

WATER ASSESSMENT

Daisy Hill Solar Farm

November 2019





About ITP Renewables

ITP Renewables (ITP) is part of the ITP Energised Group which, established in 1981, specialises in renewable energy, energy efficiency and carbon markets consulting. The Group has offices and projects throughout the world.

ITP was established in Australia in 2003 and has undertaken a wide range of projects, including designing grid-connected renewable power systems; providing advice for government policy; feasibility studies for large, off-grid power systems; developing micro-finance models for community-owned power systems in developing countries; and modelling large-scale power systems.

The staff at ITP have backgrounds in renewable energy and energy efficiency, research, development and implementation, managing and reviewing government incentive programs, high-level policy analysis and research, engineering design and project management.



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1. INTRODUCTION

1.1 OVERVIEW

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 recommended for construction and operation.

1.2 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.



2. PROJECT DESCRIPTION

2.1 Solar Farm

ITP Development (ITP) is proposing to develop the Daisy Hill Solar Farm (also referred to as Hil1A), as described in the solar farm summary sheet for this proposal (see Table 1). It will be located approximately 2.5m south of the town of Hillston, NSW (see Figure 1). Details of the layout are contained in the drawing HIL1A-G-210.

Table 1: Site information

Parameter	Description
Site name	Daisy Hill Solar Farm
Lot/DP(s)	103/755189
Street address	Hillston, NSW 2675
Council	Carrathool Shire Council
AC capacity	10 MW
DC capacity	12 MW
Project area	30 ha
Current land use	Grazing and cropping

ITP is proposing to construct a solar farm with a DC capacity of 12 MW and AC output of 10 MW, on an approximately 70 ha site that is currently used for grazing and cropping.

There are to be approximately 32,000 solar modules installed on around 400 mounting structures running north to south. Each row of solar photovoltaic (PV) modules will rotate to track the sun across the sky from east to west each day. The spacing between each row is 6m. The hub height of each tracker is around 2m, with the peak of the modules reaching a height of approximately 2.5m when the array is fully tilted to 60 degrees from horizontal. The general arrangement of the solar farm and the array tracker details are shown in drawing HIL1A-G-210.

The solar farm will also include four 2.5 MW inverter stations. The stations are to be located within the array and each are mounted on a 20-foot skid. Each of these inverter stations incorporates the high/medium voltage switchgear and transformers. The arrangement of the inverter station skid is shown in drawing HIL1A-G-430.

The mounting system is constructed on piles that are driven into the ground. During construction, there is expected to be 100 personnel on site working from 7 am – 4 pm, Monday to Friday. The construction is anticipated to take approximately 3 months. Once operational the site will be unmanned. Maintenance is expected to be carried out quarterly by a crew of 2 – 3 people.

Solar panels and related infrastructure will be decommissioned and removed upon cessation of operations. This is likely to occur within two years of the end of the project. The site can then be returned to the pre-development land use.

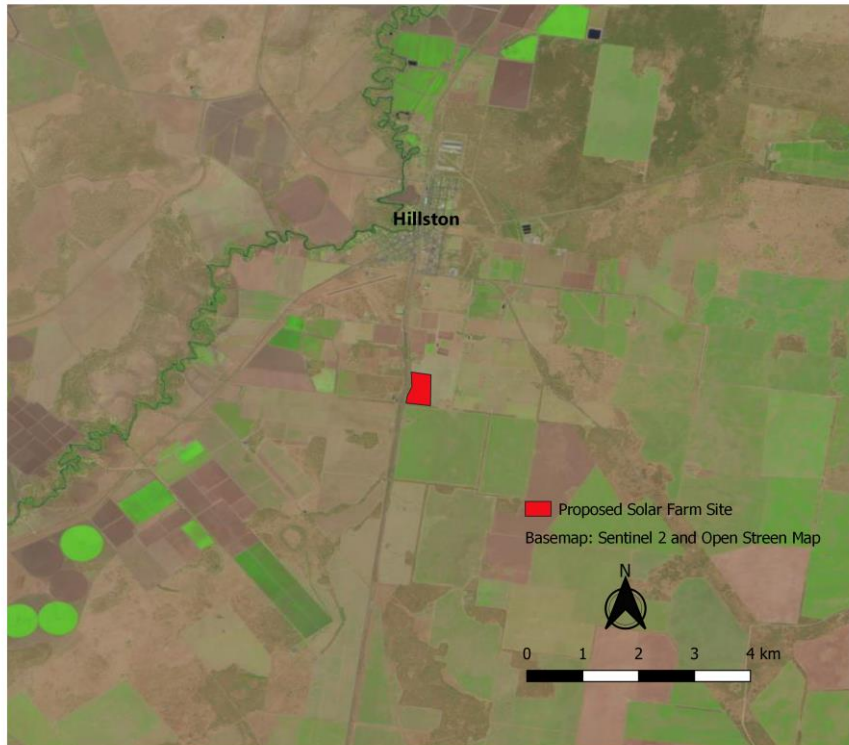


Figure 1: Proposed solar farm site and surrounding area

2.2 Hydrology, climate and topographic conditions

The project area for the Daisy Hill Solar farm is within the Carrathool Shire Council Area.

Hillston (120m AHD) along with West Wyalong (250m AHD) and Ivanhoe (87m AHD) form the major townships within the western part of the Lachlan Water Resource Plan area (NSWDPI, 2018). The town of Hillston is situated on the Lachlan River, the fourth longest in Australia (MDBA, 2019), with the floodplains of the Lachlan Valley supporting sheep and cattle grazing, dryland farming and irrigated cropping (NSWDECCW, 2011). The western part of the Lachlan catchment is characterized by relatively flat topography and warm-hot semi-arid plains and an annual average rainfall of 300 mm.

The catchment area of the Lachlan River represents 8% of the Murray–Darling Basin, contributing 834 GL (or 6.5%) per year to the water of the basin, with significant tributaries being the Abercrombie, Belubula, Boorowa rivers and Mandagery Creek. Water users include urban water supply, stock and domestic, irrigated agriculture and mining (MDBA, 2019)



3. 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 2.

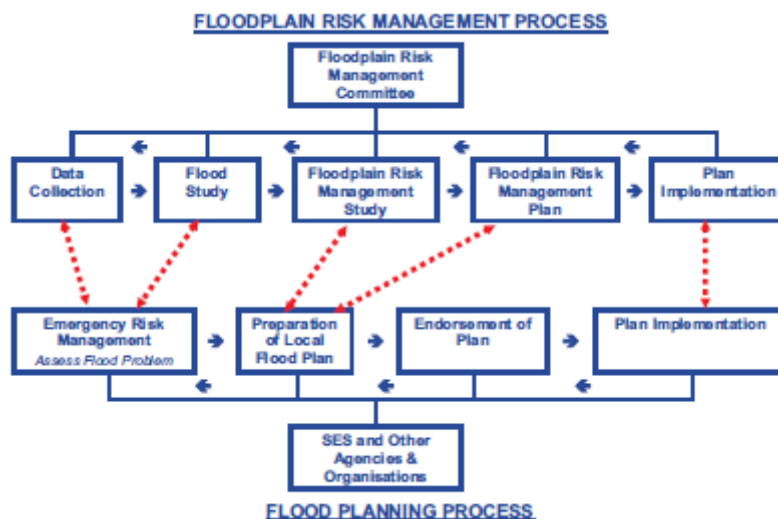


Figure 2: Floodplain risk management and planning process

3.1 Local Government Act 1993

The Local Government Act provides the legal framework for the system of local governments of the state of NSW. Specific to this project is Section 733, which exempts councils from liability in relation to flood prone land under the provision that they have undertaken substantial assessments in accordance with the latest approval manual.

The 2005 gazetted Floodplain Development Manual is the current approved manual and supports section 733 and the NSW Government's Flood Prone Land Policy. Both the manual and the policy provide councils with the framework to implement processes, and sustainable strategies to manage the floodplain risks that specifically impact human occupation.

3.2 Environmental Planning and Assessment Act 1979

This is an Act to instate an environmental planning system and assessment arrangement 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. Section 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 offers sustainable and integrated management of the state's water sources for the benefit of both present and future generations. Water management principles are intended to guide

decision-making under the Act in relation to floodplain management. They require the existing and future risk to human life and property, arising from occupation of the floodplain, to be minimised.

3.4 Carrathool Local Environmental Plan (LEP) 2012

The Carrathool Local Environmental Plan (LEP) 2012 aims to make local environmental planning provisions for land in the 3.4 Carrathool area in accordance with the relevant standard environmental planning instrument. The regional area includes specific information for residents in the town of Hillston.

The Plan provides the prohibited and permitted types of development within the local area. Some types of development are also regulated by specific state environmental planning policies. The Plan (Part 6.2) does provide specific management requirements for flood planning, which applies to land at or below the flood planning level (1 in 100 ARI plus 0.5m freeboard). It requires that development consent cannot be granted unless the proposed development is compatible with the 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. The site is shown in relation to the Hillston Floodplain Management Plan - Floodway Network and Flood Fringe area Sheet 5 (NSW Government, 2005) below (figure 3). Figure 4 shows the site in relation to flood prone areas modelled by (Cardno Willing, 2005). These maps indicate that the proposed site is not within a floodway but the southern part of the block is within a flood fringe area (i.e. the extent of the 1990 flood). The 1990 and 1956 are the most significant recorded floods for Hillston (Cardno Willing, 2005).

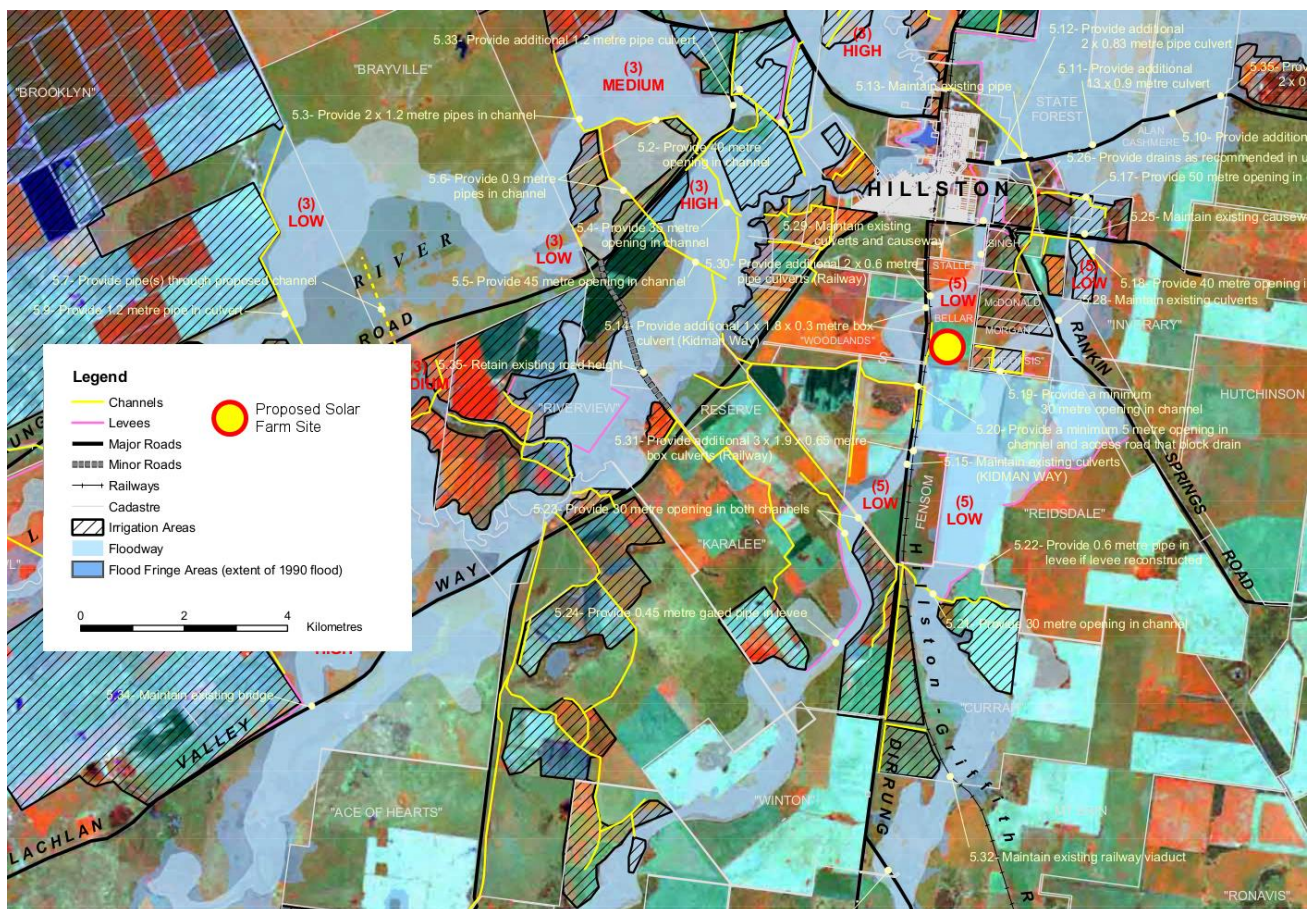


Figure 3: Site in relation to floodways and flood fringe areas (1990 major flood)

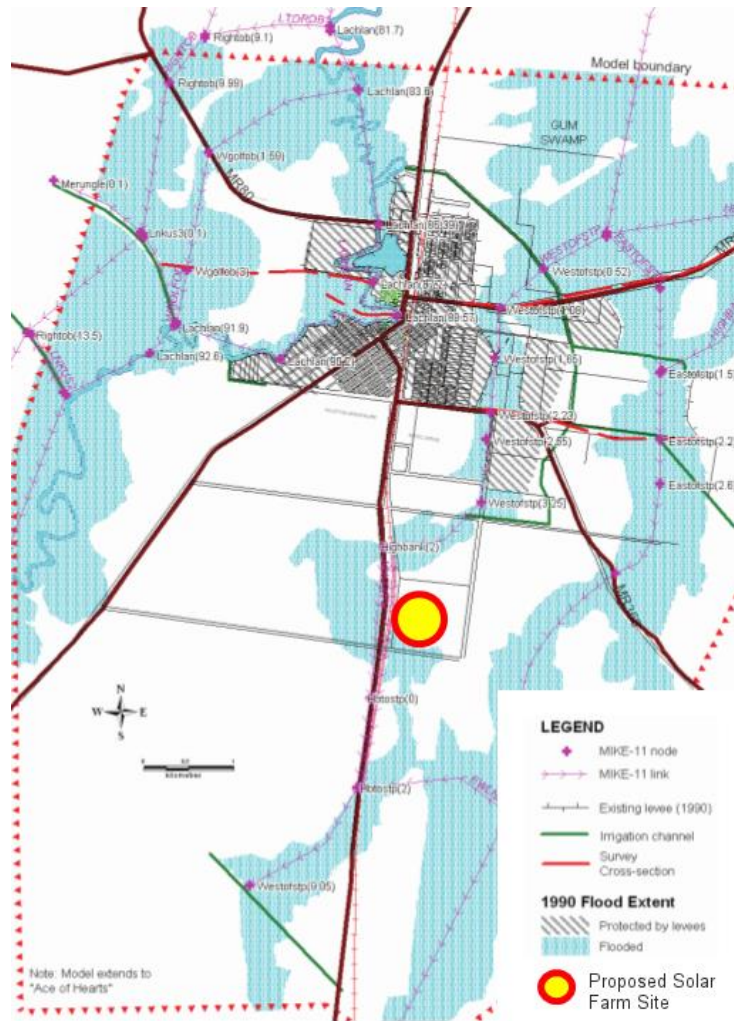


Figure 4: Site in relation to areas flooded in 1990 (estimated by Cardno Willing, 2005)

3.4.1 Carrathool Development Control Plan

The Carrathool Dumaresq Development Control Plan (DCP) is currently under review (Carrathool Shire Council, 2019), with guidance for developments and the statutory planning controls of the Local Environmental Plan provided in the Carrathool Local Environmental Plan 2012 (Legislation NSW, 2012). The guidance provides proponents assistance with criteria to address in development applications.

The guidance on flood protection states that the consent authority must be satisfied on a number of points regarding developments, including that the development:

- is compatible with the flood hazard of the land, and
- is not likely to significantly adversely affect flood behaviour resulting in detrimental increases in the potential flood affectation of other development or properties, and
- incorporates appropriate measures to manage risk to life from flood

- d) is not likely to significantly adversely affect the environment or cause avoidable erosion, siltation, destruction of riparian vegetation or a reduction in the stability of river banks or watercourses, and
- e) is not likely to significantly adversely affect the environment or
- f) cause avoidable erosion, siltation, destruction of riparian
- g) vegetation or a reduction in the stability of river banks or watercourses,

Development Control Plans typically state that planning restrictions will apply to development on land below the 'flood planning level' of watercourses. The 'flood planning level' refers to the flood level established by the 1% Annual Exceedance Probability (AEP) flood (commonly referred to as the '1 in 100-year flood') plus 0.5 metres freeboard" (Legislation NSW, 2012, page 44).

NSW local government DCPs also typically provide guidance on stormwater drainage systems for rural lots and large residential lots, which are relevant to the proposed solar farm site. Guidelines typically suggest that, "In some circumstances... drainage easements over downstream properties may be required. Consent from the owner(s) of the downstream properties is to be submitted with the development application" (Armidale Dumaresq Council 2012, section 5.2).

3.4.2 Carrathool Shire Council Community Strategic Plan 2012-2022

The Carrathool Shire Council Community Strategic Plan 2012-2022 2027 is planned and executed under key themes identified through extensive community consultation (Carrathool Shire Council, 2013). These include:

- Promoting Community Health and Wellbeing
- Caring For and Protecting Our Natural and Built Environment
- Protect and enhance biodiversity
- Growing and Diversifying our Economic Base

The themes do not contain specific flood or water management aspects. However, within the themes above, the strategies include minimising the impact on the environment from development activities, maintaining and managing water quantity and quality.

3.5 State Environmental Planning Policy (Infrastructure) 2007

Part 3, Division 7 of the State Environmental Planning Policy (Infrastructure) 2007 relates to 'Flood Mitigation Work'. This policy provides details on the types of works which may be required for land that is susceptible to flooding by the probable maximum flood event, also known as flood liable land. The policy states that 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 within the mapped flood planning area under the Local Environmental Plan and does not require additional flood mitigation work.

3.6 Protection of the Environment Operations (POEO) Act 1997

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



With relevance to the site, the Act aims to reduce risks to human health and avoid degradation of the environment by promoting pollution prevention, through the reduction of materials used and advocating the re-use, recovery or recycling of materials. The Act contains the requirements for the management of water discharges and 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 provisions for the conservation of soil resources and 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 insofar as they relate to Parts 2A, 3 and 4, jointly with the Minister for the Environment.

4. CATCHMENT AND FLOOD HISTORY

The Project is located in the Carrathool Shire Council, 2.5m south of the town of Hillston. According to spatial data from the Australian Hydrological Geospatial Fabric (Geofabric), the proposed facility is located within a large sub-catchment that flows into Lachlan River (see figure 5 below).

The Project area is situated within a relatively flat region, with much of the area being between 116-120m contour values (figure 4). The centre of the site has an elevation of 119m (AHD), with the nearest part of the Lachlan River having an elevation of 117m (AHD)². The land is mostly cleared of native vegetation and is currently used for farming.

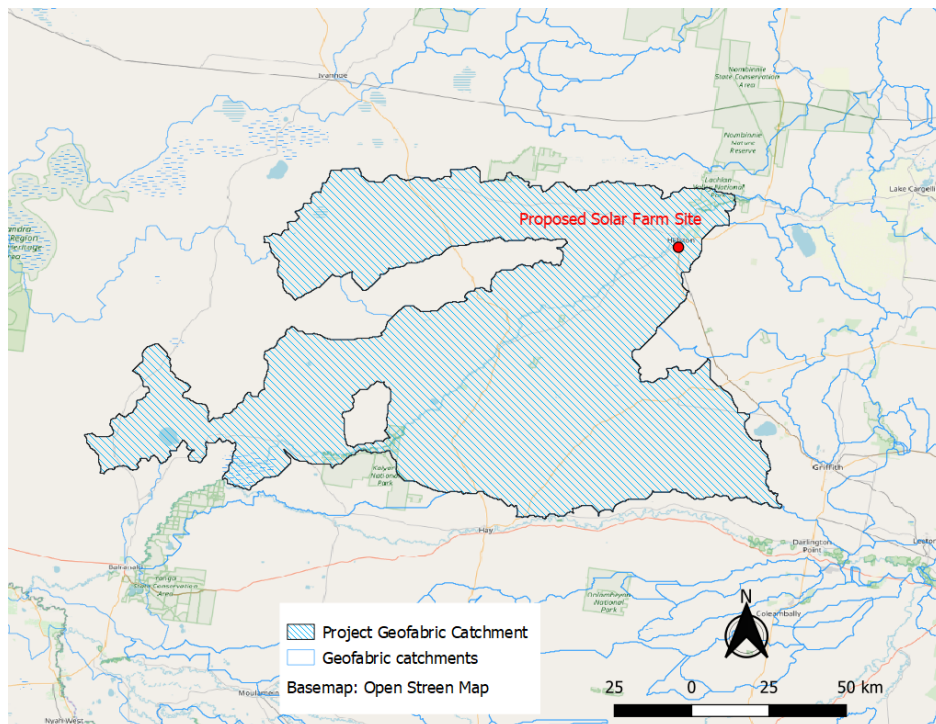


Figure 3: Catchments of the project area identified in Geofabric

² Elevation values sourced from ELVIS - Elevation and Depth - Foundation Spatial Data (locations: -33.51316°/145.53606° and -33.50458°/145.49486°)

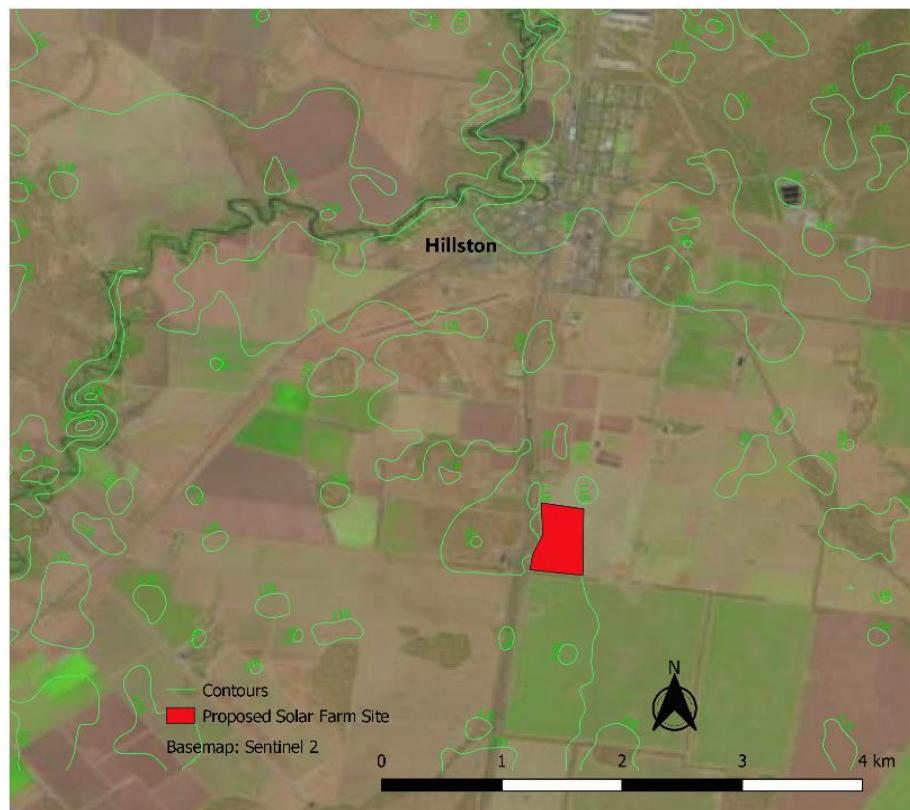


Figure 4: Site topography

4.1 Hillston floodplain risk study 2005

Cardno Willing (2005) conducted an in-depth floodplain risk study for the Hillston area in 2005. The final provides localised information on potential flood events including history of flooding in town, a 1% Annual Exceedance Probability (AEP) Flood Extent Maps, and a Flood Planning Level (FPL) recommendations³. The report notes that, historically, Hillston, “...has been affected by a number of historical floods. Recent floods were in 1952, 1955, 1956, 1969, 1974, 1975, 1976, 1978, 1984, 1989, 1990 and 1998. The largest of these floods were those in 1956 and 1990.” The report also notes that “... Over 140 [urban] properties would be affected in a 1% AEP flood without levees” and more generally that, “Flooding can have a direct economic impact due to the damage and related losses caused to property and people on the floodplain. Damages from flooding may be categorised typically as either financial or social in nature. Figures 3 and 4 (above – section 3.4) provide an indication of the location of the project site in relation to the 1% AEP Flood Extent and Flood Planning Level Maps. These maps indicate that the southern part of the project site within a flood fringe area but not within a floodway.

³ Sourced from https://www.carrathool.nsw.gov.au/carrathool/final_frms_report_v6-ds [November 22nd, 2019].

5. AVAILABLE DATA

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

5.1 Rainfall for selected stations

The Bureau of Meteorology (BOM) has a station at the Hillston Airport (station number 075032). Table 2 outlines the average annual and maximum daily, monthly and annual rainfall for the Hillston Airport station and two other selected stations (i.e., station number 075096 - Hillston (Cowl Cowl) and station number 075167 - Merriwagga (Thurlo)). Average monthly values for the 3 rainfall stations are provided in table 3.

Table 2: Rainfall

Station Number	Station Name	Period of Record	Rainfall (mm)			
			Average Annual	Highest Annual	Maximum Daily	Highest Monthly
075032	Hillston Airport	1881 - 2019	370.2	820.0	123.0	242.4
075096	Hillston (Cowl Cowl)	1871 - 2017	339.4	652.9	102.6	213.6
075167	Merriwagga (Thurlo)	1975 - 2019	364.3	615.0	81.0	241.6

Table 3: Average Monthly Rainfall

Station Number	Rainfall (mm)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
075032	30.6	27.4	33	27.1	32.2	35.1	30.7	30.7	28.2	35.6	28.9	30.5
075096	25.2	25.3	27	24.8	31.3	37.9	25.9	30.3	24.5	29.1	26.3	26.8
075167	32.8	27.3	30.1	19	33.6	32.4	30.3	27.4	30.1	35.8	28.4	30.6

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 are two government surface water monitoring sites located within 4km and 17km of the site. Streamflow records (Table 4) for these sites are available for various locations in the region from the WaterNSW Real-time portal.

**Table 4: Stream Gauging Stations**

Station Number	Station Name	Available/Relevant Data	Distance from project area
412039	LACHLAN RIVER AT HILLSTON WEIR	Watercourse Level, Watercourse Discharge, Water Temperature, Electrical Conductivity @ 25deg C	3.8 km northwest
412196	LACHLAN RIVER DOWNSTREAM GANOWLIA WEIR (LANES BRIDGE)	Watercourse Level, Watercourse Discharge, Water Temperature, Electrical Conductivity @ 25deg C	16.8km north

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 that 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 and Hydrogeological Conditions

The NSW Office of Water (2011) notes that “Groundwater is an important source of water in the western part of the [Lachlan] catchment, with a large irrigation industry in the Hillston area reliant on groundwater for the production of citrus and vegetable crops (page 1)” and that the majority of groundwater extraction in the catchment takes place in alluvial aquifers spread across the western part of the catchment from Lake Cargelligo to beyond Hillston (page 14). Under the Water Management Act 2000, there is a current water sharing plan for the Lachlan Alluvial Groundwater Sources (NSWDPI, 2016 & 2019). The water sharing plan recognizes benefits for users, economic considerations, unregulated streams, and sets rules for alluvial aquifers in the area.

The western part of the Lachlan catchment is characterized by unconsolidated Cenozoic sediments (NSWDPI, 2018b). CSIRO (2008) note that the aquifers of the region consist of unconsolidated alluvial sediments that form a broad alluvial fan at the point where the Lachlan River emerges into the riverine plain near Hillston. The unconsolidated sediments are subdivided into the shallow and heterogeneous Sheparton Formation unconfined aquifer and underlying leaky confined aquifers in the Calivil Formation and Renmark Group. Further work by Lamontagne et al., (2011) found that geological cross sections near Hillston were consistent with an alluvial environment, having a make-up comprised of mixed sand, sandy clay and clay horizons of varying thicknesses. NSWDPI (2018b) note that there are a number of Groundwater-dependent ecosystems (GDEs) of high value along the Lachlan River, including upstream and downstream of Hillston. A ground water vulnerability map for the Lachlan Catchment (NSWDLWC, 2001a) shows the areas below Hillston to be of low-moderate risk, and the areas above the town to be of moderate-high risk (see figure 5 below). The fan-shaped area west of Lake Brewster to Hillston is believed to be the major recharge area to the unconsolidated sediments of the Murray Basin and should be afforded a greater level of protection

(NSWDLWC, 2001b). A scientific review of the Lower Lachlan Groundwater Sharing Plan (NRC, 2006) notes that recharge from rainfall was calculated assuming a rate of 1% of average annual rainfall at Hillston for the plan but that confidence in the approach for this estimation is low to moderate due to relative error in the different components of the water balance. Shallow aquifer salinity for the Lower Lachlan Alluvium shows the Hillston area to have values less than 500 Total dissolved solids (TDS, mg/L). With less than 1,700 mg/L generally considered to be low for shallow aquifers. The lowest salinity groundwater in the catchment occurs close to the Lachlan River near Hillston (NSWDPI, 2018; see figure 6). Ground water monitoring of the Lower Lachlan Alluvium (GS30) by the Murray Darling Basin Authority (MDBA, 2012) indicates that groundwater elevation (m AHD) has decreased by approximately 5m from 1970-2010, with most of the decline happening after 2000 (see figure 7)

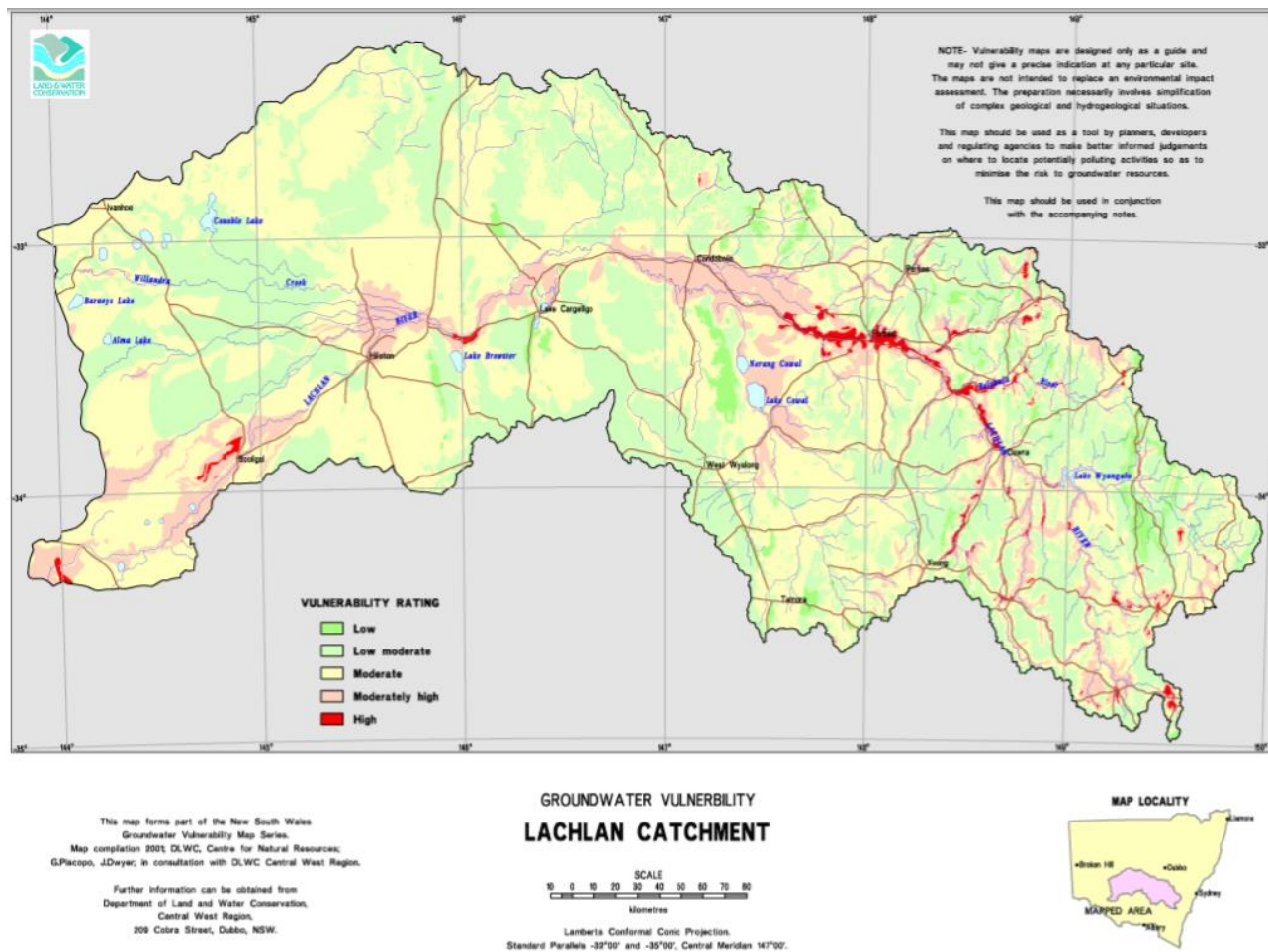


Figure 5: Groundwater vulnerability map for the Lachlan Catchment (source: NSWDLWC, 2001a)

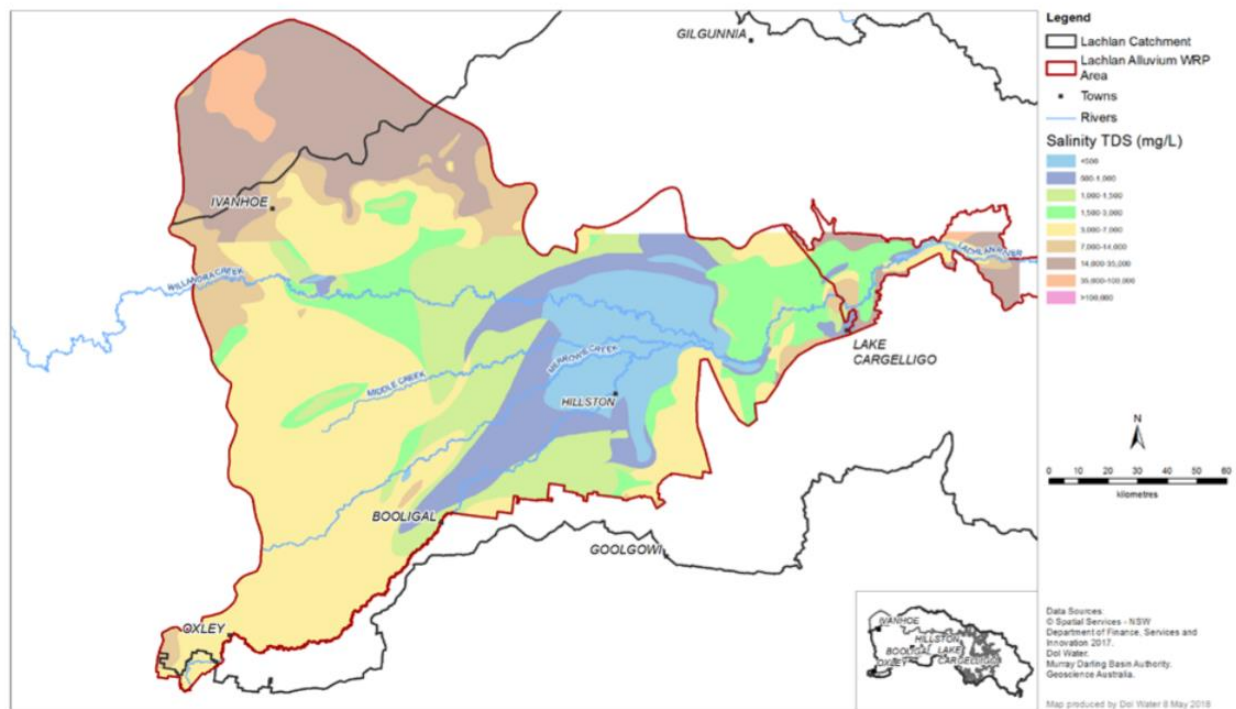


Figure 6. Groundwater salinity in the Lower Lachlan Alluvium (shallow aquifer – source NSW DPI, 2018)

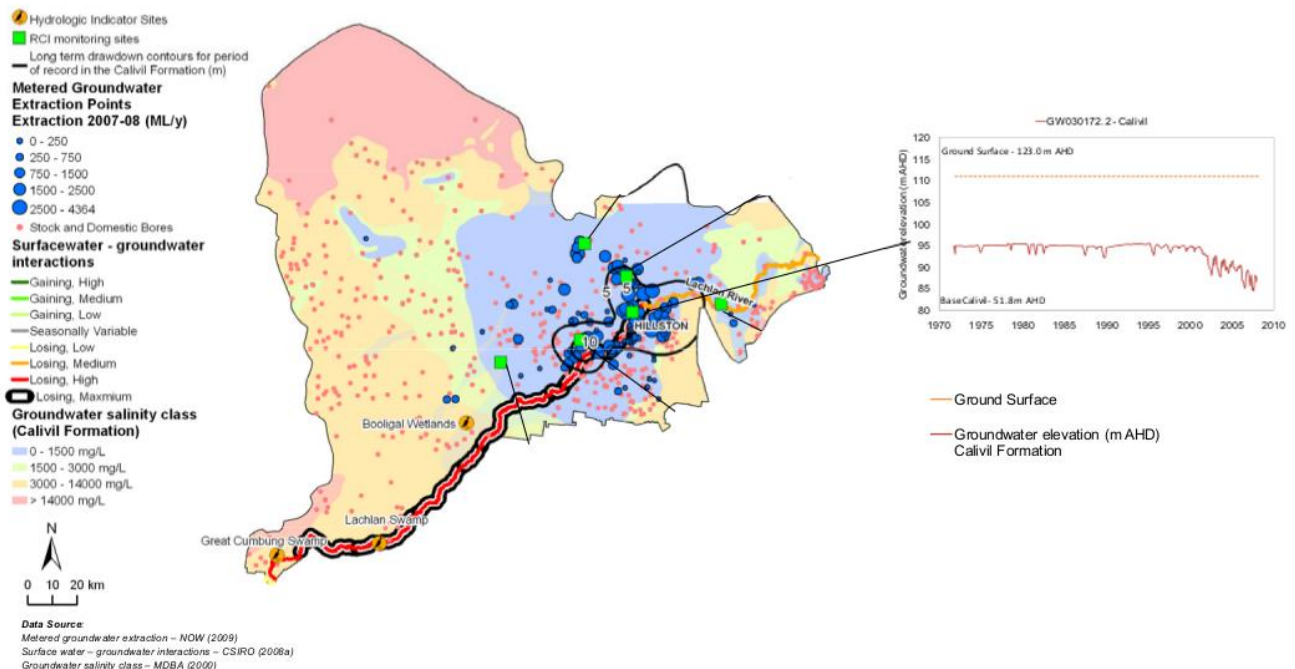


Figure 7. Groundwater Heights in the Lower Lachlan Alluvium - GS30 (source MDBA, 2012)

5.4 Surface Water and Riparian Conditions

A water sharing plan is in place for the Lachlan Unregulated and Alluvial Water Sources (NSW Legislation, 2019b). The Lachlan River system is regulated from the upper limit of Wyangala Dam to

the junction with the Murrumbidgee River and, historically, floodplain connectivity, wetland health and the riparian zone have been adversely affected by river regulation and agricultural production in the Lachlan catchment (NRC, 2013). NSW DPI (2017) provide a detailed overview of the surface water resources under the Lachlan Water Resource Plan, with key observations being:

- **Water quality** in the Lachlan WRP varies from poor to excellent. The water in the Lachlan River (Hillston Weir, 412039) has a score of 49 which falls in the 'poor' range (see figure 8). Water quality problems occurring within the catchment are mostly caused by a combination of alteration to natural flow regimes and land use change.
- **Riparian and geomorphic condition** is considered to be a key attribute connecting rivers and terrestrial ecosystems. The maps in NSW DPI (2017) indicate that the percent cover of native woody riparian vegetation near Hillston is high (60%-80%) and that the geomorphic recovery potential of streams near Hillston is also high.
- **Conservation areas:** the area north of Hillston including the Yathong, Nombinnie and Round Hill Nature Reserves are noted for being a large, continuous area of vegetation of ecological importance within the broader Lachlan catchment
- **River operations and management** have a long history in the area (dating back to the 1960s), with current focus being upon large dams along the Lachlan (e.g. Wyangala and Carcoar dams), weirs, licenced water use and environmental water.

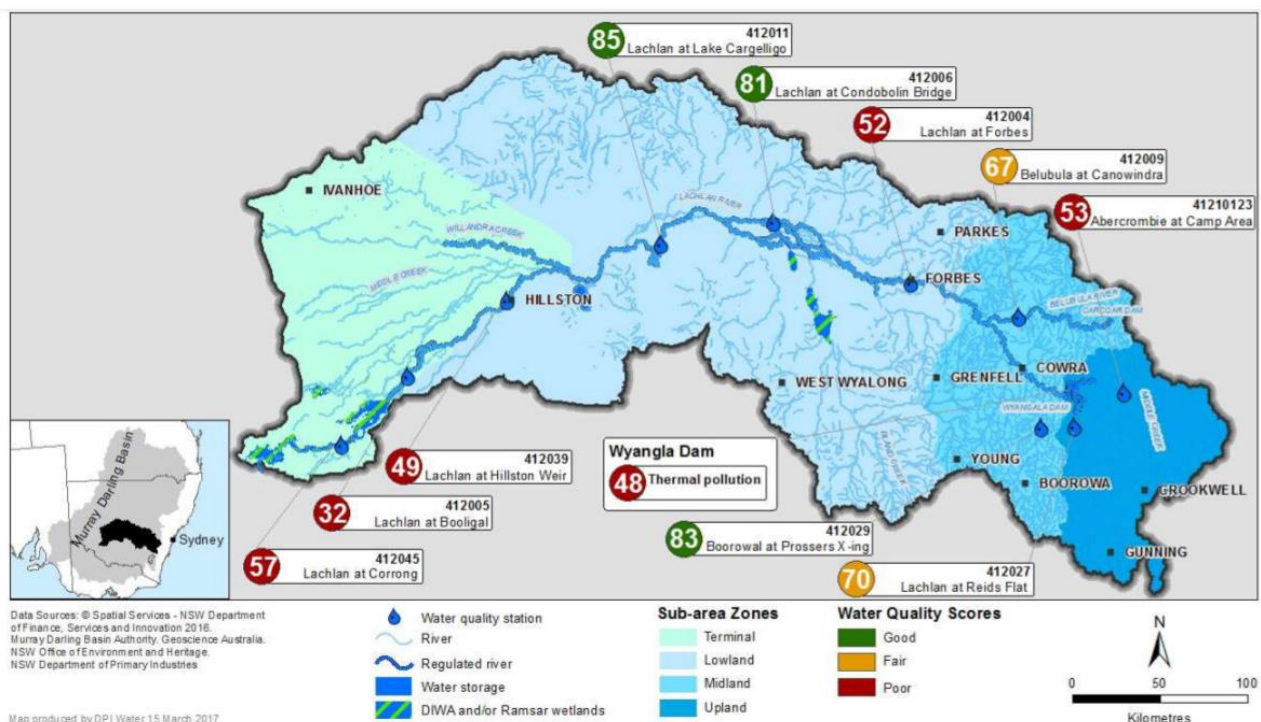


Figure 8: Lachlan surface water quality (source: NSW DPI, 2017)



6. POTENTIAL IMPACTS

The proposed site activity is not expected to materially contribute to any regional groundwater issues, particularly those associated with nearby farming districts.

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 Cardno Willing (2005) study indicate that the southern part of the project site within a flood fringe area but not within a floodway. As such, a major flood event (or flash flooding) may cause disruption during construction activities or for material suppliers. Localized drainage patterns at site there is potential for overland flow during rainfall. The water will flow in a westerly direction towards the Lachlan River.

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 farming there is very little natural ground cover vegetation. The eSPADE resource (NSW OEH, 2019), provides a Soils Essential Report for along the Springs Road to the east of the site (see figure 9 and table 6 below).

Table 6. Site details for eSPADE site 1000195

SITE DETAILS

Site Location:	HI		
Map Reference:	MGA Grid Reference: Zone 55, 367264E, 6289535N. 8030 MERRIWAGGA (1:100000) map sheet.		
Profile Details:	WIND TUNNEL SOIL SURVEY Survey (1000195), Profile 352, collected by Dr David Eldridge on 12 September, 1983		
Physiography:	pan/playa under woodland grass understorey and used for volun./native pasture. Slope 1% (estimated), profile drainage is poorly drained, erosion hazard is slight, and no salting evident		
Soil Type:	Uf1.33 (PPF)		
Base of observation:			
Profile Field Notes:	C90 T10 UKLF HLZZ SEDI	S NIL	EKMP AHZZ

SOIL DESCRIPTION**Layer 1**

0.00 - 0.10 m
Horizon

dark reddish brown (5YR 3/4) [moist] fine clay loam sandy with massive structure (earthy), few (1-10/10x10cm) (Root size unknown), field pH is 7.0. Coarse fragments are not evident, pans are not evident, segregations are not evident; smooth not evident boundary to ...

Layer 2

0.10 - 0.25 m
Horizon

yellowish red (reddish brown) (5YR 4/6) [moist] fine clay loam sandy with massive structure (earthy), few (1-10/10x10cm) (Root size unknown), field pH is 7.0. Coarse fragments are not evident, pans are not evident, segregations are not evident; smooth not evident boundary to ...

Layer 3

0.25 - 0.42 m
Horizon

yellowish red (reddish brown) (5YR 4/6) [moist] light clay with massive structure (earthy), few (1-10/10x10cm) (Root size unknown), field pH is 7.0. Coarse fragments are not evident, pans are not evident, segregations are not evident; smooth gradual (50-100 mm) boundary to ...

Layer 4

0.42 - 0.60 m
Horizon

(reddish brown) (5YR 4/8) [moist] light clay with massive structure (earthy), few (1-10/10x10cm) (Root size unknown), field pH is 8.0. Coarse fragments are not evident, pans are not evident, segregations are very few (< 2%), calcareous; smooth gradual (50-100 mm) boundary to ...

Layer 5

0.60 - 0.96 m
Horizon

reddish brown (dull reddish brown) (5YR 5/4) [moist] light clay with massive structure (earthy), few (1-10/10x10cm) (Root size unknown), field pH is 8.5. Coarse fragments are not evident, pans are weakly cemented, calcrete, segregations are few (2% - 10%), coarse (6-20 mm), calcareous

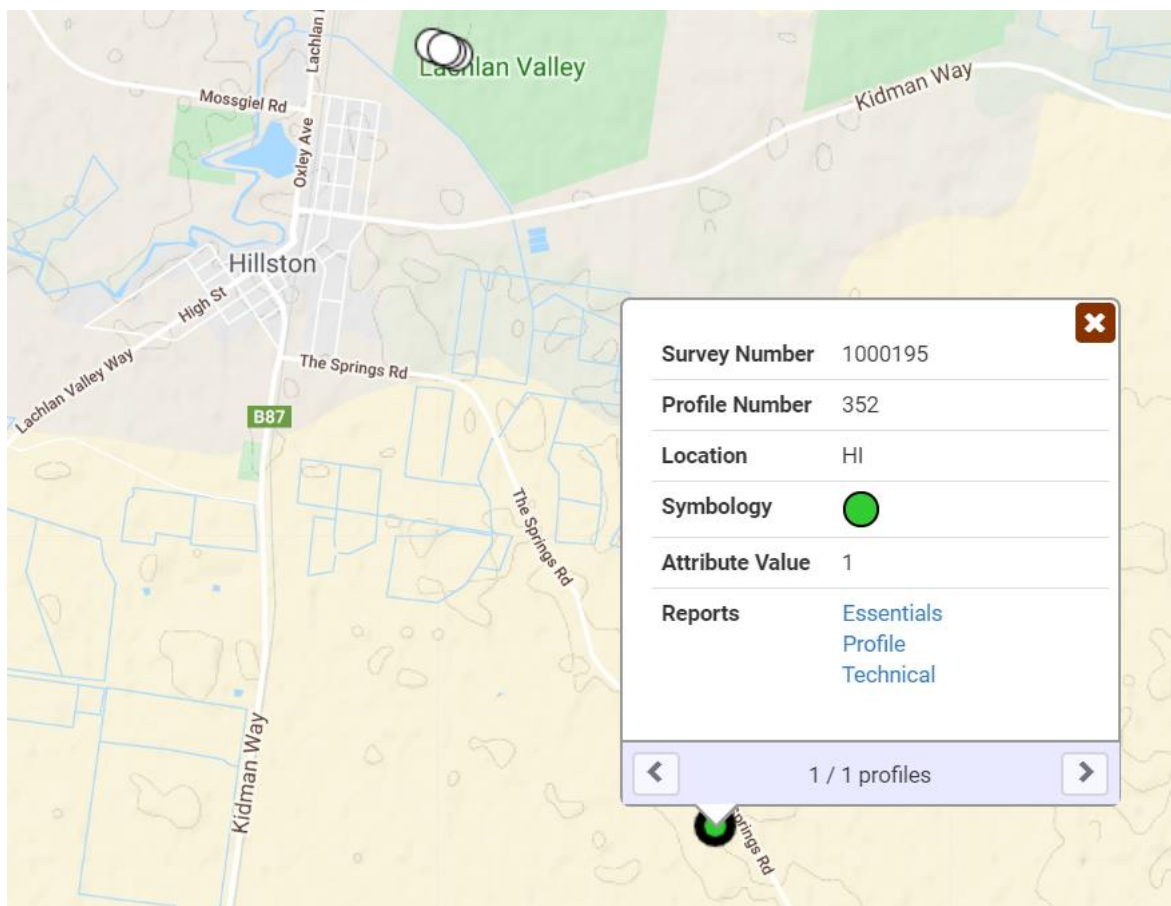


Figure 9. The location of the eSPADE site 1000195 (source: espade.environment.nsw.gov.au © State of NSW and Office of Environment and Heritage 2019)

There is the potential that site runoff will contain sediments and increase turbidity or other water quality parameters in downstream water ways.

7. 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 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 .

Table 7: Proposed Mitigation Measures

Stage	Measure	Activities/Approach
Design	Site drainage and water quality controls	Design Basis • Undertake hydrological assessment of the site's 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	General site works: • 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.



		• 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, turfing and revegetation.
Construction and/or Demolition	Stormwater point source control	In the event of concrete works: • Do not undertake works if chance of heavy rain. • Store rinsate⁴ 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. In the event that dewatering practices are required: • 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 offsite (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 of offsite 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.

⁴ 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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