REPORT

Mulwala Solar Farm

Water Report

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Name	Signature	Date
Samantha Garvitch		17/05/2018

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1 Introduction

This surface and ground water assessment has been prepared in accordance with the requirements of the Secretary's Environmental Assessment Requirements (SEARs) for the proposal. The assessment was completed as follows:

- Desktop assessment and field assessment
- Definition of existing conditions
- Potential impact assessment
- Identification of mitigation and management measures.

The EIS must address the following specific issues, as outlined in the SEARs, relevant to water resources:

Water – including an assessment of the likely impacts of the development (including flooding) on surface water and groundwater resources (including, wetlands, riparian land, groundwater dependent ecosystems and acid sulphate soils), related infrastructure, adjacent licensed water users and basic landholder rights, and measures proposed to monitor, reduce and mitigate these impacts; details of water requirements and supply arrangements for construction and operation, and a description of the erosion and sediment control measures that would be implemented to mitigate any impacts in accordance with Managing Urban Stormwater: Soils & Construction (Landcom 2004).

Table 1 SEARs addressed

SEAR	Related section(s)
Surface water	Section 2.2
Groundwater	Section 2.3
Flooding	Section 2.2.2
Wetlands	Section 2.2.3
Riparian land	Section 2.2.4
Groundwater dependent ecosystems	Section 2.3.5
Acid sulphate soils	Section 2.2.7
Adjacent licensed water users / BLR	Section 2.2.6 & 2.3.3
Water supply requirements / supply arrangements	Section 3.2.1 & 3.3.1
Impacts and mitigation measures	Section 3 & 3.4
Erosion and sediment control measures	Appendix B

1.1 Specific requirements

The NSW Office of Environment and Heritage (OEH) also recommends the EIS needs to appropriately address the following with relation to flooding:

- The EIS must map the following features relevant to flooding as described in the Floodplain Development Manual 2005 (NSW Government 2005) including:
  - Flood prone land
  - Flood planning area, the area below the flood planning level
  - Hydraulic categorisation (floodways and flood storage areas)
  - Flood hazard
- The EIS must describe flood assessment and modelling undertaken in determining the design flood levels for events, including a minimum of the 5% Annual Exceedance Probability (AEP), 1% AEP flood levels and the probable maximum flood, or equivalent extreme event.
- The EIS must model the effect of the proposed development (including fill) on the flood behaviour under the following scenarios:
  - Current flood behaviour for a range of design events as identified above. This includes the 0.5% and 0.2% AEP year flood events as proxies for assessing sensitivity to an increase in rainfall intensity of flood producing rainfall events due to climate change.
- Modelling in the EIS must consider and document:
  - Existing council flood studies in the area and examine consistency to the flood behaviour documented in these studies.
  - The impact on existing flood behaviour for a full range of flood events including up to the probable maximum flood.
  - Impacts of the development on flood behaviour resulting in detrimental changes in potential flood affection of other development on land. This may include redirection of flow, flow velocities, flood levels, hazards and hydraulics categories.
  - Relevant provisions of the NSW Floodplain Development Manual 2005.
- The EIS must assess the impacts on the proposed development on flood behaviour, including:
  - Whether there will be detrimental increases in the potential flood affectation of other properties, assets and infrastructure.
  - Consistency with Council Floodplain Risk Management Plans.
  - Consistency with any Rural Floodplain Management Plans.
  - Compatibility with the flood hazard of the land.
  - Compatibility with the hydraulic functions of flow conveyance in floodways and storage in flood storage areas of the land.
  - Whether there will be adverse effect to beneficial inundation of the floodplain environment, on, adjacent to or downstream of the site.
  - Whether there will be direct or indirect increase in erosion, siltation, destruction of riparian vegetation or a reduction in the stability of river banks or watercourses.
  - Any impacts the development may have upon existing community emergency management arrangements for flooding. These matters are to be discussed with the SES and Council.
  - Whether the proposal incorporates specific measures to manage risk to life from flood. These matters are to be discussed with the SES and Council.

- Emergency management, evacuation and access, and contingency measures for the development considering the full range or flood risk (based upon the probable maximum flood or an equivalent extreme flood event). These matters are to be discussed with and have the support of Council and the SES.
- Any impacts the development may have on the social and economic costs to the community as consequence of flooding.

These are addressed in Section 2.2.2.

2 Existing environment

The 378-hectare surveyed project site is located on property primarily used for dry land broadacre farming (cropping and grazing). The south-eastern corner of the property has been established for centre-pivot irrigation, supplied by a groundwater bore. The remaining land is naturally slightly undulating and has been extensively cultivated for many years. Various natural depressions are scattered across the property that typically become waterlogged when inundated (Figure 1). There is minimal off-site drainage with some discharge to local depressions or roadside table drains near property boundaries, meaning that most surface water on the property either infiltrates to groundwater or evaporates.

N

0 170 340 510

Meters

APPROX SCALE 10,000 @ A3
GDA 1994 MGA Zone 55

Disclaimer: While all reasonable care has been taken to ensure the information contained on this map is up to date and accurate, no guarantee is given that the information portrayed is free from error or omission. Please verify the accuracy of all information prior to use. Development Footprint area for indicative purposes only.

DATA SOURCES
Base topographic data © Commonwealth of Australia (Geoscience Australia) 2006.
Imagery from Esri Basemap layer.

LEGEND

- Project Boundary
- Development Footprint
- Cadastre
- Areas Subject To Inundation

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Figure 1
Areas Subject To Inundation
Mulwala Solar Farm Project

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Compiled: 29 May 2018

2.1 Legislative environment

The legislative environment concerning the protection of water resources in relation to the proposed development is described briefly in Table 2 below.

Table 2 Legislative environment

Jurisdiction	Legislation / instrument	Purpose	Statement of compliance
Federal Commonwealth	*Water Act 2007*	Provides the legislative framework for ensuring that Australia's largest water resource, the Murray-Darling Basin, is managed in the national interest	The Mulwala Solar Farm does not involve any changes to existing water entitlements or the way in which these are accessed and as such will continue to comply
State New South Wales	*NSW Water Management Act 2000*	The WMA is the main instrument for the sustainable and integrated management of NSW's water resources. The Act allocates and provides water for the environmental health of NSW's rivers and groundwater systems, while also providing licence holders with more secure access to water and greater opportunities to trade water through the separation of water licences from land	
	NSW Murray and Lower Darling Regulated Rivers Water Sources – Water Sharing Plan 2016	Includes rules for protecting the environment, water extractions, managing licence holders' water accounts and water trading in the Plan area	
	Riverina Murray 2036 Regional Plan	The Plan will guide the NSW Government's land use planning priorities and decisions over the next 20 years	The Mulwala Solar Farm supports all four Goals of the Plan (refer Section 2.1.1)
Local Federation Council	*Corowa Local Environment Plan 2012*	Local environmental planning provisions for development of land in the Federation Council. Development provisions in the LEP specific to this project include flooding and earthworks	Addressed in this Section

2.1.1 Riverina Murray 2036 Regional Plan

The Mulwala Solar Farm supports all four Goals of the Plan, as follows:

- Goal 1 – a growing and diverse economy
  - Solar farm developments present a new industry to the local economy that adds to the diversity of industry and employment in the region
- Goal 2 – a healthy environment with pristine waterways
  - The development proposal does not impact on local waterways and has the potential to improve local water characteristics (refer Section 3)
- Goal 3 – Efficient transport and infrastructure networks
  - Distributed power generation close to end-users provides for efficient infrastructure networks
- Goal 4 – Strong, healthy and connected communities
  - A new industry outside of the major population centres in the region (Albury, Wagga Wagga and Griffith) supports and builds the resilience of existing smaller communities.

2.2 Surface water

2.2.1 Hydrology

The site is in the Murray-Darling basin, in the Murray Local Land Services region, however, there are no watercourses or wetlands in the immediate vicinity.

Surface drainage from the property is naturally poor with water pooling in surface depressions in wet years, however there is no riverine flood threat from the Murray River (approximately 5 kilometres to the south). The most significant depression is towards the northern end of the site as shown in Figure 1. This depression is well-defined, approximately one metre deeper than the surrounding property and appears to be the western end of a long, flat bottomed depression that extends east between Mulwala-Savernake and Bull Plain Roads. The site inspection revealed that while local runoff pools in the depression, it is not a waterway as there is no flow across property boundaries.

This main depression on-property has no outlet and runoff pools and stagnates for infiltration and evaporation. It is important to note that there are no defined overland flow paths across the property with all runoff from the property collecting in surface depressions.

2.2.2 Flooding

The Murray River is approximately five kilometres to the south, with the full supply level of Lake Mulwala being 1.5 kilometres to the south-east of the site. The site is not flood prone and is not shown in the flood planning areas in the *Corowa Local Environment Plan 2012 – Flood Planning Maps* (refer Figure 2).

RPS has specifically addressed NSW OEHs requirements regarding flooding, as per Table 3.

Table 3 OEH flooding requirements

Requirement	Response
• The EIS must map the following features relevant to flooding as described in the Floodplain Development Manual 2005 (NSW Government 2005) including: • Flood prone land • Flood planning area, the area below the flood planning level • Hydraulic categorisation (floodways and flood storage areas)	Flood prone land is defined in the Floodplain Development Manual 2005 as "land susceptible to flooding by the Probable Maximum Flood (PMF) event. Flood prone land is synonymous with 'flood liable land'. The introduction to Chapter 11: Flood Risk Management of the Corowa Development Control Plan (2013) defines flood liable land

Requirement	Response
• Flood hazard	as that shown on the flood planning area maps in the Corowa Local Environmental Plan (2012) reproduced in Figure 2. The site is outside of the flood planning area as the site as shown in Figure 2. The site has no floodways or flood storage areas as it is not flood prone. The site has no flood hazard as it is not flood prone.
• The EIS must describe flood assessment and modelling undertaken in determining the design flood levels for events, including a minimum of the 5% Annual Exceedance Probability (AEP), 1% AEP flood levels and the probable maximum flood, or equivalent extreme event.	The site is not flood prone i.e. not subject to the PMF event.
• The EIS must model the effect of the proposed development (including fill) on the flood behaviour under the following scenarios: • Current flood behaviour for a range of design events as identified above. This includes the 0.5% and 0.2% AEP year flood events as proxies for assessing sensitivity to an increase in rainfall intensity of flood producing rainfall events due to climate change.	The site is not flood prone and therefore there are no impacts to flood behaviour due to the development.
• Modelling in the EIS must consider and document: • Existing council flood studies in the area and examine consistency to the flood behaviour documented in these studies. • The impact on existing flood behaviour for a full range of flood events including up to the probable maximum flood. • Impacts of the development on flood behaviour resulting in detrimental changes in potential flood affection of other development on land. This may include redirection of flow, flow velocities, flood levels, hazards and hydraulics categories. • Relevant provisions of the NSW Floodplain Development Manual 2005.	The site is not flood prone and therefore there are no impacts to flood behaviour due to the development.
• The EIS must assess the impacts on the proposed development on flood behaviour, including: • Whether there will be detrimental increases in the potential flood affectation of other properties, assets and infrastructure. • Consistency with Council Floodplain Risk Management Plans. • Consistency with any Rural Floodplain Management Plans. • Compatibility with the flood hazard of the land. • Compatibility with the hydraulic functions of flow conveyance in floodways and storage in flood storage areas of the land. • Whether there will be adverse effect to beneficial inundation of the floodplain environment, on, adjacent to or downstream of the site. • Whether there will be direct or indirect increase in erosion, siltation, destruction of riparian vegetation or a reduction in the stability of river banks or watercourses. • Any impacts the development may have upon existing community emergency management arrangements for flooding. These matters are to be discussed with the SES and Council.	The site is not flood prone and therefore there are no impacts to flood behaviour due to the development.

Requirement	Response
• Whether the proposal incorporates specific measures to manage risk to life from flood. These matters are to be discussed with the SES and Council. • Emergency management, evacuation and access, and contingency measures for the development considering the full range or flood risk (based upon the probable maximum flood or an equivalent extreme flood event). These matters are to be discussed with and have the support of Council and the SES. • Any impacts the development may have on the social and economic costs to the community as consequence of flooding.	

As outlined in Table 3, the site is not flood prone, thereby removing the requirement for detailed flood assessment. This conclusion was confirmed through communication with NSW OEH (Andrew Fisher, Acting Senior Team Leader, Planning SW Region *pers.comm.* 11 May 2018). A copy of this communication is provided in Appendix C.

2.2.3 Wetlands

There are some wetland areas located inside the property as identified in the *Corowa Local Environmental Plan 2012* (as shown in Figure 3). The wetland areas identified within the solar farm footprint is the low area subject to local inundation and have been excluded from development.

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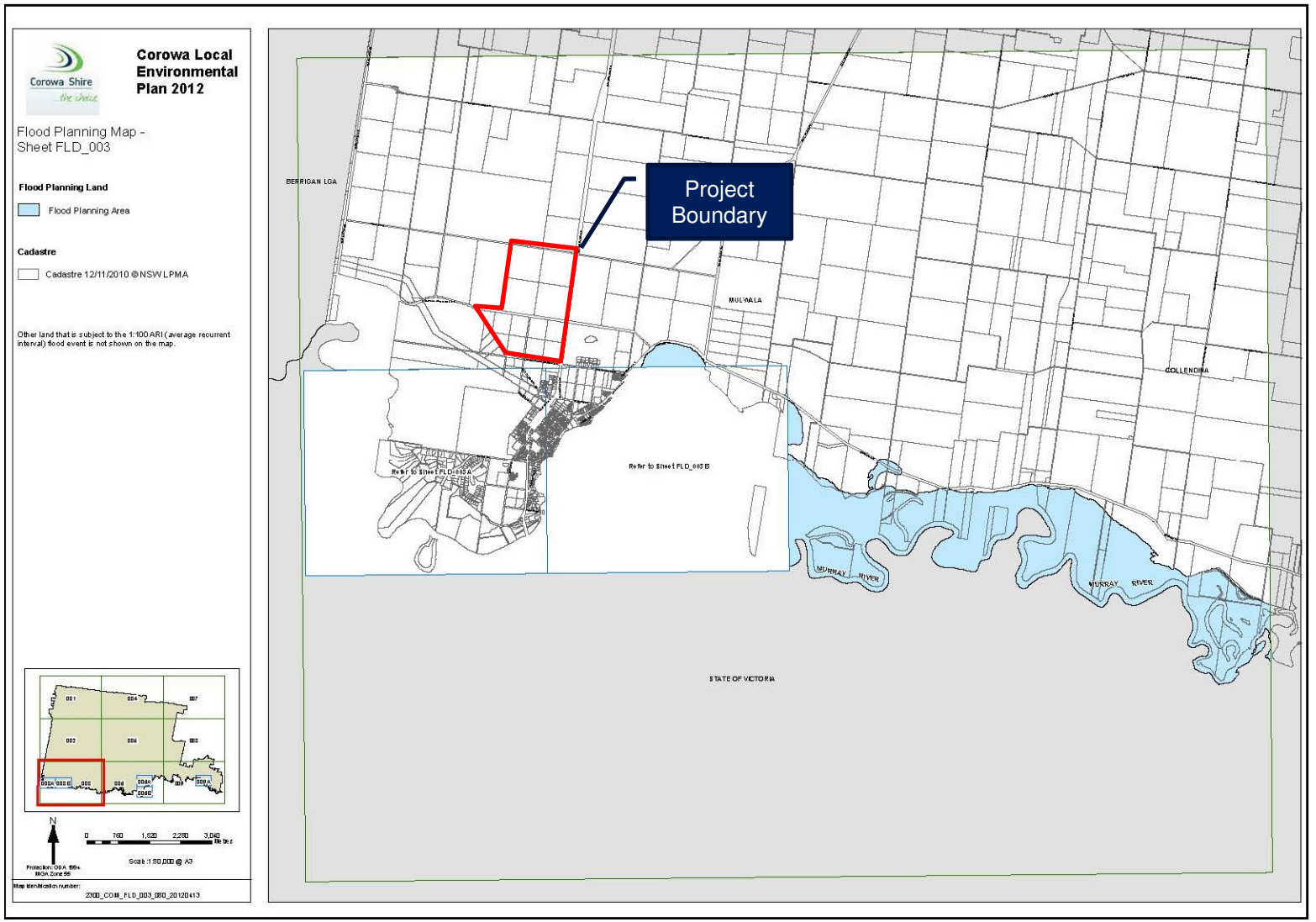

Figure 2 Flood planning area (Corowa Local Environmental Plan 2012)

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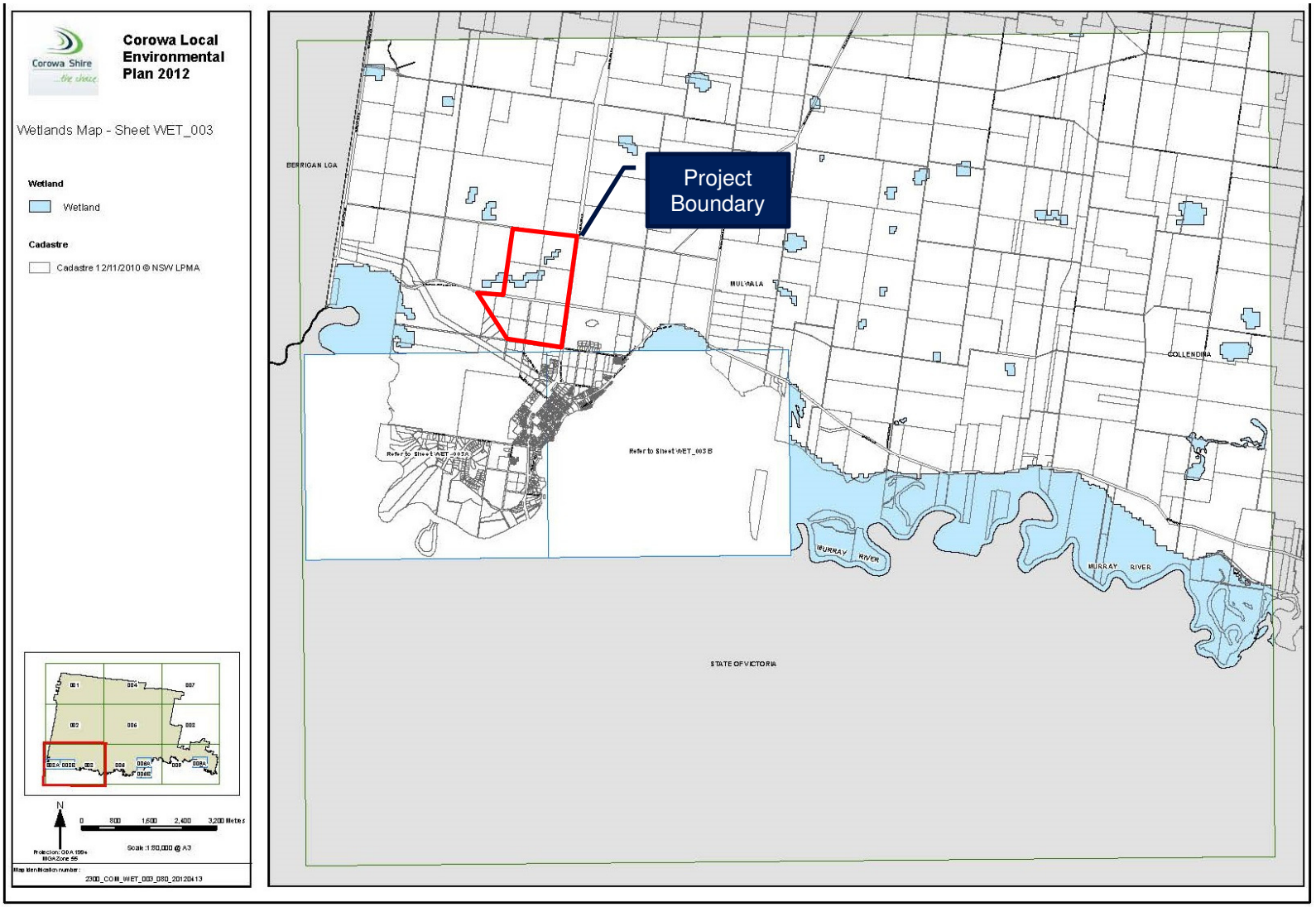

Figure 3 Wetland areas (Corowa Local Environmental Plan 2012)

2.2.4 Riparian land

The development site is not located in a riparian zone given its location 1.5 kilometres from the full supply level of Lake Mulwala and five kilometres distance from the Murray River.

2.2.5 Existing surface water supply

Minimal volumes of surface water are used on the property, with surface water availability being ephemeral. Six small ground tank dams (refer example in Plate 1) are located within the project boundary that provide some stock water supply in wet years. This stock water supply is supported by reticulated stock water system supplied from groundwater.

2.2.6 Adjacent surface water users / Basic Landholder Rights

Adjacent properties are similar to the project property in that surface water fills ground tanks for stock water supply in wetter seasons. This take of surface water is generally assumed to be within the limits of Basic Landholder Rights (i.e. 10% of average runoff volume arising from the property).

2.2.7 Acid sulphate soils

The presence of acid sulphate soils on the property is unlikely, as shown in Figure 4.

Plate 1 Existing stock dam (located in main depression in NW portion of site)

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Figure 4 Acid Sulphate Soils Risk (CSIRO, 2018)

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2.3 Groundwater

2.3.1 Hydrogeological setting

The development site is located within the Lower Murray Alluvium Groundwater Management Area 016 (Figure 5). A description of the Lower Murray GWMA016 follows (Alamgir, 2011):

> *Lower Murray GWMA016 is underlain by regional shallow and deep aquifer systems which, in places, provides high yielding and good quality groundwater supplies for irrigation, stock and domestic and town water supply as well as other uses. The management of the water source is regulated by a water sharing plan established under NSW legislation (Water Management Act 2000). The water sharing plan defines the Lower Murray Groundwater Source as all water contained in the unconsolidated alluvial aquifers of the Calivil and Renmark Formations, and the Shepparton Formation deeper than 12 metres (within the defined area). The Lower Murray deep aquifers extend down to the bedrock to a maximum depth of 350 metres below the ground surface.*
>
> *The Calivil and Renmark Formations aquifers are composed of pale grey to white quartz sand layers with lenses of grey to white clay, peat and coal extending from the bottom of the Shepparton Formation down to the bedrock. The Lower Shepparton Formation has generally yellow to brown poorly sorted sand and clay sediments that extend to a depth of between 20 and 50 metres below the ground surface.*

Typically, the geological conditions are suitable for irrigation where the vertical leakage is low. This can be a negative impact for irrigation purposes when shallow groundwater levels rise due to poor irrigation practices. Historically the riverine plains have been susceptible to waterlogging and salinisation due to high water tables however this effect has moderated in recent times due to drought, irrigation water trading and improvements in irrigation practice.

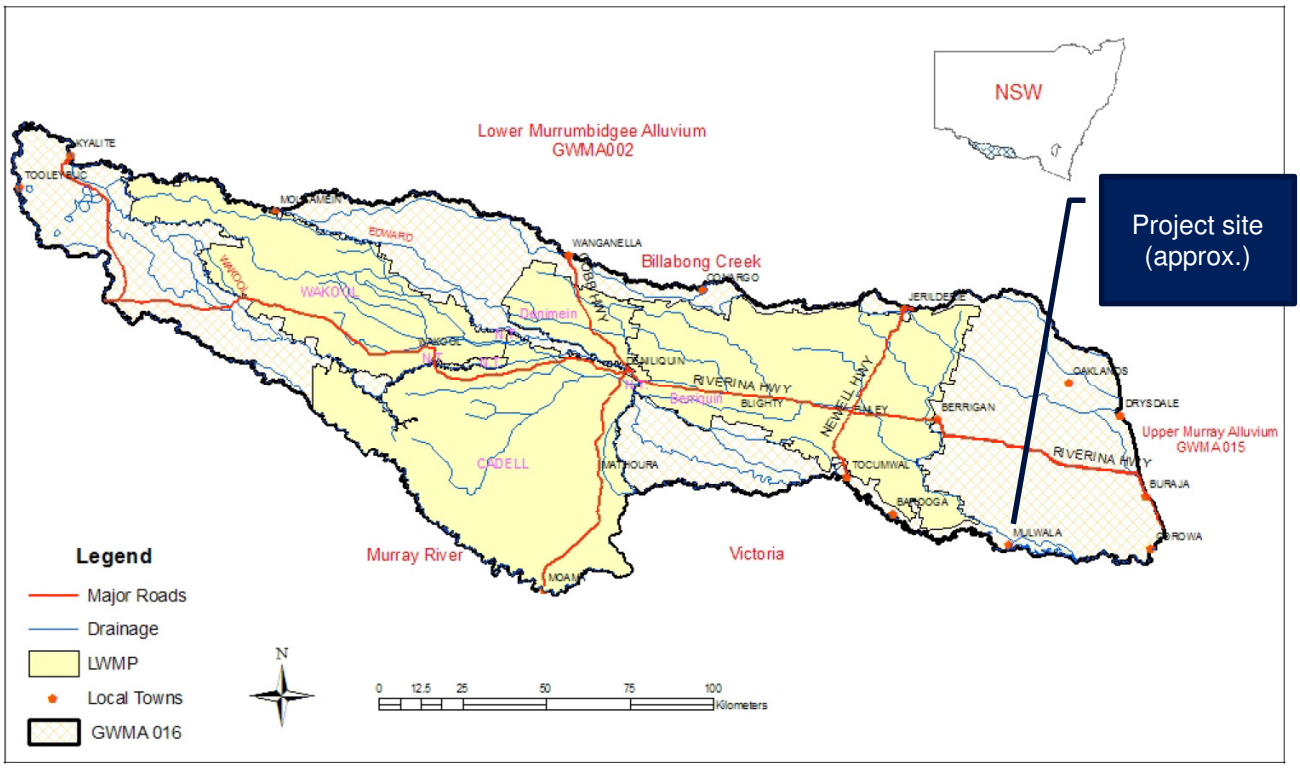

Figure 5 Lower Murray Alluvium GWMA016 (Alamgir, 2011)

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2.3.2 Groundwater monitoring

The NSW Department of Crown Lands and Water monitors groundwater level and quality through its network of groundwater observation bores across New South Wales. Two of these bores are located nearby to the development site; GW036350.3.3 (11 km) and GW036354.2.2 (18 km), as shown in Figure 8. Driller's logs are not available for these monitoring bores. However, bore hydrograph data is available (NSW DPIW, 2018) and is presented in Figure 6 and Figure 7.

The seasonal and reactive nature of the hydrograph suggests the bores are monitoring the shallow Shepparton formation, which is predominantly recharged by rainfall and irrigation leakage. Generally, the water levels in the bores range between 12 and18 metres below ground level across the monitored period, with recharge occurring in winter/spring and drawdown (assumed due to irrigation extraction) occurring throughout the summer/autumn. The impacts to groundwater level due to dry and wet winter/spring periods (2015 and 2016 respectively) are clearly visible.

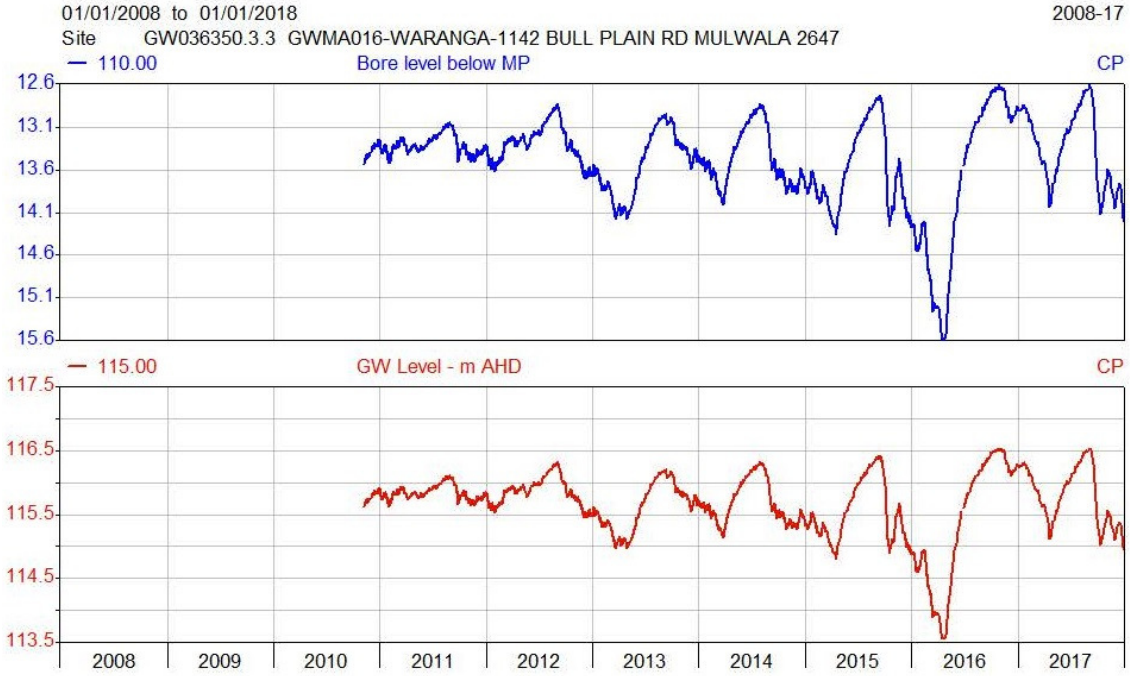


Figure 6 Lower Murray Alluvium GWMA016 – Monitoring Bore No. GW036350.3.3 hydrograph (NSW DPIW, 2018)

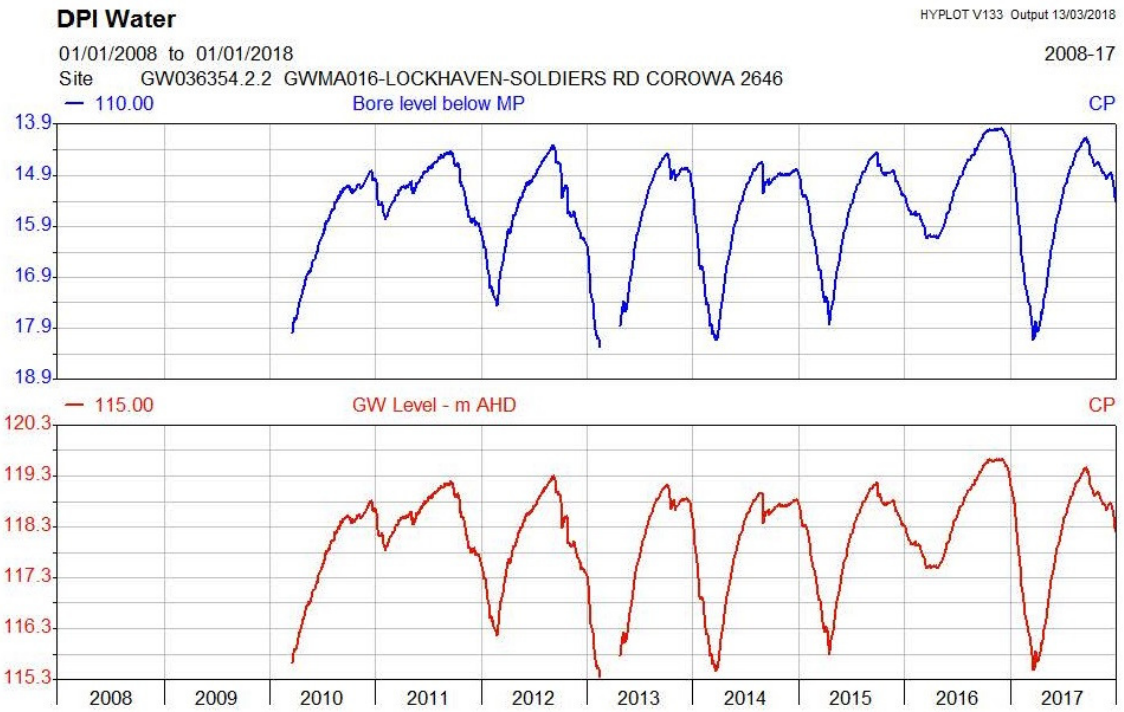


Figure 7 Lower Murray Alluvium GWMA016 – Monitoring Bore No. GW036354.2.2 hydrograph (NSW DPIW, 2018)

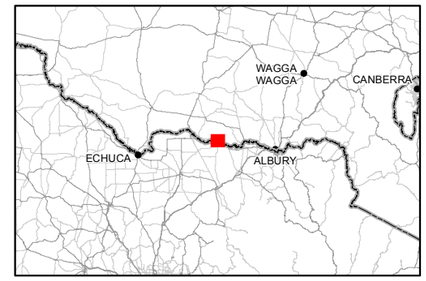
2.3.3 Existing groundwater bores

The development site is located within an established irrigation area with the aquifers supporting considerable consumptive use for both irrigation and stock and domestic. As such, there are numerous bores in the local area and on the property as shown in **Figure 9**. There are groundwater work records for bores within the Project Area and details of these bores are given in Table 4. Details of existing bores nearby to the site (**Figure 9**) are given in Appendix A.

A groundwater bore (GW501586) provides water for centre-pivot irrigation in the south-east corner of the site.

Table 4 Existing bores within the Site

Bore number	Registered use	Location	Date drilled	Licence number	Licence status	Work type	Bore depth (m)	Bore diameter (mm)	Water bearing zone	S.W.L (m)	Soil material	Yield (L/s)
GW045526	Domestic, stock	On site	-	50WA509707	Cancelled	Bore	54.9	127	-	-	-	-
GW045527	Stock	On site	-	50WA509708	Cancelled	Bore	18.3	102	-	-	-	-
GW045528	Stock	On site		50WA509709	Cancelled	Bore	24.4	102	-	-	-	-
GW045755	Test bore	On site	01/08/1976	50BL105319	Lapsed	Bore	11	180	Unconsolidated	2.5	Clay-gravel	-
GW045756	-	On site	01/08/1976	-	-	Bore	14.6	180	Unconsolidated	3	Sand-gravel	-
GW500951	Test bore	On site	19/06/2001	50BL196510	Cancelled	Bore	109	165	Unknown	8.4	Clay	80
GW501586	Irrigation	On site	19/08/2003	50BL196707	Converted	Bore	136	225	-	10.7	Sand-clay	46



LEGEND

- Project Boundary
- Development Footprint

Groundwater Borehole

- Within Study Area
- Outside Study Area
- Waterbody
- Watercourse

N

0 0.5 1 1.5

Kilometers

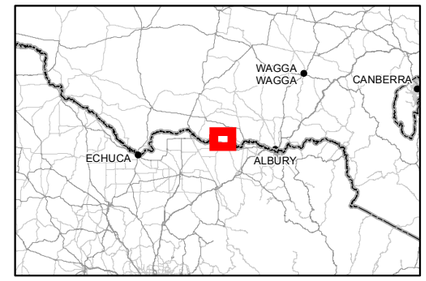
APPROX SCALE 25,000 @ A3
GDA 1994 MGA Zone 55

Disclaimer: While all reasonable care has been taken to ensure the information contained on this map is up to date and accurate, no guarantee is given that the information portrayed is free from error or omission. Please verify the accuracy of all information prior to use.

DATA SOURCES
Road network provided by Department of Environment, Land, Water and Planning (DELWP) Web Map Service.
Watercourse data provided by DELWP 2018.
Imagery from Esri basemap layer.

RPS

Figure 8
Groundwater Borehole Locations
Mulwala Solar Farm



LEGEND

- Project Boundary
- Development Footprint

Groundwater Borehole

- Within Study Area
- Outside Study Area
- Waterbody
- Watercourse

N

0 1.5 3 4.5

Kilometers

APPROX SCALE 80,000 @ A3
GDA 1994 MGA Zone 55

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DATA SOURCES
Road network provided by Department of Environment, Land, Water and Planning (DELWP) Web Map Service.
Watercourse data provided by DELWP 2018.
Imagery from Esri basemap layer.

RPS

Figure 9
Groundwater Borehole Locations
Mulwala Solar Farm

2.3.4 Groundwater quality

Groundwater within the Lower Murray Alluvium GMA, across the three aquifers (Shepparton, Calivil and Renmark formations) varies in quality, however, is generally suitable for irrigation and stock and domestic use. There is a trend for increasing groundwater salinity in the Calivil and Renmark formations from east to west across the GMA, with the highest quality water in the east (Jerilderie/Finley < 2,000 us/cm) deteriorating to > 30,000 us/cm in the far west (Tooleybuc/Kyalite). The landowner reports that groundwater on the site is of high quality and is suitable for all purposes.

The following summary is taken from the Lower Murray Alluvium GMA Groundwater Status Report 2010 (Alamgir, 2011):

Groundwater quality is typically highly variable in time and space. Total Dissolved Solids (TDS) range from 140 mg/L to 41,000 mg/L. Monitoring of groundwater quality is ongoing at 20 key monitoring bores. Groundwater quality remains almost unchanged in terms of salinity. There is no definite pattern of improvement or deterioration of groundwater quality with respect to salinity.

2.3.5 Groundwater dependent ecosystems

A search of the Groundwater Dependent Ecosystem Atlas from the Bureau of Meteorology indicates that there are no aquatic and subterranean Groundwater Dependent Ecosystems (GDEs) in the vicinity of the Mulwala Solar Farm (Figure 10, Figure 11), while the moderate potential of terrestrial GDE exists (Figure 12).

No indication of any significant terrestrial GDEs was observed during the site inspection.

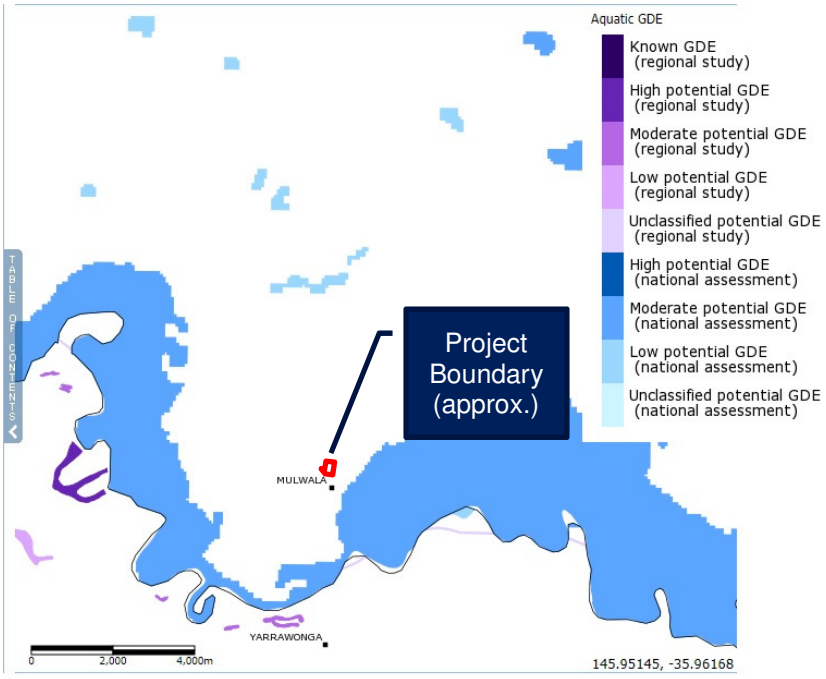

Figure 10 Aquatic GDE (Bureau of Meteorology, 2017)

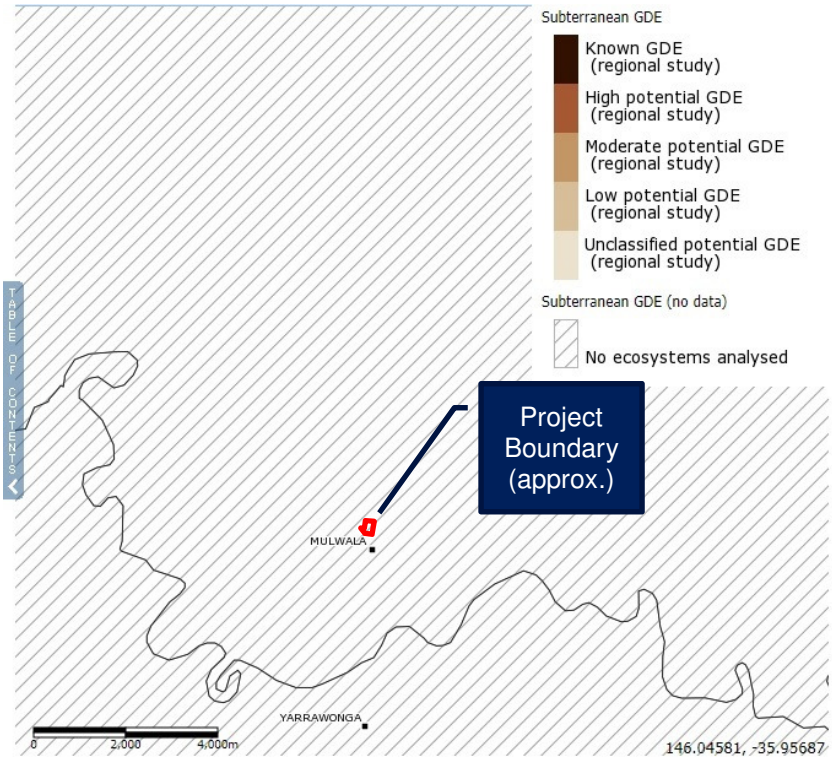

Figure 11 Subterranean GDE (Bureau of Meteorology, 2017)

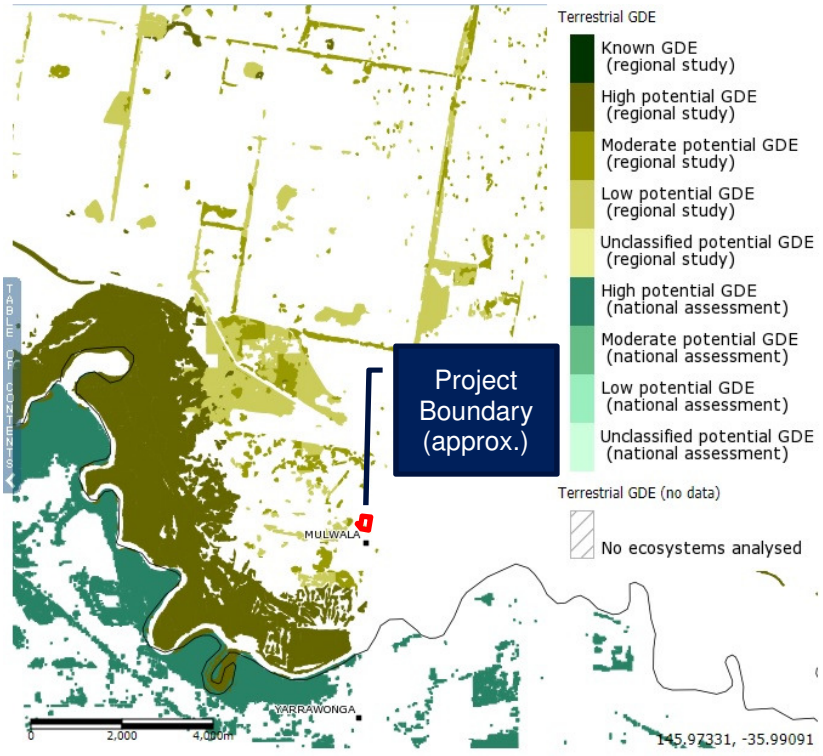

Figure 12 Terrestrial GDE (Bureau of Meteorology, 2017)

3 Potential impacts and proposed mitigation measures

The current land use is irrigated and dryland broadacre agriculture and conversion to solar does not create a new land-use that will alter existing surface water or groundwater processes. The existing land use is compatible with water management principles. A detailed assessment of the impacts that might occur under the activities that are proposed, and proposed mitigation measures follows.

3.1 Flooding

The site is not flood prone (as outlined in Section 2.2.2 and Table 3) and the construction, operation and decommissioning of the proposed works do not impact the existing inundation characteristics that may arise from localised stormwater runoff events. The proposed works are minor in nature with respect to surface water movement and do not significantly alter the flow direction, intensity or volume of runoff arising from the property. The existing surface water conditions on the property will remain, with the areas subject to possible localised inundation excluded and buffered from development to maintain existing storage capacity of runoff waters. Despite no flooding or stormwater risk affecting the site, nuisance inundation has the potential to impact development infrastructure. This risk is mitigated by installation of critical infrastructure (such as substation and ancillary infrastructure) 300 millimetres minimum above natural surface levels.

3.2 Construction and decommissioning

3.2.1 Water supply

Raw water supply for construction and decommissioning (mainly for dust suppression of earthworks and access roads) will be securely sourced from the existing licenced groundwater bore and/or via water tankers. The amount of water required for this purpose will vary according to weather conditions during construction however it is expected to be less than 0.5 megalitres in total. This volume is well within the supply capacity of the groundwater bore and will have negligible impact to nearby groundwater users. In fact, the removal of irrigation demand from the property due to the project will be of benefit to nearby groundwater users through improvements in groundwater level and bore inflow/recovery rates.

A static water supply (20,000 litres) for fire protection will be established on site during construction with appropriate fittings for access by local brigade appliances. This facility will remain throughout the duration of the project. Water supply for fire protection will also be sourced from the existing on-site bore similar to that for dust suppression on an as-required basis (expected to be extremely infrequent).

Water supply during construction and decommissioning will not be sourced from surface water meaning there will be no anticipated impact to adjacent surface water users.

Potable water supply for staff amenities will be imported to site in containers as required under a commercial supply arrangement.

Self-contained temporary toilet facilities will be provided by a commercial contractor during construction and decommissioning. Water for these facilities will be imported to site with sewage removed from site via tanker for disposal at a regulated dump point.

3.2.2 Surface water

Potential impacts to surface waters arise from:

- Contamination from sediment and unintended spillages of fuel, lubricants, herbicides, sewage and other chemicals
- Increased soil compaction through additional access tracks and other hardstand areas changing runoff characteristics and potential for concentrated flows.

Earthworks include surface excavation to create access roads, site levelling for power conversion units, laydown areas, vehicle parking and site offices, decommissioning of on-farm irrigation infrastructure, driving or piling of solar panel mounting structures and trenching for electrical cable installation. The nature of these earthworks is consistent with the soils management under the existing land use (i.e. laser grading for centre-pivot irrigation). It is noted that no access tracks are to be constructed in the areas subject to possible localised inundation, so no access track water management infrastructure (such as culverts) is required.

Impacts of these works will be controlled through the Erosion and Sediment Control Plan (ESCP) for the site to mitigate impacts to surface water resources and drainage water quality from unintended movement of sediment and other contaminants. A draft ESCP, prepared in accordance with the provisions of the Managing Urban Stormwater: Soils and Construction (Landcom, 2004), is provided in Appendix B.

The limited changes in nature of the property arising from the development ensure that the site can easily be rehabilitated and returned to its former agricultural land use.

3.2.3 Groundwater

All disturbance in the described earthworks will occur within the top one metre of the ground surface. This is highly unlikely to penetrate the groundwater table with the NSW Department of Primary Industries (DPI) groundwater monitoring bores consistently recording water table levels deeper than 12 metres (refer Figure 6 and Figure 7). No existing bores will be impacted by the works.

There is minimal potential for groundwater contamination in the unlikely event of an accidental spill involving:

- Fuel (refuelling of plant and machinery)
- Lubricants (during operation of plant and machinery)
- Herbicides (weed and grass control as part of site establishment works)
- Sewage (portable amenities)
- Other chemicals (construction consumables such as adhesives, etc)

Any such risk is adequately mitigated through implementation of operational procedures regarding storage, use and emergency management.

There is no expected impact to Groundwater Dependent Ecosystems as none exist at the project site or in the local area.

3.3 Operation

3.3.1 Water supply

Water supply for operation is minimal (expected to be approximately 500 kL per year) and limited to that required for cleaning of the solar panels, fire protection and provision for staff amenities. Water supply for fire protection and cleaning solar panels (expected to be up to two times per year) will be imported to site in tankers or sourced from rainwater tanks collecting roof runoff from operational and maintenance buildings.

Water supply during operation will not be sourced from surface or groundwater meaning there is no anticipated impact to adjacent water users in terms of changes to quality and quantity.

Potable water supply for staff amenities will be imported to site in containers as required under a commercial supply arrangement. On-site rainwater tanks will provide some non-potable water supply for staff amenities. Sewage generated at the site will be stored for removal and disposal off site at accredited facilities. Amenities will be included in the operations and maintenance buildings and will be installed and operated to comply with all relevant standards and building codes.

3.3.2 Surface water

There is minimal potential for impacts to surface water quality to occur during the operational phase. The increased risk to surface water during operation arises predominantly from the slight increase in imperviousness of the site from access roads, car parking, laydown areas and associated operational buildings, which has the potential to increase runoff volume and intensity.

The solar panels themselves do not increase the imperviousness of the site. The full ground surface underneath and between the panels will remain available for infiltration of direct rainfall and rainfall runoff from the panels. The ground surface will be vegetated (managed grass cover) to maintain and enhance infiltration capacity. The reduction in stock grazing on the property is also likely to improve the infiltration characteristics of the soil with a reduction in compaction.

The proposed works do not significantly alter the existing pattern and direction of surface water movement across the property, with no changes to the natural ground surface due to the foundations for the solar panels. The existing surface water characteristics will remain unchanged and will continue to discharge to the natural depressions on the site, which have been excluded and buffered from the development footprint.

Other pervious areas will be maintained with grass cover to maximise rainfall infiltration and limit risk of sediment movement off site. The small increases in runoff volumes and changes to runoff characteristics due to the increased imperviousness of the site (from access tracks, etc) are adequately managed through the implementation of the operational ESCP, which includes appropriate water control features (such as infiltration trenches, sediment capture devices, etc) to maximise infiltration and minimise the risks of sediment movement.

There is a minor risk of contamination related to unintended spillages of fuel, lubricants, herbicides, sewage and other chemicals however this risk is controlled through implementation of operational procedures regarding storage, use and emergency management.

It is noted that the reduction in irrigation volume on the property as a result of the change in land use to a solar farm presents a positive impact to surface water conditions by reducing the average soil moisture content across the property, meaning there is more potential to absorb rainfall (despite the slight increase in imperviousness of the site due to access tracks) and reduce runoff volumes discharging to the internal depressions or off-site.

3.3.3 Groundwater

There is minimal potential for groundwater contamination in the event of a spill of fuel, lubricants, herbicides, sewage and other chemicals. Any such risk is adequately mitigated through implementation of operational procedures regarding storage, use and emergency management.

It is noted that the reduction in irrigation volume on the property as a result of the change in land use to a solar farm actually presents a positive impact to groundwater conditions by reducing the extraction and recharge to shallow water tables, and hence reducing the risk of land salinisation, from irrigation leakage.

3.4 Mitigation measures

The following mitigation measures are proposed to control any potential impacts to surface and groundwater arising from the construction, operation and decommissioning of the Mulwala Solar Farm:

- Project footprint to maintain existing surface water characteristics and surface water storage in natural depressions through exclusion from the development
- Critical infrastructure raised 300 millimetres above natural surface to avoid impacts from nuisance inundation
- Refuelling of plant and machinery to be done at least 50 metres away from water bodies (i.e. stock dams, ephemeral depressions) and constructed drainage lines in an impervious bunded area
- All fuels, chemicals and other potential contaminants to be stored at least 50 metres from water bodies and constructed drainage lines in an impervious bunded area
- Stormwater management and control measures to be designed and installed as part of the construction phase and in accordance with the ESCP for the site (refer Appendix B)
- Construction, operation and decommissioning works to be carried out in accordance with the ESCP for the site (refer Appendix B)
- Procedures for the testing, treatment and discharge of construction waste water to be established and implemented
- Grass cover to be maintained under all solar panel arrays to maximise water infiltration whilst balancing risk of fire from build-up of combustible vegetation
- All solid and liquid waste to be appropriately stored in containers awaiting collection and disposal to approved facilities off site with appropriate house-keeping of the entire site to maintain a clean and tidy condition at all times
- All machinery and plant to be checked daily to ensure no leakage of fuels, lubricants or other liquids
- All staff to be appropriately trained in the spill response plan for the minimisation and management of unintended spills
- Water requirements for the site to be captured from roof runoff or imported to site via commercial arrangements with local water authorities
- Staff amenities to be installed and operated to comply with all relevant standards and building codes.

4 Conclusion

The Mulwala Solar Farm is not considered likely to negatively influence local and regional surface water and groundwater systems. Each of the SEARs and specific requirements of the NSW OEH have been addressed as outlined in Table 1 and Section 1.1.

The proposed works do not involve significant changes to the nature of surface water characteristics on the property. The removal of centre-pivot irrigation reduces the average soil moisture content across the site, providing an offset to any increases in runoff due to the slight increase in site imperviousness (due to access tracks and other hardstand areas).

Local groundwater conditions are likely to improve as a result of the project with the removal of irrigation reducing extractions and leakage accessions to groundwater.

The potential impacts identified to surface water and groundwater availability, quantity and quality in the vicinity of the Mulwala Solar Farm are minor and are adequately managed through the mitigation measures proposed.

5 Bibliography

Alamgir, M. (2011). *Lower Murray Alluvium: Groundwater Management Area 016 – Groundwater Status Report 2010.* Sydney: NSW Office of Water.

Bureau of Meteorology. (2017). Retrieved July 26, 2017, from GDE Atlas: http://www.bom.gov.au/water/groundwater/gde/map.shtml

CSIRO. (2018, April 10). *Australian Soil Resource Information System*. Retrieved from CSIRO: http://www.asris.csiro.au/

Landcom. (2004). *Managing Urban Stormwater: Soils and Construction.* Sydney.

NSW DPIW. (2018). Retrieved March 13, 2018, from Real-time data: http://realtimedata.water.nsw.gov.au/water.stm?ppbm=STATE_OVERVIEW&so&3&sobkm_url

Appendix A Bore details

Table 5 Existing bores in the vicinity of the property

Bore number	Registered use	Location	Date drilled	Licence number	Licence status	Work type	Bore depth (m)	Bore diameter (mm)	Water bearing zone	S.W.L (m)	Soil material	Yield (L/s)
GW059594	Domestic, stock	Nearby	01/07/1984	50BL130462	Converted	Spear	9.1	86	Unconsolidated	3.00	Clay-gravel	1.10
GW057694	Domestic, stock	Nearby	01/01/1983	50BL126458	Converted	Bore	10.00	150	Unconsolidated	4.00	Clay-sand	1.26
GW059812	Domestic, stock	Nearby	01/07/1984	50BL130463	Converted	Bore	10.90	86	Unconsolidated	4.80	Clay-sand	0.50
GW060622	Domestic, stock	Nearby	01/02/1985	50BL131810	Converted	Bore	11	86	Unconsolidated	3.6	Clay-sand	3.70
GW064942	Domestic	Nearby	01/01/1980	-	-	Bore	8.30	400	-	-	-	-
GW064943	Domestic	Nearby	01/01/1980	-	-	Bore	8.20	400	-	-	-	-
GW060323	Domestic, stock, irrigation, farming	Nearby	01/12/1985	50BL131853	Cancelled	Battery spears	7.30	Casing 60 Opening 86	Unconsolidated	2.40	Clay-sand-gravel	6.30
GW505355	Domestic, stock, industrial	Nearby	10/07/1995	50BL198060	Converted	Bore	10.00	140	Unknown	3.00	Clay- sand grains (lithic)	1.25
GW500123	Domestic, stock	Nearby	02/11/1995	50BL196232	Cancelled	Bore	36.00	Casing 150 Opening 100	Unknown	-	Unknown- sand-clay	-
GW504784	Domestic	Nearby	01/01/1930	50WA506529	Current	Well	-	-	-	-	-	-
GW501003	Irrigation	Nearby	01/06/2001	50BL196632	Cancelled	Bore	17.00	Hole 190 Casing 105 Screen 105	Unknown	-	clay- sand	-
GW005128	Domestic, stock	Nearby	01/01/1951	50BL009020	Stock, domestic	Bore	36.60	102	-	-	-	-
GW062967	-	Nearby	01/02/1987	-	-	Bore	20.50	50	-	-	Clay-sand	-
GW061238	Domestic, stock	Nearby	-	50WA509861	Cancelled	Bore	12.20	-	Unknown	-	-	-
GW062980	-	Nearby	01/04/1987	-	-	Bore	13.50	50	-	-	Sand- clay	-
GW500077	Domestic	Nearby	14/11/1990	50BL141933	Converted	Bore	39.00	125	Unknown	11.00	Clay- Sand	0.90
GW504677	Domestic	Nearby	01/01/1978	50WA505329	Current	Bore	-	-	-	-	-	-
GW503458	Domestic	Nearby	15/10/2004	50BL199210	Converted	Bore	14.30	160	Unknown	3.66	-	1.00

Bore number	Registered use	Location	Date drilled	Licence number	Licence status	Work type	Bore depth (m)	Bore diameter (mm)	Water bearing zone	S.W.L (m)	Soil material	Yield (L/s)
GW501237	Domestic	Nearby	08/02/2001	50WA510124	Cancelled	Bore	33.00	Hole 150 Casing & opening 125	Unknown	14.00	Clay	0.38
GW005132	Domestic, stock	Nearby	01/01/1951	50BL009021	Cancelled	Bore	36.60	102	-	-	-	-
GW062828	Domestic, stock	Nearby	01/11/1986	50BL134763	Converted	Bore	54.80	Casing 125 Opening 139	Unconsolidated	9.00	Clay- sand	4.30
GW065443	Domestic, stock	Nearby	26/10/1988	-	-	Bore	98.30	Annulus 200 P.V.C 139 Screen 125	Unconsolidated	8.50	-	12.60
GW050434	Stock	Nearby	-	GW050434	Cancelled	Well	-	-	-	-	-	-
GW500752	Irrigation	Nearby	28/02/2000	50BL196708	Converted	Bore	90.00	Hole 310 Casing 285 Opening 220	Unknown	12.00	Clay- gravel	60.00
GW500628	Irrigation	Nearby	25/08/1999	50BL196708	Converted	Bore	91.00	170.00	Unknown	11.40	Clay- sand	-
GW062968	-	Nearby	01/02/1987	-	-	Bore	18.00	50	-	-	Sand- clay	-
GW503596	Domestic	Nearby	20/11/2008	50WA506620	Current	Bore	15.00	Hole 150 Casing & opening 115	Unknown	12.50	Clay- sandstone- sand	2.50
GW505416	Domestic	Nearby	01/10/2007	50WA506117	Current	Bore	32.00	Hole 200 Casing & opening 140	-	-	-	0.250
GW058849	Domestic	Nearby	01/01/1984	50BL128376	Converted	Bore	8.00	75.00	Unknown	-	-	0.50

Appendix B

Draft Erosion and Sediment Control Plan

Introduction

This Erosion and Sediment Control Plan (ESCP) serves to satisfy the requirements for the control of erosion and sediment movement associated with the construction, operation and decommissioning of the Mulwala Solar Farm, in accordance with the provisions of the guideline *Managing Urban Stormwater: Soils and Construction* ('Blue Book', Landcom 2004).

Aims

This ESCP aims to:

- Prevent local land degradation through soil erosion or sedimentation
- Minimise localised flooding events caused by stormwater runoff
- Protect local waterways and ecosystems from unsatisfactory sediment loads and turbidity.

Scope

The scope of this ESCP covers all construction, operation and decommissioning activities associated with the Mulwala Solar Farm.

Documents

- Construction Environment Management Plan (CEMP)
- Site layout Drawings – construction (progressive) and final layout including location and type of environment and sediment control measures

[It is noted that these documents will be prepared as part of the detailed design phase of the project.]

Key issues

The following aspects have been identified as key issues requiring consideration:

- Permanent vs. interim (construction related) erosion controls
- Retention and protection of vegetated strips, including free drainage
- Sediment traps and filters
- Minimising concentrated runoff
- Quality of waters exiting site
- Timely stabilisation of disturbed areas
- Vehicular sediment tracking.

Compliance criteria

This ESCP nominates the following compliance criteria:

- All soils and sediment laden runoff must be sufficiently contained on site
- No waterways or drainage lines are to be unlawfully altered as a result of construction activities
- Any potential for accelerated erosion events and/or sedimentation events are to be mitigated.

Responsibilities

As indicated by the CEMP, the responsibility for all stormwater, erosion and sediment issues arising from construction, operation and decommissioning of the Mulwala Solar Farm rests with the Project Manager. Authority for the completion of individual ESCP items has been delegated as follows.

Project Manager

- Ensure authority or stakeholder approval of the ESCP has been granted prior to the initiation of on-site works
- Initiate the ESCP at the start of on-site works
- Ensure the ESCP is reviewed and approved should deficiencies be encountered.

Environmental Officer

- Action, facilitate and monitor the implementation of the controls of the ESCP as defined by contractual and regulatory arrangement
- Promptly communicate any issues arising to the Project Manager for rectification.

Nature and extent of earthworks

The nature of earthworks associated with the Mulwala Solar Farm is relatively minor and includes:

- Surface excavation to create access roads
- Site levelling for locating power conversion units
- Materials laydown areas
- Vehicle parking and site offices
- Decommissioning of on-farm irrigation water supply channels
- Driving or piling of solar panel mounting structures
- Trenching for electrical cable installation.

Surface water, erosion and sediment control measures

Erosion, sedimentation and surface water control measures as per the Blue Book, that may be utilised during the construction of the project include:

- Thoughtful placement of site amenities, materials laydown areas and temporary work areas in accordance with the Blue Book – site secured with temporary fencing
- Restricting, limiting or diverting vehicle movements around excessively wet or boggy areas
- Site watering to limit dust generation as required (wind erosion)

- Limiting the time unprotected areas are exposed to rain and wind
- Protecting drains and discharge points with sediment traps until exposed areas are either sealed or rehabilitated
- Utilisation of targeted environment and sediment control if high risk areas are encountered
- Maintenance of protective ground vegetation on pervious areas (grass cover)
- Installation of vehicle access protection measures across drainage lines
- Use of sediment fences around topsoil stockpiles (if stockpiles are required)
- Use of check dams / straw bale filters within drainage lines to encourage infiltration and sediment capture
- Use of earth banks for the distribution and dispersion of concentrated runoff flows across pervious, vegetated lands prior to entering drainage networks

Monitoring and Reporting

Monitoring of environment and sediment control issues on a weekly basis will be performed by the Environmental Officer or delegated other whilst monthly (or as otherwise directed) monitoring will be assigned to the Project Manager. Particular attention will be given to sediment loading on erosion control devices throughout the site and any signs of scouring encountered on exposed ground, particularly after rainfall events. Any erosion / sediment events will constitute an incident and will be reported as per the CEMP.

Management of Incidents

In the event of an environment and sediment control incident, appropriate response measures will be applied. An Incident Immediate notification must be issued by the Project Manager, when the incident has exceeded regulatory criteria.

Appendix C
Communication with NSW OEH (flood assessment)

Delete | Respond | Quick Steps | Move | Tags | Editing | Speech | Zoom

Fri 11/05/2018 3:41 PM

AF

Andrew Fisher <Andrew.Fisher@environment.nsw.gov.au>

[EXT] OEH Response RE: Mulwala Solar Farm SSD 9039 - flood assessment

To Nathan Heinrich

Cc Chris Alderton; Samantha Garvitch

You replied to this message on 11/05/2018 3:46 PM.

Nathan,

In response to your query, our Floodplain Management Officer has provided the following response:

- Clarification: the flood extent shown in the email from the consultant represents the Flood Planning Area (FPA) from the Federation Shire LEP maps and does not represent the PMF (Probable Maximum Flood). This FPA is based on the 1% AEP flood with some level of freeboard component which is usually 0.5m. Not sure of the source of this mapping but suspect it maybe a historical flood extent i.e. 1917 event, that approximates the 1% AEP flood. However, given the location of the development site on higher ground I would suspect that it would not be flood prone in the PMF event that originates from the Murray River, so I tend to agree with this finding.
- However, for these types of developments across the region (not impacted directly by riverine flooding) we have required an assessment of overland flooding to be completed, with the level of assessment tailored to each specific site. In this case, given that there are no evident major flow paths across the site, that I can discern from the documents supplied, I would suggest that a simple assessment and discussion of the topographic features of the site and the local catchment to determine the likelihood of major flow paths developing during significant local rainfall events will suffice. If the topographic assessment finds that there is a likelihood of defined flow paths developing across the development site then a simple hydrologic/hydraulic model should be developed to assess the impacts to downstream areas.
- Council have commented that they are concerned about "changes in surface water runoff" from the site, so this simple assessment could also satisfy this concern.

If you decide that you will not be addressing some or all of the SEARs requirements relating to flooding then you will need to specifically justify their exclusion in your discussion in the EIS.

I trust this is of assistance. Let me know if you require anything further.

Regards,

Andrew

NSW GOVERNMENT Office of Environment & Heritage

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The Office of Environment and Heritage (OEH) South West Planning Team has a new email address.
Please send submissions for biodiversity and Aboriginal cultural heritage planning and regulation