

8/12/2023

David Canterbury
Project Manager
NGH Consulting
Level 3, 21 Mary Street
Surry Hills, NSW 2010

Flood Risk Assessment: Solar Farm Development, Kidman Way, Hillston NSW

Dear David,

Cumulus Engineering has undertaken a Flood Risk Assessment (FRA) for the proposed development located at Solar Farm Development, Kidman Way, Hillston NSW (herein referred to as the 'subject site'). A proposed design has been considered and assessed against the relevant Carrathool Shire Council flood planning controls.

1 Background

The subject site is located approximately 4 km south of the township of Hillston which lies within the Carrathool Shire region of New South Wales, 400km west of Sydney. The site is bordered by Kidman Way to the east and agricultural land to the north, south and west as illustrated in Figure 1-1. The proposed development consists of the construction of a new solar farm facility on existing rural land.

The site has been identified as being subject to flood risk by Council and as such, the proponent must demonstrate the proposed development complies with the objectives of the Carrathool LEP 2012 (Section 5.21 Flood Planning Provision).

Cumulus Engineering have therefore been engaged to prepare a Flood Risk Assessment (FRA) for the proposed development to fulfil Council requirements. Our scope of work was inclusive of the following:

- Collation and desktop review of available design flood information and relevant data including development plans and topographical data.
- Review of flood related planning requirements (Carrathool LEP 2012, State Environmental Planning Policy (Transport & Infrastructure) 2021).
- Provision of advice relating to planning controls.
- Assessment of the proposed development to ensure compliance with relevant flood related development controls.

Cumulus Engineering has assessed the flood risk at the site using existing flood data which has been provided by the Carrathool Shire Council (CSC) and was procured as part of the Hillston Flood Risk Management Study and Plan completed by Catchment Simulation Solutions in 2022.

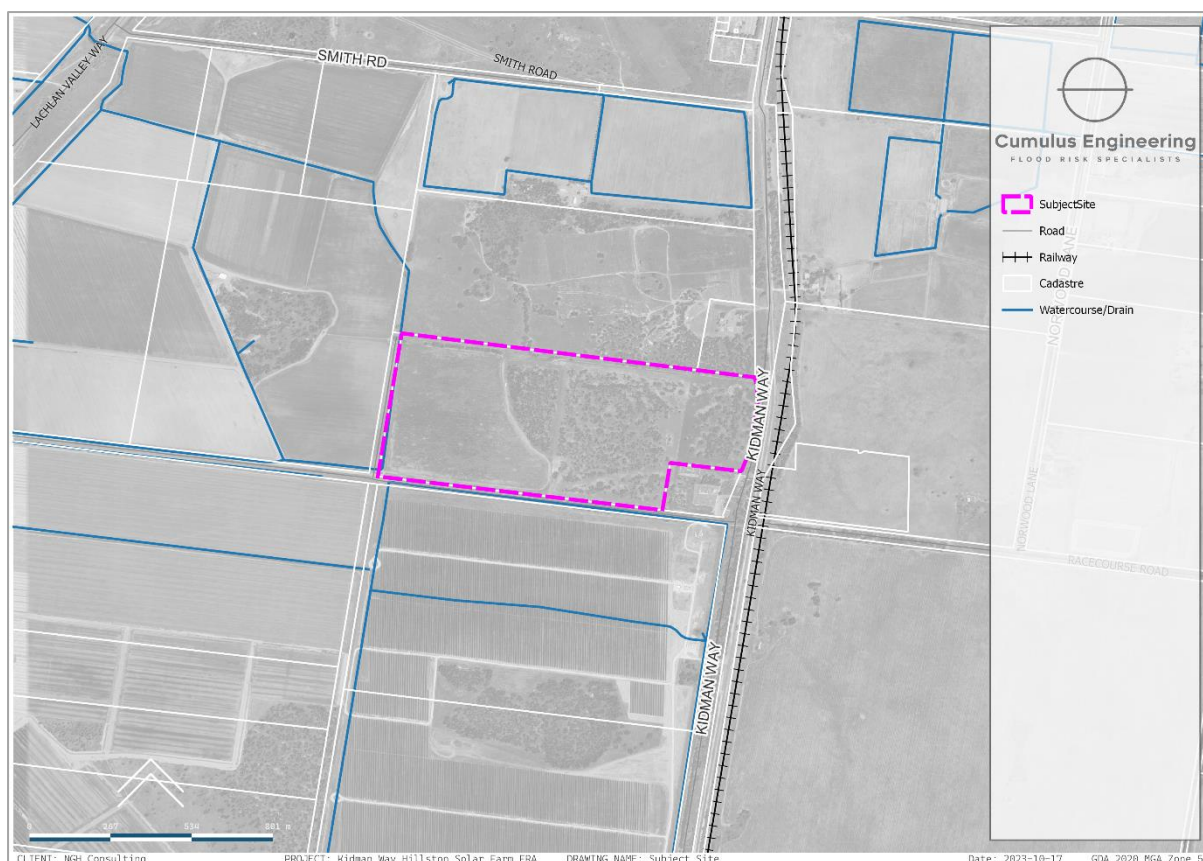


FIGURE 1-1 SUBJECT SITE

1.1 Carrathool Local Environmental Plan (LEP)

The Carrathool LEP (2012) aims to make local environment planning provisions for land within the Hillston region. The plan sets out intended objectives and requirements for development in the area. Section 5.21, Flood Planning, details planning provisions for development in regard to flooding and flood behaviour. The objectives of the LEP include the following:

- To minimise the flood risk to life and property associated with the use of land.
- To allow development on land that is compatible with the flood function and behaviour on the land, considering projected changes as a result of climate change.
- To avoid adverse or cumulative impacts on flood behaviour and the environment.
- To enable the safe occupation and efficient evacuation of people in the event of a flood.

The proposed development has been assessed against the relevant planning requirements which is outlined in the detail in the following sections.

2 Assessment of Proposed Design

2.1 Proposed Design

Figure 2-1 displays the layout plan for the development, which proposes accessing the site from the east via Kidman Way along an internal access track. Within the solar farm area, the development includes two six banks of solar panels in the western portion of the site, as well as an internal road, inverter stations and site amenities. A security fence will border the solar farm development.



FIGURE 2-1 SITE LAYOUT PLAN

2.1.1 Flood Risk at Site

Depths for the 1% AEP flood event with the proposed layout plan are illustrated in Figure 2-2 and indicate that the site experiences some flooding with varying depths throughout. Flooding in the vicinity of the site is generally from localised rainfall after shorter duration storms of up to 6 hours.

Based on the current proposed site layout, all infrastructure for the solar farm is located outside of the 1% AEP flood extent. Flood depths across the site vary with the deeper flooding occurring in a low point in the eastern portion of the site where depths reach 1.35 metres. Depths along the proposed access track along the northern boundary of the site to the Kidman Way (as illustrated in Figure 2-1) would exceed 900mm and would be impassable in a 1% AEP flood event.

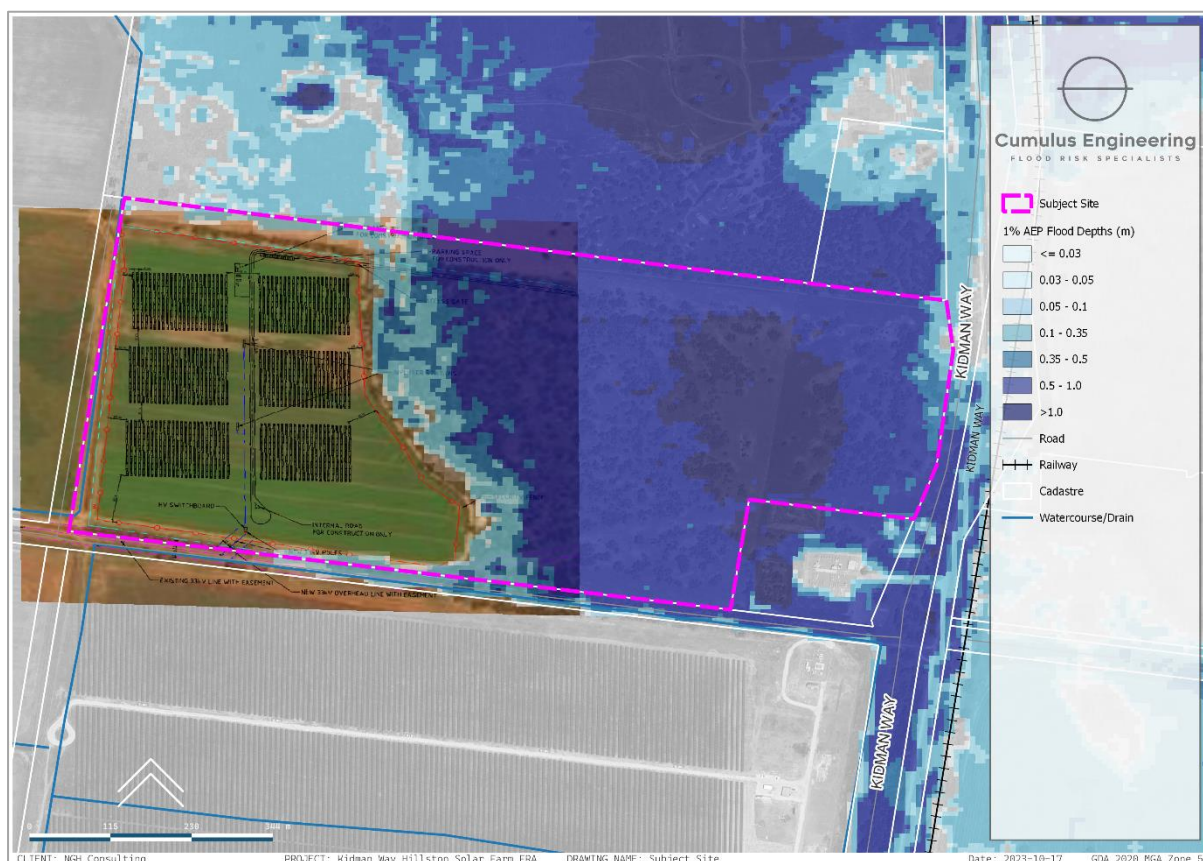


FIGURE 2-2 1% AEP FLOOD DEPTHS ACROSS THE SITE

2.1.2 Flood Risk to Access Site

The proposed site access track from Kidman Way is directly inundated by floodwaters up to 950 mm deep (as illustrated in Figure 2-3) impacting access to the site in the 1% AEP event. This scenario presents challenges as it obstructs safe vehicular access to and from the site from Kidman Way posing a risk to the safety of individuals and emergency vehicles, impeding their ability to enter or exit the site during flood events. Evacuation of the site prior to a flood event is recommended.

An alternative emergency access routes could be achieved to the west of the subject site to Lachlan Valley Way along an unnamed and undeveloped road corridor. Based on aerial imagery it appears a 4WD track is currently located along that alignment.

In addition, a flood response plan is recommended for the site to ensure it is evacuated in advance of inundation of the surrounding access roads.

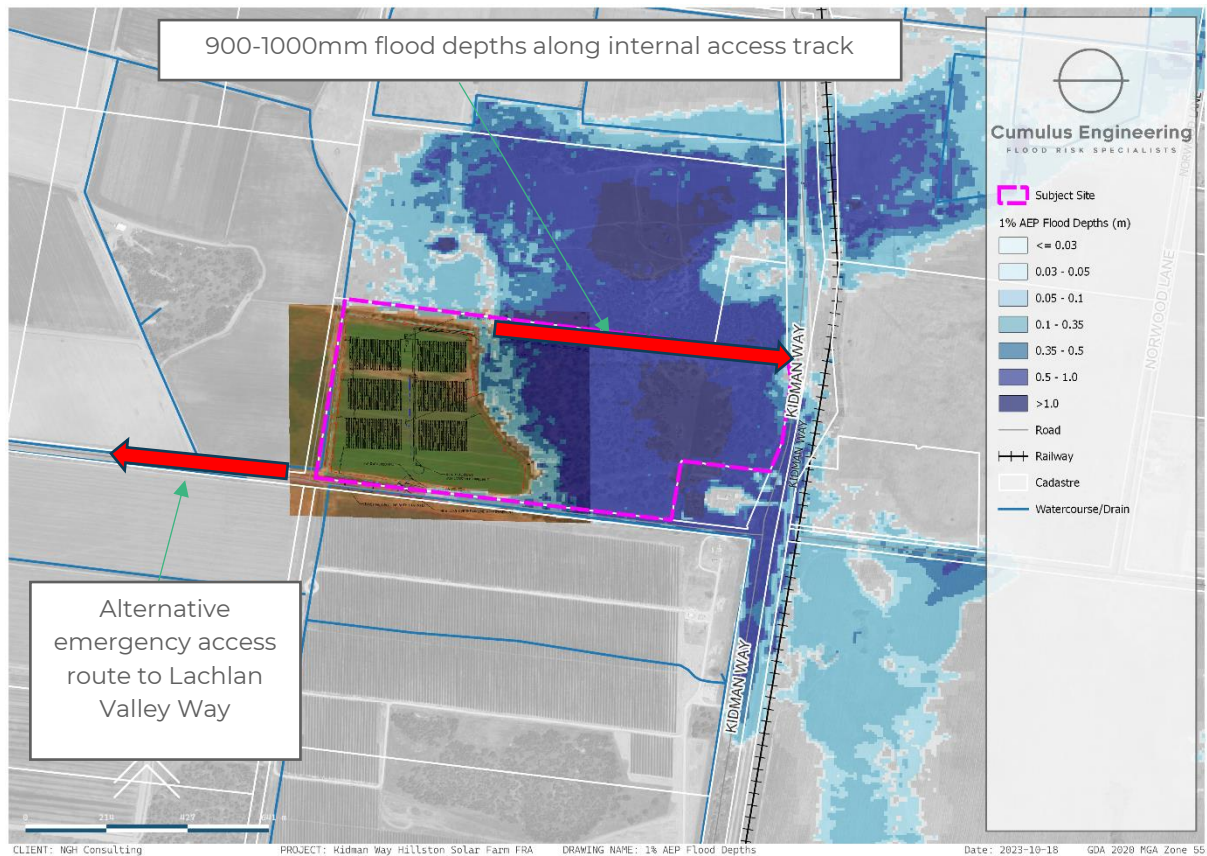


FIGURE 2-3 ACCESS ROUTES FROM SUBJECT SITE

2.1.3 Compliance with Planning Codes

Cumulus Engineering has reviewed the state and local planning requirements for the site and assessed the design against the relevant flood-related planning requirements.

Table 2-1 shows the design meets all the planning requirements set out in Section 5.21, Flood Planning of the Carrathool LEP and outlined in Section 1.1 of this memo.

TABLE 2-1 COMPLIANCE WITH PLANNING CONTROLS

PLANNING REQUIREMENTS	CUMULUS ENGINEERING COMMENT	COMPLIANT (TICK/CROSS)
(1) OBJECTIVES	See list above	n/a
(2) DEVELOPMENT CONSENT MUST NOT BE GRANTED TO DEVELOPMENT ON LAND THE CONSENT AUTHORITY CONSIDERS TO BE WITHIN THE FLOOD PLANNING AREA UNLESS THE CONSENT AUTHORITY IS SATISFIED THE DEVELOPMENT:	<i>The proposed development is partially impacted by flood-prone areas as shown in Figure 2-2 and satisfies the planning requirements as outlined below.</i>	✓
	A) IS COMPATIBLE WITH THE FLOOD FUNCTION AND BEHAVIOUR ON THE LAND <i>Flood mapping shows that the site of the proposed development is partially impacted by inundation in the 1% AEP event, however based on the current site layout, solar farm infrastructure would be located outside of the 1% AEP flood extent. None of the proposed solar farm infrastructure is inundated aside from the access track to Kidman Way.</i> <i>A flood response plan is recommended for the site to ensure evacuation of the site in advance of a flood event.</i>	✓
	B) WILL NOT ADVERSELY AFFECT FLOOD BEHAVIOUR IN A WAY THAT RESULTS IN DETRIMENTAL INCREASES IN THE POTENTIAL FLOOD AFFECTATION OF OTHER DEVELOPMENT OR PROPERTIES <i>The solar farm infrastructure is located outside of the flood extent aside from the access track to Kidman Way. There is no fill proposed within the flood extent and therefore there will be no adverse impacts to other properties.</i>	✓
	C) WILL NOT ADVERSELY AFFECT THE SAFE OCCUPATION AND EFFICIENT EVACUATION OF PEOPLE OR EXCEED THE CAPACITY OF EXISTING EVACUATION ROUTES FOR THE SURROUNDING AREA IN THE EVENT OF A FLOOD <i>The access route within the site to Kidman Way is inundated with depths reaching up to 950mm in the 1% AEP event. The available flood data indicates an alternate flood-free access route could be utilised west of the site to access Hillston via Lachlan Valley Way, along an unnamed road corridor that currently consists of an unsealed 4WD track.</i> <i>This design option is considered compliant provided a flood response plan is developed and maintained for the site.</i> <i>The solar farm infrastructure within the site is not flood-affected in the 1% AEP event.</i>	✓
	D) INCORPORATES APPROPRIATE MEASURES TO MANAGE RISK TO LIFE IN THE EVENT OF A FLOOD, <i>The access route within the site to Kidman Way is inundated with depths reaching up to 950mm in the 1% AEP event. The available flood data indicates an alternate flood-free access route that could be used west of the site to access Hillston via Lachlan Valley Way, along an unnamed road corridor that currently consists of an unsealed 4WD track.</i> <i>A flood response plan is recommended for the site to ensure evacuation of the site in advance of a flood event. The solar farm infrastructure within the site is not flood-affected in the 1% AEP event.</i>	✓

PLANNING REQUIREMENTS	CUMULUS ENGINEERING COMMENT		COMPLIANT (TICK/CROSS)
	E) WILL NOT ADVERSELY AFFECT THE ENVIRONMENT OR CAUSE AVOIDABLE EROSION, SILTATION, DESTRUCTION OF RIPARIAN VEGETATION OR A REDUCTION IN THE STABILITY OF RIVERBANKS OR WATERCOURSES.	<i>There are no significant works of fill proposed within the flood extent which would have an impact on riparian vegetation or riverbank stability.</i>	✓
(3) IN DECIDING WHETHER TO GRANT DEVELOPMENT CONSENT ON LAND TO WHICH THIS CLAUSE APPLIES, THE CONSENT AUTHORITY MUST CONSIDER THE FOLLOWING MATTERS:	A) THE IMPACT OF THE DEVELOPMENT ON PROJECTED CHANGES TO FLOOD BEHAVIOUR AS A RESULT OF CLIMATE CHANGE	<i>An increase in rainfall intensity associated with climate change could be expected to increase overland flow depths and durations, however the area where the solar farm infrastructure is located is flood-free and unlikely to become hazardous even with increased rainfall intensity.</i> <i>A flood response plan is recommended for the site to ensure evacuation of the site in advance of a flood event. An alternative emergency access route has been identified as discussed.</i>	✓
	B) THE INTENDED DESIGN AND SCALE OF BUILDINGS RESULTING FROM THE DEVELOPMENT	<i>All solar farm infrastructure is located outside of the flood extent and is appropriate from a floodplain management perspective.</i>	✓
	C) WHETHER THE DEVELOPMENT INCORPORATES MEASURES TO MINIMISE THE RISK TO LIFE AND ENSURE THE SAFE EVACUATION OF PEOPLE IN THE EVENT OF A FLOOD	<i>The solar farm infrastructure is located outside of the flood extent aside from the access track to Kidman Way.</i> <i>A flood response plan will also be prepared for the site ensuring the site is evacuated in advance of a flood event. An alternative emergency access route has also been identified as discussed above.</i> <i>Flood risk at the site can be appropriately managed using the above measures.</i>	✓
	D) THE POTENTIAL TO MODIFY, RELOCATE OR REMOVE BUILDINGS RESULTING FROM DEVELOPMENT IF THE SURROUNDING AREA IS IMPACTED BY FLOODING OR COASTAL EROSION.	<i>It is unlikely this will be necessary given the solar farm infrastructure is located outside of the flood extent and therefore unaffected in a 1% AEP flood event.</i>	✓

3 Conclusions and Recommendations

The subject site located at Solar Farm Development, Kidman Way, Hillston NSW has been identified as being subject to flood risk by Carrathool City Council and as such Cumulus Engineering have actioned a Flood Risk Assessment (FRA) to review available flood information to understand flood behaviour and flood impact on the development.

Objectives for the development regarding flooding and flood risk must minimise the flood risk to life and property associated with the development and ensure safe egress and evacuation of people in the event of a flood event.

The findings for the proposed development are as follows:

- While portions of the site are inundated, the solar farm infrastructure remains outside of the 1% AEP flood extent and is unaffected except for the site access track located on the northern boundary.
- The access track to/from Kidman Way is inundated to significant depths in a 1% AEP event.
- An alternative emergency access route could be used to the west along an unnamed road corridor.
- It is recommended that a flood response plan for the site is developed and maintained to ensure the site is evacuated in advance of a flood event in the vicinity of the site. This should be developed and active prior to operation of the solar farm.

It is considered that flood risk at the site can be appropriately managed through the floodplain management measures described above.

Please do not hesitate to contact me if you require further clarification.



Julian Skipworth

Director | Principal Engineer

Attached:

Attachment A – Development Plans

Attachment B – Flood Maps

Attachment C – Julian Skipworth CV



SITE AMENITY
FOR CONSTRUCTION ONLY

PARKING SPACE
FOR CONSTRUCTION ONLY

Cumulus Engineering
FLOOD RISK SPECIALISTS

ACCESS GATE

INVERTER STATIONS

Kidman Way

SECURITY FENCE

HV SWITCHBOARD

INTERNAL ROAD
FOR CONSTRUCTION ONLY

NEW 33kV POLES

EXISTING 33kV LINE WITH EASEMENT

NEW 33kV OVERHEAD LINE WITH EASEMENT

0 57 114 172 m



Cumulus Engineering
FLOOD RISK SPECIALISTS

 Subject Site

1% AEP Flood Depths (m)

 ≤ 0.03

 0.03 - 0.05

 0.05 - 0.1

 0.1 - 0.35

 0.35 - 0.5

 0.5 - 1.0

 > 1.0

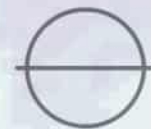
 Road

 Railway

 Cadastre

 Watercourse/Drain

0 214 428 642 m



Cumulus Engineering
FLOOD RISK SPECIALISTS

 Subject Site

1% AEP Flood Depths (m)

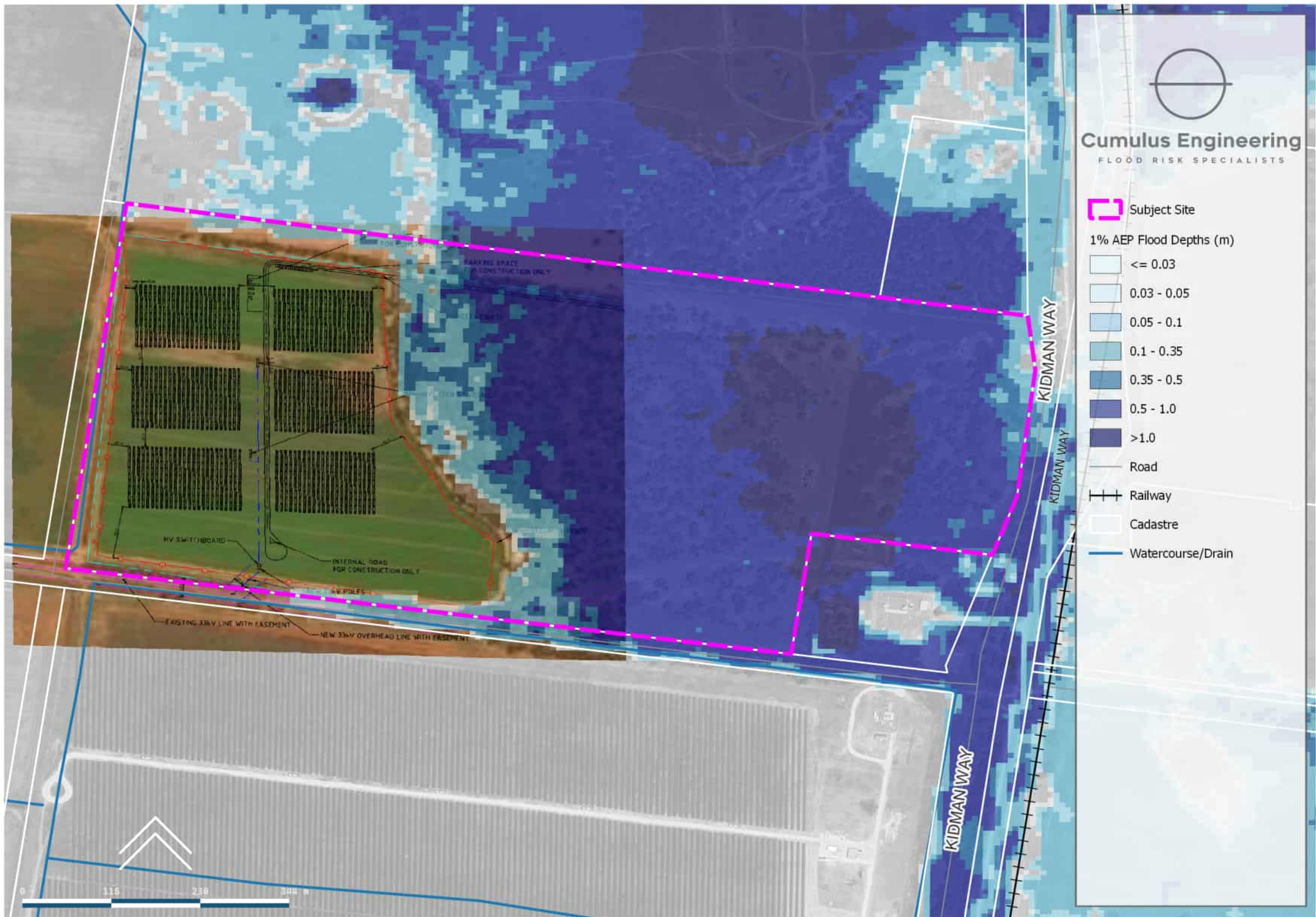
-  ≤ 0.03
-  0.03 - 0.05
-  0.05 - 0.1
-  0.1 - 0.35
-  0.35 - 0.5
-  0.5 - 1.0
-  > 1.0

 Road

 Railway

 Cadastre

 Watercourse/Drain





Julian Skipworth

Director | Principal Engineer | CPEng NER RPEQ

 Julian.Skipworth@cumuluseng.com.au

 0404 631 712

 Newport, VIC

 in/julian-skipworth

Julian is a Chartered Engineer and Floodplain Management professional with over 12 years of experience in the industry. Julian has gained extensive experience in hydraulic and hydrologic analysis and in the delivery of detailed flood risk and flood mitigation studies in both rural and urban environments. He also has extensive experience in community and stakeholder engagement. Julian is passionate about making his client's lives easier and delivering practical and timely engineering solutions.

Career Experience & Highlights

2011 - 2019	2019 - 2022	2022 - Present
Assistant Group Manager Senior Engineer	Victorian Regional Manager Principal Engineer	Director Principal Engineer
Water Technology	WMS Engineering	Cumulus Engineering

Education

Bach. Of Enviro Eng (Hons)

University of Southern Queensland | 2007 – 2010

Diploma Project Management

Engineering Education Au | 2013

Affiliations

Engineers Australia Member

Chartered Engineer

National Engineers Register RPEQ (23788)

Victorian Water Panel – Committee member

- Julian launched Cumulus Engineering in 2022, a specialist water engineering business with a focus on flood risk assessment and floodplain management adopting core values of reliability, transparency and flexibility.
- Opened the Victorian office of WMS Engineering (a specialist water consultancy) in 2019 and built a successful team which gained a significant market share of floodplain management work in Victoria.
- Achieved Chartered Status in 2015 and was promoted to Assistant Group Manager of the floodplains team at Water Technology.
- Written numerous technical papers including:
 - When Perception and Evidence Based Practice Collide – Floodplain and Waterway Management in the aftermath of the 2016 Floods at St Mary's, Tasmania - 9th Australian Stream Management Conference. Hobart, 2018*
 - Improving Fishway Design Through the Use of Detailed 2D and 3D Hydrodynamic Modelling - 2017 Hydraulics in Water Engineering*



Julian Skipworth

Director | Principal Engineer | CPEng NER RPEQ



Julian.Skipworth@cumuluseng.com.au



0404 631 712



Newport, VIC



in/julian-skipworth

Selected Projects

Cowies Creek Stormwater Strategy (2021 – 2022)

City of Greater Geelong (delivered in partnership with Alluvium)

A complex stormwater and flood risk study delivered in partnership with Alluvium Consulting. The catchment included some of the largest growth areas in Victoria. Julian project managed the study and led the flood risk component of the project, while also supporting Alluvium in the delivery of a drainage strategy and DSS which formed the second half of the study.

Central Bendigo Flood Mitigation Study (2020 – 2021)

City of Greater Bendigo

This project identified and assessed a large number of mitigation options to improve flood risk for Central Bendigo. The project involved thorough consultation with the community, updating existing hydrological and hydraulic models to be compliant with ARR2019 and then assessing a range of mitigation options in order to identify options which were community-supported, feasible and will improve flood risk for the communities and businesses of central Bendigo.

Wangaratta Flood Study (2016 – 2017)

Rural City of Wangaratta

This was a large and complex flood study covering the city of Wangaratta and surrounding localities. The study included complex hydrology of the Ovens and King River systems, multi-domain TUFLOW modelling, extensive community engagement and assessment of a range of flood mitigation options.

Other Key Projects

- Moree Town Levee Feasibility Study – Moree Shire Council (2021)
- Maryborough Flood Study – Central Goldfield Shire Council (2021)
- Southbank Climate Change TUFLOW Modelling – City of Melbourne (2020)
- Kangaroo Flat Flood Mitigation Study – City of Greater Bendigo (2020)
- Kyabram Flood Study – Campaspe Shire Council (2020)