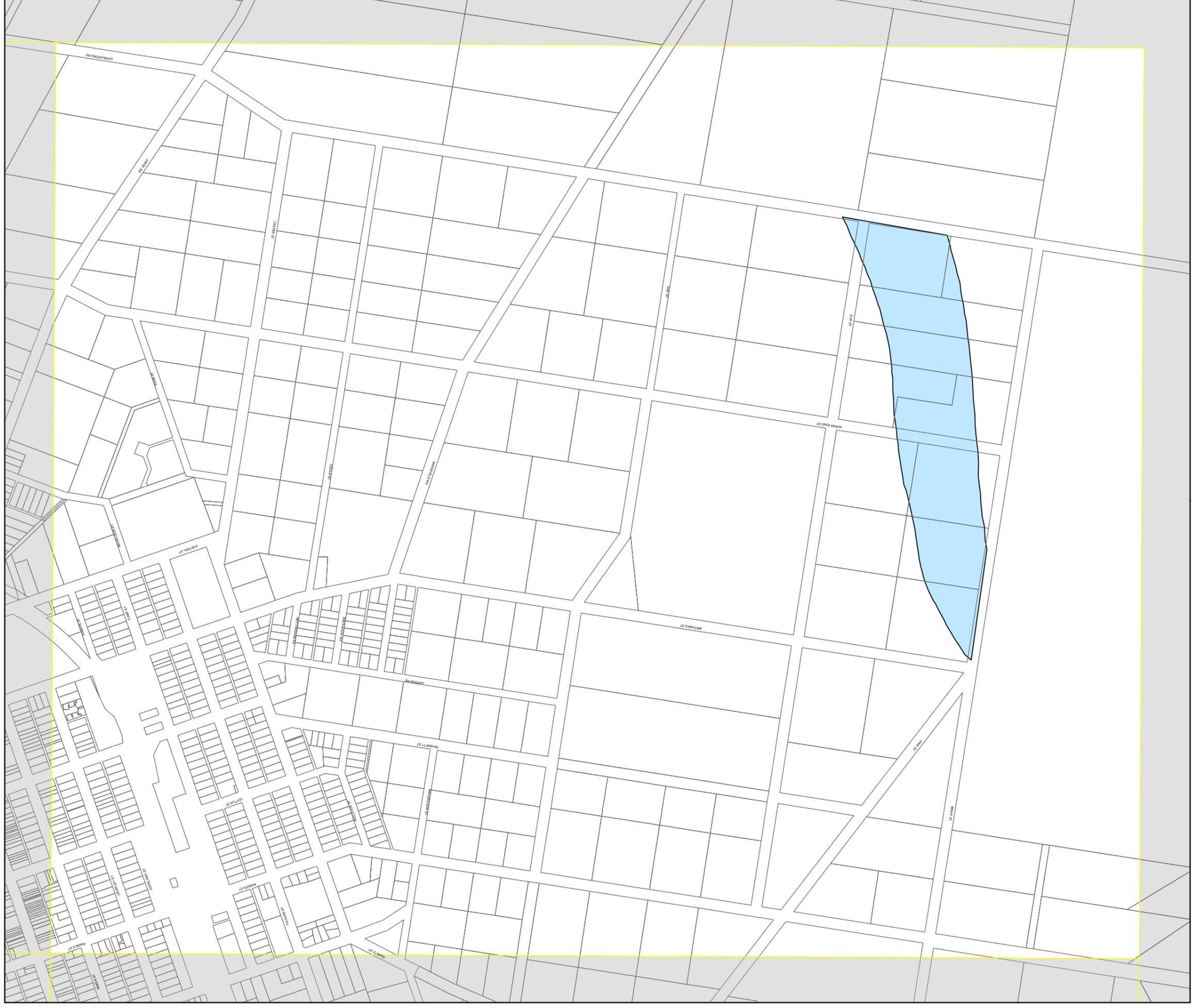


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Projection: GDA 1994
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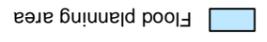




**Temora Local
Environmental
Plan 2010**

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Sheet FLD_004C

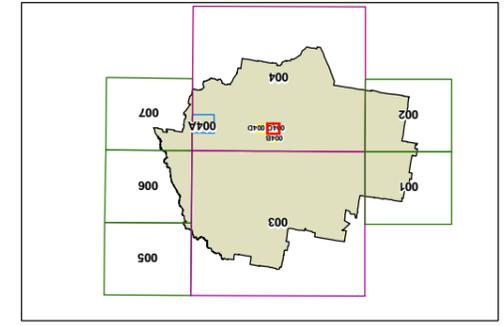
Flood Planning Area



Cadastre



Cadastre 03/03/2009 @ LPMa



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Kilometers

Projection: GDA 1994
Zone 55

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Temora Local Environmental Plan 2010

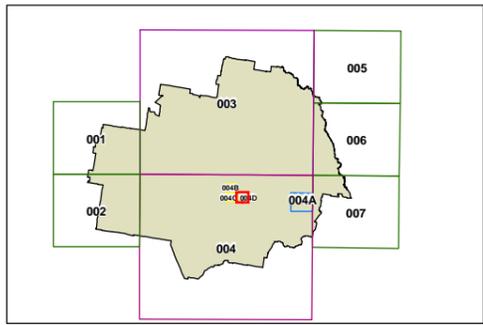
Flood Planning Map - Sheet FLD_004D

Flood Planning Area

 Flood planning area

Cadastre

 Cadastre 03/03/2009 © LPMA



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Projection: GDA 1994
Zone 55

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Temora Local Environmental Plan 2010

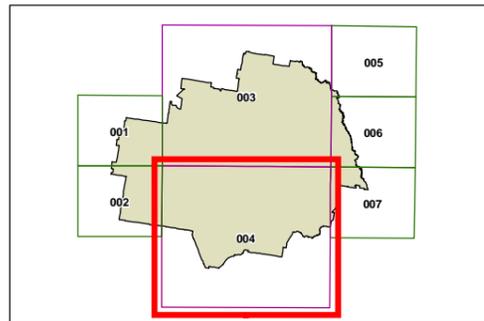
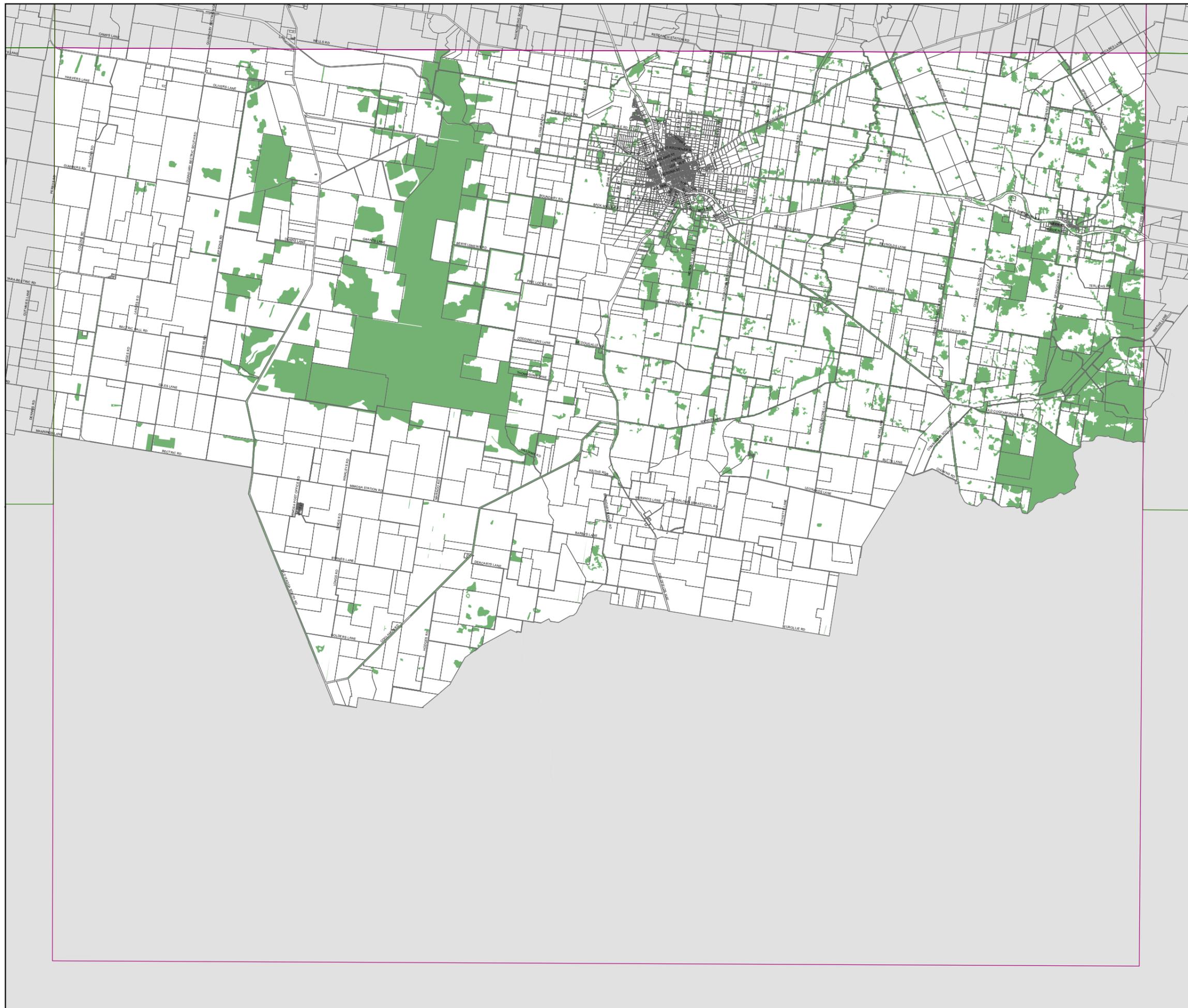
Natural Resources Sensitivity - Biodiversity Map - Sheet NRB_004

Sensitive Area

 Biodiversity

Cadastre

 Cadastre 03/03/2009 © LPMA



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Projection: GDA 1994
Zone 55

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Temora Local Environmental Plan 2010

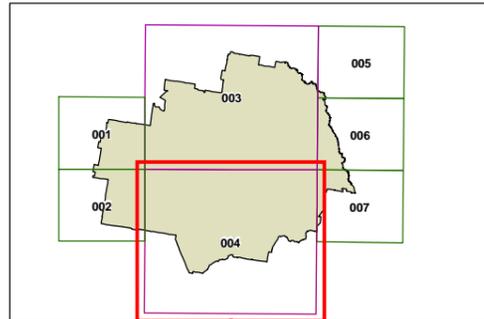
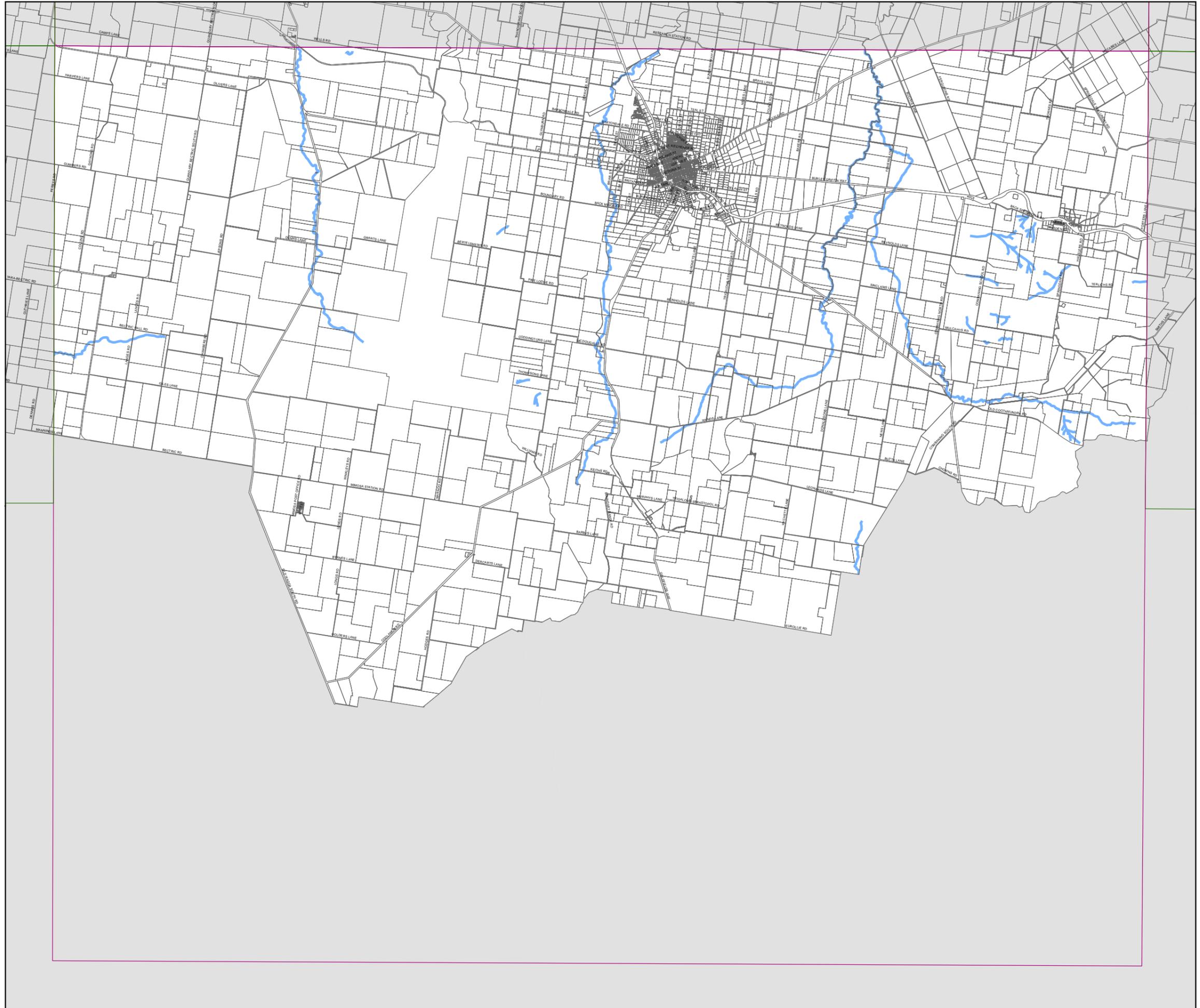
Natural Resources Sensitivity - Water Map - Sheet NRW_004

Sensitive Area

Water

Cadastre

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0 1 2 4 6 Kilometers

Scale: 1:160,000 @ A3

Projection: GDA 1994
Zone 55

Map identification number:
7350_COM_NRW_004_160_20100517



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