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KELLYVILLE PARK PNRL EELS

CENTRE OF EXCELLENCE AND COMMUNITY SPORTS CENTRE

FLOOD IMPACT ASSESSMENT

wsp

FEBRUARY 2022

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Kellyville Park PNRL Eels
Centre of Excellence and Community Sports Centre
Flood Impact Assessment

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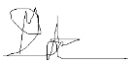
Reviewed by:	Michele Zornitta	28/02/2022	
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GLOSSARY & KEY TERMS

1D	One-dimensional
2D	Two-dimensional
ADRH	Australian Disaster Resilience Handbook
AEP	Annual Exceedance Probability
AHD	Australian Height Datum
AIDR	Australian Institution for Disaster Resilience
AR&R	Australian Rainfall & Runoff
BoM	Bureau of Meteorology
DA	Development application
DCP	Development Control Plan
DEM	Digital Elevation Model
DPIE	Department of Planning, Industry and Environment NSW
EES	Environment, Energy and Science Group
EIS	Environmental Impact Statement
FPL	Flood Planning Level
GPU	Graphical Processing Unit
IFD	Intensity Frequency Duration
LiDAR	Light Detection and Ranging
PMP	Probable Maximum Precipitation
PMF	Probable Maximum Flood
RHDA	Rouse Hill Development Area
SEARs	Secretary's Environmental Assessment Requirements
SSDA	State Significant Development Application
TDL	Trunk Drainage Land (the riparian corridor and 1% AEP flood lands)
THSC	The Hills Shire Council

EXECUTIVE SUMMARY

This flood assessment report has been prepared by WSP to accompany the flood impact assessment for the Eels Centre of Excellence and Community Sports Hub at Kellyville Memorial Park, Kellyville

The proposed development would comprise two double-storey building (i.e. Community Facilities building and Centre of Excellence building) and a new car park. The Centre of Excellence building includes an elite level gymnasium, medical and rehabilitation facilities, aquatic recovery and rehabilitation pools, a lecture theatre and meeting rooms, a player education and study area. The Community Facilities building has two levels and includes unisex changerooms and amenities, a first aid/medical room, a community gymnasium, a multi-purpose room and a dining area (i.e. kitchen, café and bar). The Community Facilities building is also connected with a grandstand which is located to the south of the building. This flood assessment report investigates:

- the flood risk within and around the vicinity of the site and establishes the mitigation measures required to ensure the sustainability and safety of the scheme over its lifetime.
- the flood impact generated by the proposed development to ensure that not exacerbation of flood risk elsewhere.

This flood assessment has been produced in line with the requirements indicated by the Planning Secretary's Environmental Assessment Requirements (SEARs), flood authorities and Council recommendations.

FLOOD CONDITONS AT THE SITE

Sydney Water flood map shows that the peak flood level touches the east boundary of the site with peak flood level between 57.8 and 58.2 m AHD. The peak flood level does not reach the site area. Thus, the proposed development is outside the 1% AEP flood extent

Further hydraulic modelling was undertaken by WSP using an improved version of Sydney Water flood model. The hydraulic modelling results shows that the proposed development is not affected by creek flooding up to and including the PMF flood event.

A site-specific flood model was also developed by WSP to investigate the 5%,1% AEP and PMF overland flood mechanisms. The model results showed that:

- In the 5% AEP the flood depth within the site is up to 700mm and the flow velocity is generally below 1m/s. The flood hazard at the site is up to hazard category H3 (Unsafe for all vehicles, children and the elderly).
- In the 1% AEP the flood depth within the site is up to 780mm and the flow velocity is generally below 1m/s. The flood hazard at the site is up to hazard category H3 (Unsafe for all vehicles, children and the elderly).
- In the PMF flood event the flood depth within the site is up to 900mm and the flow velocity is up to 3.5m/s. The flood hazard at the site is up to hazard category H6 (Unconditionally dangerous. Not suitable for any type of development or evacuation access. All building type considered vulnerable to failure).

FLOOD IMPACTS

As the proposed development is not affected by flooding from Strangers Creek up to the PMF event, no flood impact is expected from creek flooding.

The overland flood model analysis demonstrated that the proposed development does not exacerbate the flood conditions up to and including the 0.2% AEP flood event.

PROJECT BACKGROUND

1 PROJECT BACKGROUND

1.1 INTRODUCTION

WSP was appointed by Parramatta National Rugby League Club Limited to undertake a flood assessment for the proposed Eels Centre of Excellence and Community Sports Hub development at Kellyville Memorial Park, Kellyville, NSW, hereinafter referred to as "the proposed development".

The proposed development would include the construction of a community facilities building, a centre of excellence building and a car park.

The proposed development is seeking planning approval through a State Significant Development Application (SSDA). As part of the SSDA a flood assessment is required to ensure that flood risk can be safely managed within the site and that the proposed development does not exacerbate the flood risk elsewhere (i.e., outside the site area).

1.2 OBJECTIVE OF THE STUTDY

This flood assessment report investigates the flood risk within and around the vicinity of the site and establishes the mitigation measures required to ensure the sustainability and safety of the scheme over its lifetime.

This flood assessment has been produced in line with the requirements indicated by the Planning Secretary's Environmental Assessment Requirements (SEARs), flood authorities and Council recommendations.

A flood impact assessment it has also been completed to ensure that the proposed development does not exacerbate flood risk elsewhere.

1.3 STUDY METHODOLOGY

This report has been informed by consultation and meetings with Sydney Water and The Hill Shire Council that took place in November 2021.

In March 2021 Sydney Water provided flood advice that allowed to define the peak flood level for the 1% AEP flood event at the site and surrounding areas.

Sydney Water flood model was obtained and used by WSP to assess the flood conditions (i.e. flood level, flow velocities and flood hazard) at the site and the flood impacts generated by the proposed development.

An overland flood model was also developed by WSP to represent the runoff flow conditions that can affect the site in the 5%, 1% AEP and PMF flood events.

1.4 REPORT STRUCTURE

The following sections have been discussed in this report:

- **Section 1: Project background:** it provides an overview of the flood assessment report.
- **Section 2: Site description**: It describes the site area including topography and waterbodies.
- **Section 3: Proposed development:** it provides and overview of the proposed development.
- **Section 4: Project requirements:** it outlines the project requirements used in this assessment.
- **Section 5: Flood risk:** it describes the flood conditions at the site.

- **Section 6: Flood impact:** it assesses the flood impacts generated by the proposed development.
- **Section 7: Flood planning level**: it defines the flood planning level required for the proposed development.
- **Section 8: Flood compatible material:** it discusses the flood material required for the proposed development.
- **Section 9: Conclusion:** it discusses the conclusion of the flood assessment report.

SITE DESCRIPTION

2 SITE DESCRIPTION

2.1 SITE LOCATION

The proposed development lies within a site area of approximately 13 ha at 8 Memorial Avenue, Kellyville NSW within The Hills Shire Council Local Government Area.

Figure 1 below shows the site area and the proposed development location; a detailed locality map is provided in Appendix A.

The site is bounded by Memorial Avenue to the north, residential developments to the south, Strangers Creek to the west and Stone Mason Drive to the east.

The site is currently comprised of various sporting fields and an existing car park at along the east boundary. Strangers Creek flows in northern direction along the western boundary of the site.

As shown Figure 1 the proposed development occupies an area of approximately 2 ha at the north-eastern of the site.

Figure 1 Site area location map

2.2 TOPOGRAPHY

The topography at the proposal and surrounding areas has been informed by the following dataset:

- LiDAR data. 1m LiDAR data - June 2020. LiDAR data were obtained from ELVIS – Elevation and Depth – Foundation Spatial Data portal developed under the auspices of the Intergovernmental Committee on Surveying and Mapping (ICSM) at http://elevation.fsdf.org.au/; and,
- Survey data. Survey was undertaken in March 2021 by Cardno.

The data shows that the site topography falls from Stone Mason Drive along the east boundary of the site towards Stranger Creek at the west. Topography drops from approximately 70 m AHD at Stone Mason Drive to approximately 60 m AHD at Strangers Creek. Strangers Creek is located 160 m to the west of the proposed development and the creek bed elevation is approximately 7 m lower than the ground elevation at the proposed development.

Figure 2 below shows the site topography and slope directions. Appendix B includes high-resolution map.

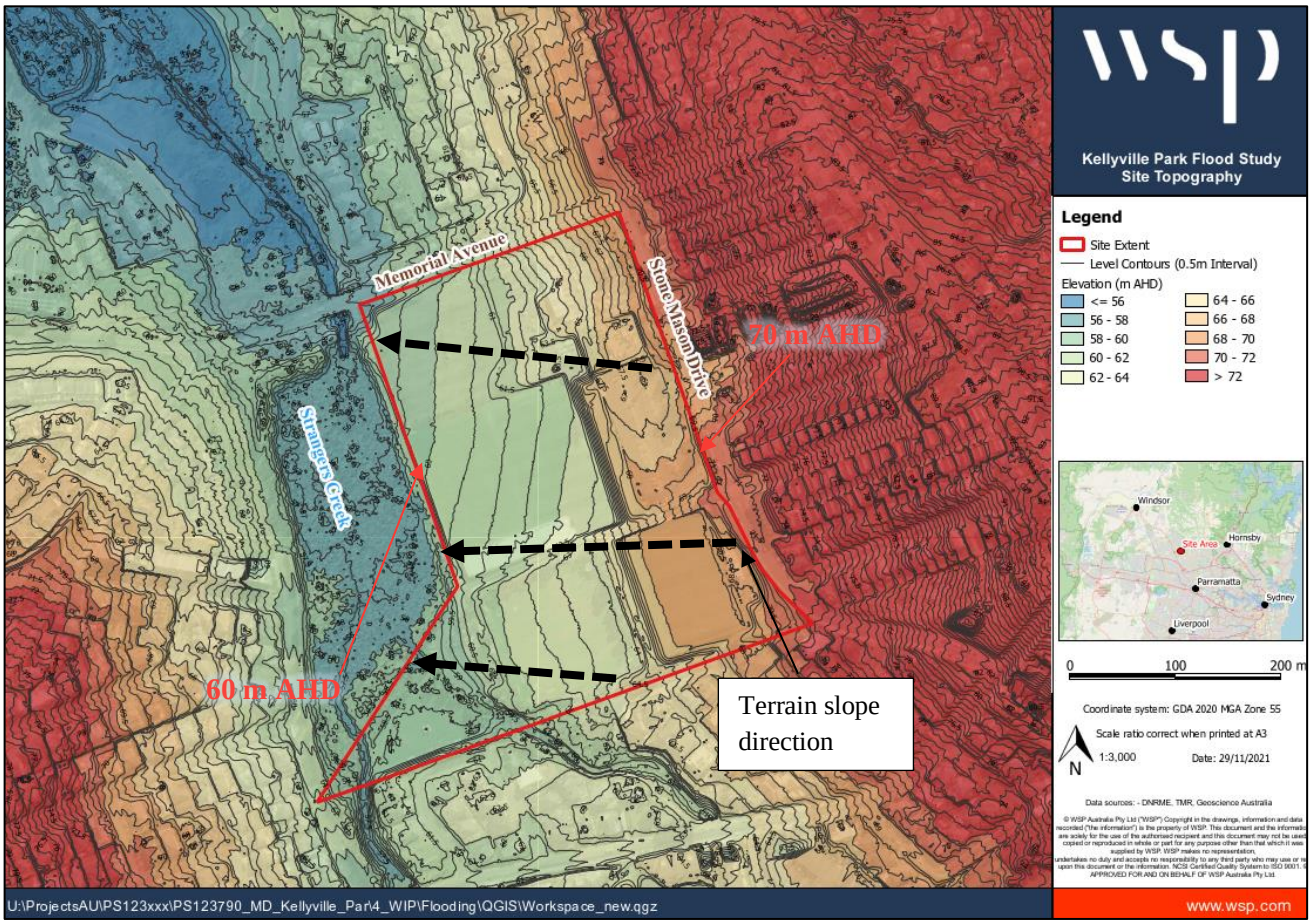

Figure 2: Topography data (LiDAR)

2.3 EXISTING WATERBODY

As shown in Figure 3, Stranger Creek is the only watercourse near the site.

Strangers Creek is a 5.4 km long creek that runs in north-west direction towards Caddies Creek. Strangers Creek has a total catchment area of approximately 7.2 km^2. The site is located at the upstream end of Strangers Creek catchment. Strangers Creek and Caddies Creek form part of the Trunk Drainage Lands (TDL) within Rouse Hill Development Area (RHDA) which is managed by Sydney Water.

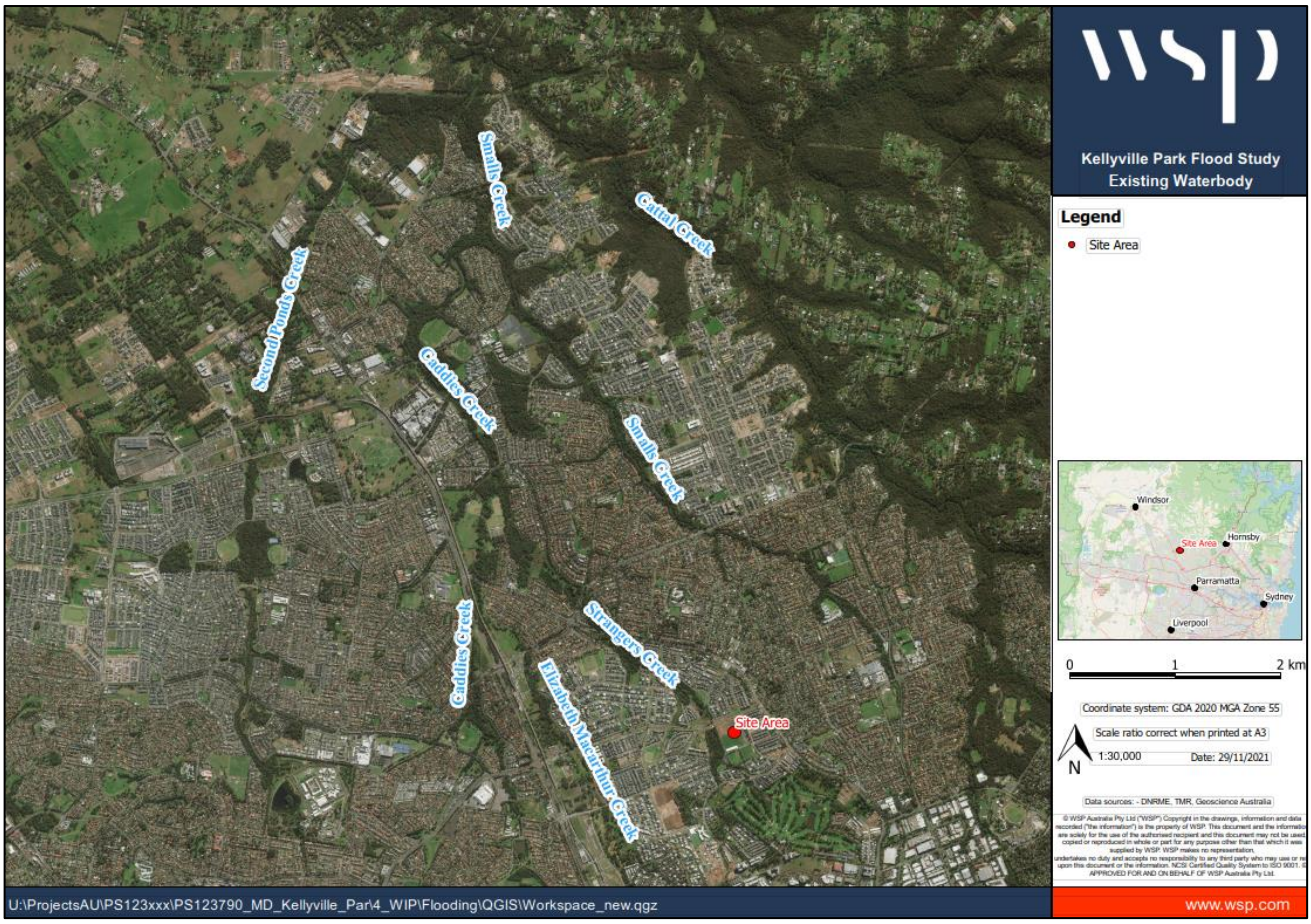

Figure 3 Existing waterbody map

Surface water runoff generated from the catchment enters the site area from the eastern boundary and is conveyed through an existing Council underground stormwater network that discharges into Strangers Creek.

2.4 PREVIOUS STUDIES

GHD completed the Rouse Hill Integrated Stormwater Strategy Review in 1998 for the Rouse Hill Infrastructure Consortium. The study included modelling of the pre and post-development hydrology, hydraulics and water quality. The study also included the changes in hydrology and hydraulics resulting from the completed development.

The trunk drainage system was subsequently designed within RHDA as mitigation measures to ensure that the peak flows downstream of the RHDA would not be increased as a result of the development.

In 2007 SKM was commissioned by Sydney Water to review the 1998 GHD study and update the hydrologic, hydraulic and water quality modelling based on the latest available information for the developed case. The study updated the hydrologic model (i.e. XPRAFTS) established by GHD and converted the hydraulic model from HEC-2 to HEC-RAS.

In 2012 AECOM completed another hydrologic and hydraulic study for the Strangers Creek, Caddies Creek and Second Ponds Creek catchment areas to support the Environmental Impact Statement for Stage 2 (Stations, Rail Infrastructure and Systems) of the North West Rail Link (NWRL) project. The hydrologic model was developed using WBNM and the hydraulic model was developed using TUFLOW.

WMA Water was commissioned by Sydney Water in 2014 to review and update the hydrologic and hydraulic models for the RHDA study area under a range of design storms from 0.5 EY to 1% AEP event. The study updated the hydrologic model (i.e. XPRAFTS) developed by GHD and SKM with the latest catchment conditions. The hydraulic model was updated from the 1-dimensional HEC-RAS model developed by SKM into a 2-dimensional TUFLOW model.

The Rouse Hill Flood Study completed by WMA Water in 2014 is currently adopted by Sydney Water as the latest flood study for the RHDA.

PROPOSED DEVELOPMENT

3 PROPOSED DEVELOPMENT

3.1 DEVELOPMENT PROPOSAL

The proposed development will provide state of the art facilities which enable physical recreation opportunities in conjunction with improved facilities for staff, players and existing users of the site. The proposed development will be integrated with the existing recreational landscape of the site and complement the upgrades to the existing playing fields being undertaken by Council. The proposed development is defined as a Recreation facility (major), and includes the following components:

- Construction of high-performance Centre of Excellence in the north-east of the site adjacent to Training Field 2:
  - Elite level gymnasium;
  - Medical and rehabilitation facilities;
  - Aquatic recovery and rehabilitation pools;
  - Lecture theatre and meeting rooms;
  - Player education and study areas;
  - Administration offices for the Parramatta Eels;
  - New female facilities including a dedicated female change room, cubicle toilets and showers;
  - Balcony and terrace area;
  - End of Trip Facilities and bicycle parking; and,
  - Refuse Area.
- Construction of a Community Facility, including a grandstand with approximately 1,500 seats in the centre of the site adjacent to the Main Playing Field 3:
  - Unisex changerooms and amenities. – Referee changeroom and amenities. – First Aid/Medical room;
  - Community gymnasium;
  - Café/kiosk;
  - Concourse terrace;
  - Multipurpose community function room with kitchen and amenities.;
  - Refuse Area; and,
  - Bicycle parking.
- Solar arrays will be included on the roof of both the Centre of Excellence and Community Facility.
- Additional 40 car parking spaces for the proposed facility to operate in conjunction with existing at grade car parking already constructed by Council.
- Additional landscaping throughout the development footprint.
- Removal of a small number of trees internal to the site, however noting perimeter trees will be retained where not affected by the proposed building footprints.
- Hours of operation for the Centre of Excellence and Community Facility are 5:00am to 12:00am, however the following key times are likely:
  - Centre of Excellence: 7.00am - 7.00pm – Community Facility: 7.00am - 10.00pm

Figure 4 shows the preliminary proposed site plan.

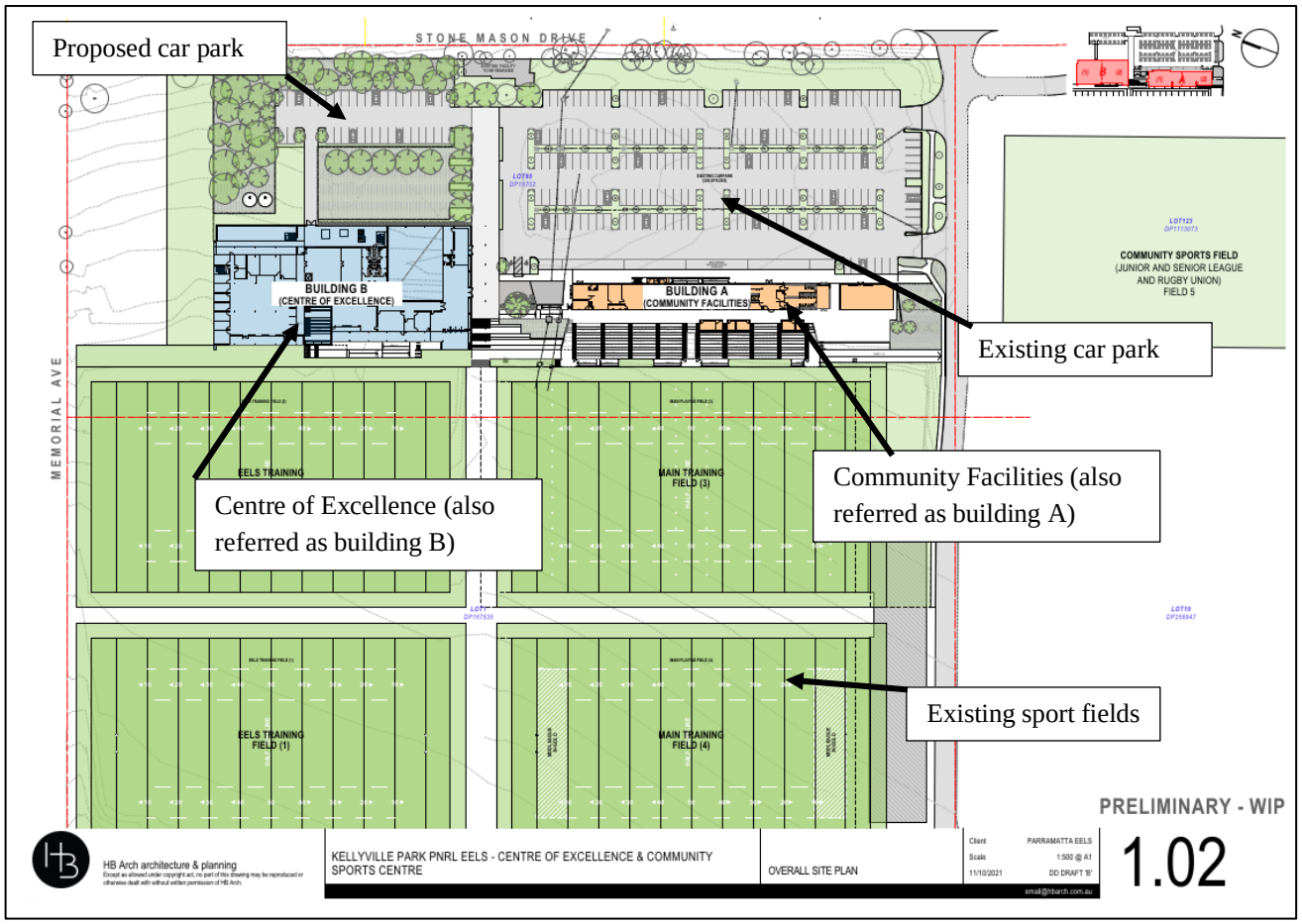

Figure 4 Proposed site plan - preliminary

Cross sections of the proposed buildings are included in Figure 5 and Figure 6 below.

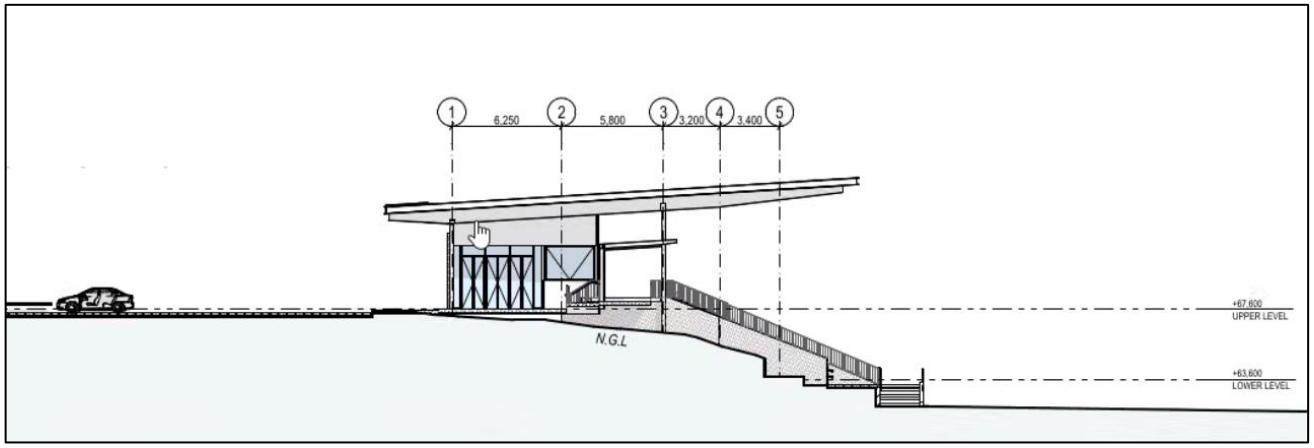

Figure 5 Community Facilities building – cross section

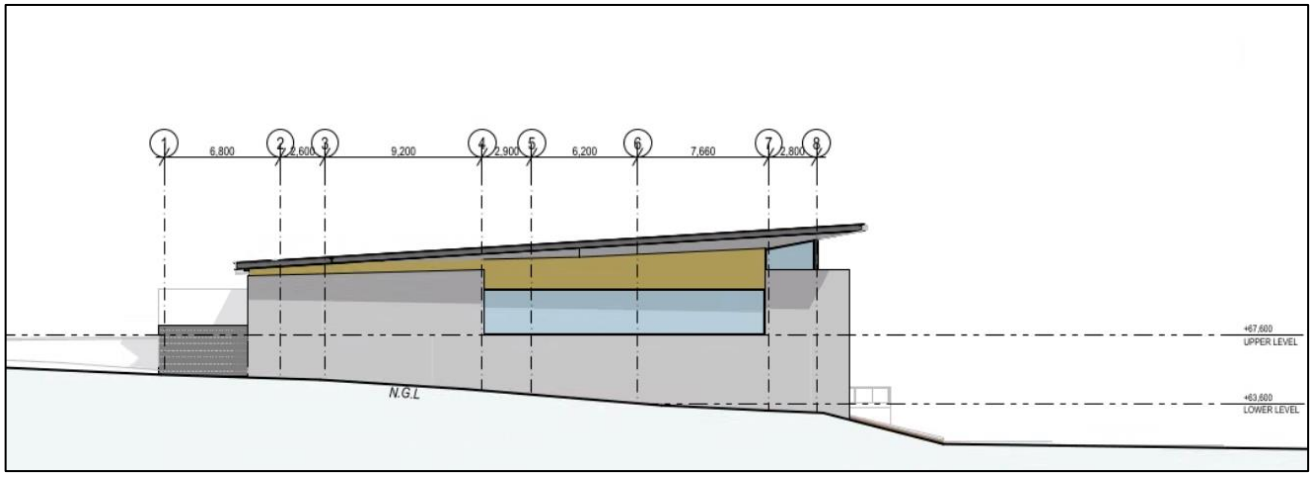

Figure 6 Centre of excellence building –cross section

PROJECT REQUIREMENTS

4 PROJECT REQUIREMETS

This section describes the project requirements considered for the proposed development from a flood risk perspective.

The following documents have been considered in defining project requirements from a flood risk perspective:

- SEARs (SSD-24452965, 18/08/2021); and,
- The Hills Development Control Plan (The Hill Shire Council)

The following guidelines have also been considered in preparing this flood assessment:

- Floodplain Risk Management Guide (NSW, 2019);
- Floodplain Development Manual (NSW 2005);
- Floodplain management in Australia: best practice principles and guidelines (CSIRO);
- Floodplain risk management guideline: practical consideration of climate change (Department of Environment and Climate Change);
- Australian Rainfall and Runoff (2019);
- Australian Disaster Resilience Handbook, Flood hazard (Australian Institute for Disaster Resilience, 2017).

Engagement with relevant stakeholders (i.e. Sydney Water and The Hill Shire Council) have also been undertaken as part of this flood assessment.

4.1.1 SEARS

In August 2021 the Department of Planning, Industry and Environmental (DPIE) provided the Planning Secretary's Environmental Assessment Requirements (SEARs) that needs to be addressed in the DA of proposed development. The SEARs specifies that the DA must include an environmental impact assessment (EIS) report which addresses key issues like flooding, biodiversity, visual impacts and etc.

This report has been prepared to address the SEARs associated with flooding. Table 4.1 presents the SEARs in relation to flooding.

Table 4.1 Design Response to SEARs Application No. SSD-24452965, dated 18/08/21 – Flooding

SEARs requirements	**Design response**
The EIS must include a flood impact assessment, which:	
▪ Identifies and describes any on-site flood impacts and risks associated with the proposed development, having regard to relevant provisions of the NSW Floodplain Development Manual and other local or State studies and guidance.	Section 5 of this report discusses the flood risk at the site for the existing and post development conditions. Section 6 of this reports discusses the flood impacts caused by the proposed development.
▪ Identifies mitigation and management measures to minimize the impact of flooding on the proposed development.	Section 6 of this report discusses the mitigation measures identified to mitigate the flood impacts generated by the proposed development.

4.1.2 THE HILL SHIRE COUNCIL

The Hills Development Control Plans (DCP) has been considered to inform the flood assessment requirements.

Table 4.2 summarises the flood requirements indicated in the DCP.

Table 4.2 The Hills Development Control Plans

DCP	Design response
Flood Impacts	
The flood impact of the development to be considered to ensure that the development will not increase flood effects elsewhere, having regard to: Loss of flood storage; Changes in flood levels and velocities caused by alterations to the flood conveyance, including the effects of fencing styles; and, The cumulative impact of multiple potential developments in the floodplain.	Section 6 of this reports discusses the flood impacts caused by the proposed development.
Flood Compatible Building	
Flood compatible building components and methods are a combination of measures incorporated in the design and/or construction and alteration of individual buildings or structures subject to flooding, or the use of flood compatible materials for the reduction or elimination of flood damage. Flood compatible materials include those materials used in building that are resistant to damage when inundated.	Section 8 of this reports addresses the requirements on flood compatible materials.
Flood Planning Levels	
A range of flood planning levels (FPL) may apply depending on the type of land use and Part C Section 6 Flood Controlled Land The Hills Shire Council Page 2 the part of the development in consideration. In principle, a higher FPL will apply to land uses considered more sensitive to flood hazards or which may be critical to emergency management operations or the recovery of the community after a flood event. Different FPLs are also considered appropriate for different parts of development. For example, the non-habitable floor levels of a dwelling can be at a lower level relative to the habitable floor level. The following table outlines those FPLs to be applied within the development controls outlined later in this section of the DCP. FPL1: 20 year ARI FPL2: 100 year ARI FPL3: 100 year ARI + 0.5m FPL4: PMF	Section 9 of this reports addresses the requirements on flood planning levels.

In November 2021 WSP engaged with The Hills Shire Council in order to understand council requirements from a flood risk perspective and check Council records of flooding at the site and surrounding areas.

Council representative informed that any specific planning requests would be addressed through a pre-lodgment meeting. Thus, Council did not provide any comments on specific requirements for the proposed development.

In terms of flood impacts, council representative advised that in general no adverse flood impact is accepted outside the site extent.

4.1.3 SYDNEY WATER

Sydney Water was consulted by WSP in March 2021 for providing flood advice at the site. Sydney Water provided the 1% AEP flood level at the site area. Flood data provided by Sydney Water are included in Section 5 and Appendix H.

Sydney Water was consulted by WSP in September 2021 to obtain the latest flood model for the site area (i.e. Rouse Hill flood model) and confirm requirements from a flood risk perspective. Sydney Water confirmed that the proposed development is required to be assessed for adverse flood impacts to the adjacent properties.

In November 2021 WSP presented the outcome of the flood assessment to Sydney Water flood engineer. Sydney Water flood engineer confirmed that the study methodology prepared by WSP to assess the flood conditions and flood impacts at the site and surrounding areas was appropriate. However, the flood engineer anticipated that the hydraulic model developed by WSP would require review by Sydney Water flood team to confirm its suitability.

This flood study has also considered the recommended requirements of referral Authorities, Sydney Water and the Environment, Energy and Science Group (EES) and addressed where appropriate and relevant to the development.

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FLOOD RISK

5 FLOOD RISK

This section describes the flood conditions and mechanisms at the site and surrounding areas for different return periods events (i.e., 5%, 1% AEP and PMF).

The characterization of the flood conditions at the site has been informed by the following data:

- Flood risk advice provided by Sydney Water in March 2021. Sydney Water provided the peak flood level for the 1% AEP flood event at the site and surrounding areas. Refer to Appendix H for further information.
- Sydney Water flood model of Strangers Creek obtained by WSP in November 2021. The flood model was used to assess the PMF peak flood level which was not included in the Sydney Water flood advice.
- Overland flood model developed by WSP in November 2021. The overland flood model allowed to describe the surface water runoff (i.e. overland flow paths) at the site and the adjacent upstream catchment.

5.1 SYDNEY WATER FLOOD AVICE

As anticipated in Section 4 flood advice was requested to Sydney Water in March 2021. Sydney Water confirmed that the site is not affected by flooding up to and including the 1% AEP flood event.

The 1% AEP flood map included in Figure 7 was provided by Sydney Water. The flood map shows that the peak flood level touches the east boundary of the site with peak flood level between 57.8 and 58.2 m AHD. The peak flood level does not reach the site area. Thus, the proposed development is outside the 1% AEP flood extent.

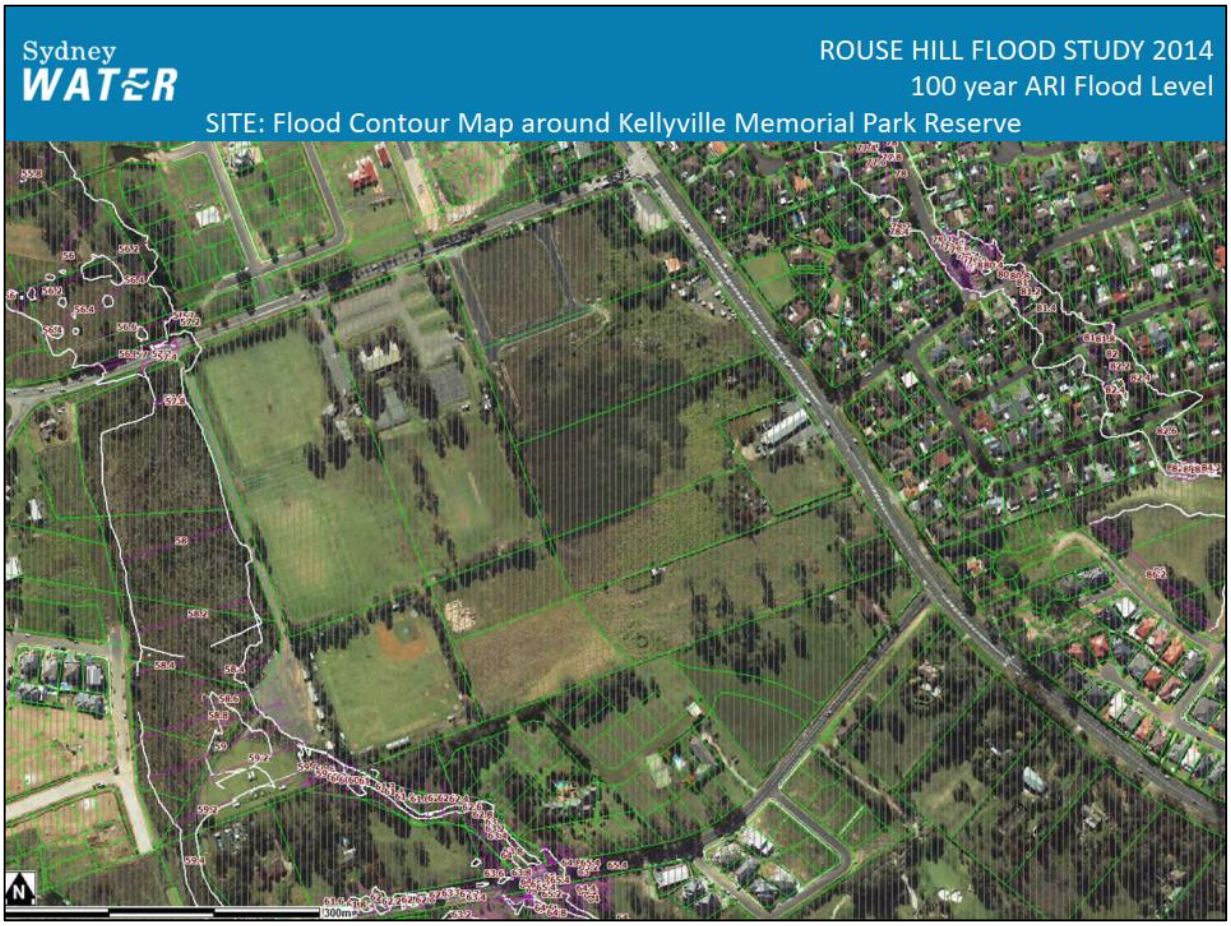

Figure 7: Sydney Water flood map (1% AEP flood event)

WSP requested Sydney Water to provide the PMF flood extent and levels. Sydney Water confirmed that the PMF flood extent was not part of the data they have available.

5.2 HYDRAULIC MODELLING

In order to refine the understanding of the flood conditions at the site and surrounding areas WSP requested and obtained in November 2021 the Sydney Water flood model relevant for the site area.

The flood model was developed by WMAwater in April 2014 as part of the Rouse Hill Flood Study and it has been successively updated as required by Sydney Water. Currently, it is adopted by Sydney Water for describing the flood conditions within the Rouse Hill Development Area.

After undertaking a high-level review of the flood model WSP updated the flood model (i.e. updated model) with the following improvements:

- Inclusion of the latest topography survey of the site (survey completed in March 2021).
- Change of the location of the upstream boundary condition in the hydraulic model to reflect the latest developments and structures at the upstream catchment. The upstream boundary condition has been moved towards downstream; this represents a conservative approach as more flood water is conveyed towards the site area. Sydney Water flood engineer agreed that the assumption is conservative. The flow inputs (i.e. QT discharge) from the hydrological model were not changed as the hydrological model represents the ultimate catchment development case.
- Conversion of the 1d network into the 2-dimensional domain to solve model instabilities in the PMF flood event. This was required as in the PMF simulation the flood model failed to represent the exchange of flow from the 1d domain into the 2d domain. As the flood behavior is typically 2 dimensional in this condition the conversion of the 1d into 2d improved the existing model representation of the flood mechanisms.

The updated model results were checked against the Sydney Water model result. The comparison confirmed that the two models generate similar results at the site area. The updated model produces slightly higher flood levels at the site which is due to the shift of the upstream boundary condition.

5.2.1 CREEK FLOODING

5.2.1.1 FLOOD LEVEL

The hydraulic model result shows that the site is not affected by flooding from Strangers Creek up to and including the 1% AEP flood event.

The 1% AEP peak flood level is shown Figure 8 (refer to Appendix E for high resolution map)

Figure 8 1% AEP flood level (Strangers Creek flooding)

The hydraulic model result shows that maximum flood level at the site in the PMF flood event ranges between 59 m AHD and 61.4 m AHD as indicated in Figure 9 (refer to Appendix E for high resolution map). The PMF flood extent does not affect the proposed development; only the area of approximately 1.3 ha along the west boundary is affected by PMF flooding. In this area peak flood depths are up to 500mm.

Figure 9 PMF flood level (Strangers Creek flooding)

5.2.1.2 FLOW VELOCITY

As introduced in the sections above, the proposed development is not affected by Strangers Creek flooding up to and including the PMF flood event. Thus, flow velocities from Strangers Creek are not relevant for the proposed development.

5.2.1.3 FLOOD Hazard

The proposed development is not affected by Strangers Creek flooding up to and including the PMF flood event. Thus, flood hazards from Strangers Creek are not relevant for the proposed development.

5.2.2 OVERLAND FLOODING

A site-specific rainfall-on-grid hydraulic model was developed by WSP to represent the overland flow mechanisms. This was required because overland flow was not included in the Sydney Water flood model. The model was used to represent the overland flood conditions and mechanisms in the existing and post-development scenarios.

The overland flood model includes the site and the upstream catchment to the east. The flood model was developed under the conservative assumption that the drainage network upstream (at the east of the site) is fully blocked and surface water runoff is conveyed entirely across the site. The site stormwater impacts and stormwater strategy are discussed separately in the Integrated Water Management Plan report prepared by WSP in October 2021.

Figure 10 shows the catchments and extension of the overland flood model.

Figure 10: Catchments – site specific flood model.

5.2.2.1 FLOOD LEVEL / FLOOD DEPTH

Flood levels and depths at the site have been assessed for the 5%, 1% AEP and PMF flood events for both the baseline and proposed scenarios.

Surface water runoff flows from the catchment at the east of the site towards Stone Manson Drive. Water runoff is collected around the mid of the site east boundary where there is a depression in the road. From the depression water flows into the site flooding 0.37 ha of the car park with water depths up to 700 mm in the 5% AEP flood event, 0.4 ha of the car park with water depths up to 780 mm in the 1% AEP flood event and 0.54 ha with water depths up to 900 mm in the PMF flood event.

From the car park water flows in west direction towards Stranger Creek following the site topography. Flood depths are generally shallow for all flood events. In the 5% AEP flood event flood depths are up to 150mm. In the 1% AEP flood event flood depths are up to 160mm. In the PMF flood event flood depths are up to 300 mm.

The proposed development has been designed with a designated flow path which allows overland flow to spill from the carpark and be conveyed safely between the two new buildings and across the sports fields.

Figure 11, Figure 12 and Figure 13 show the peak flood depths and flood levels at the site area in the overland flood model. Flood maps show the same peak flood levels around the buildings for 5% and 1% AEP flood events; this is explained by the depression in the topography where overland flow ponds before flowing towards downstream.

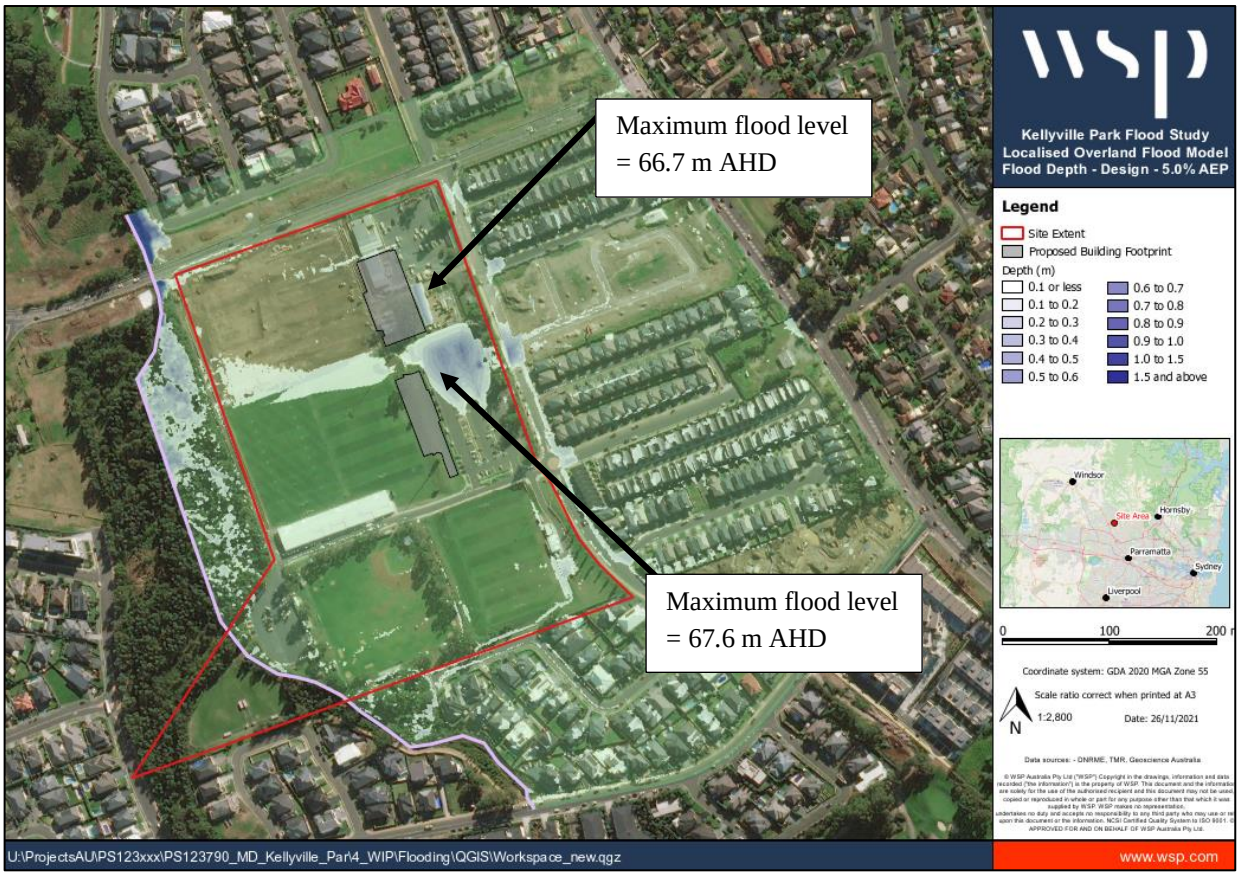

Figure 11: Overland flood model - flood depth - 5% AEP

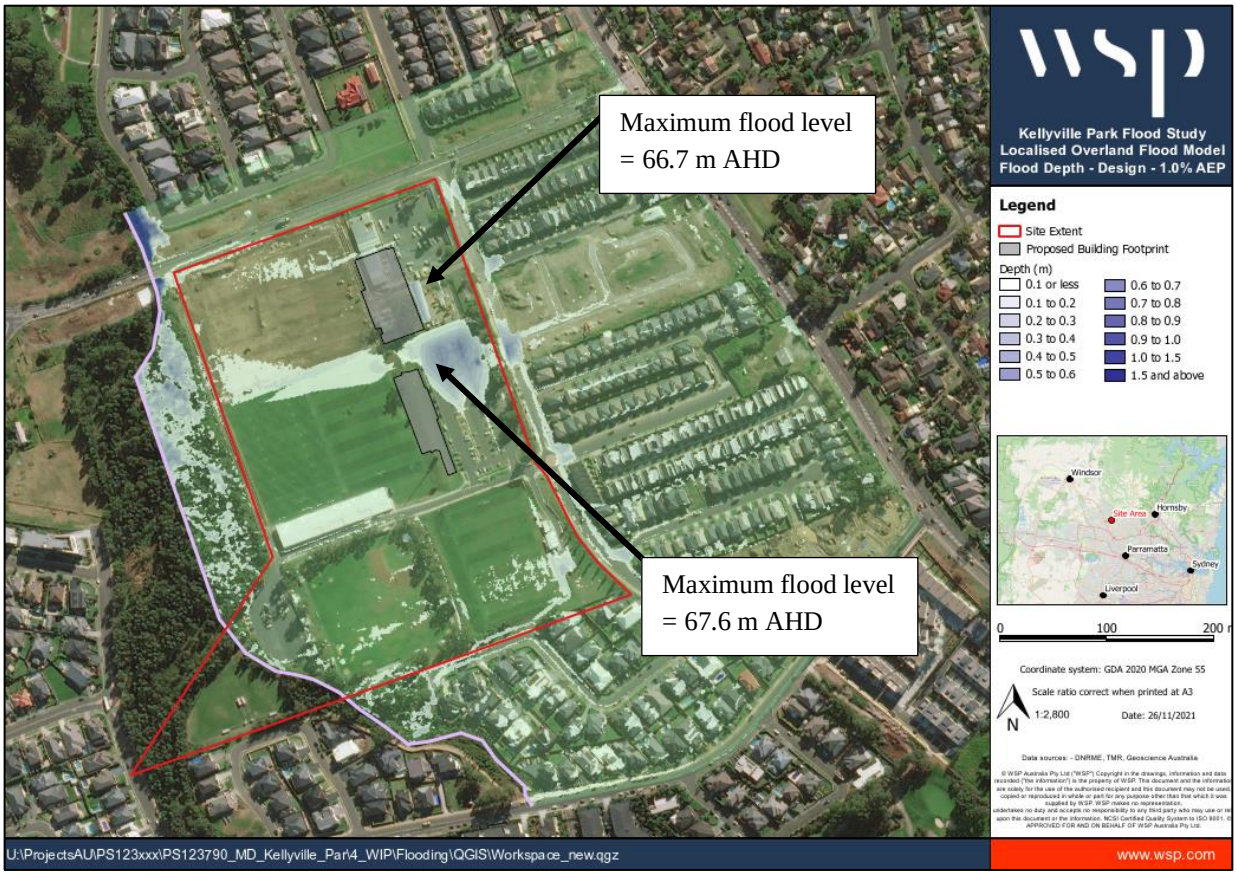

Figure 12: Overland flood model - flood depth - 1% AEP

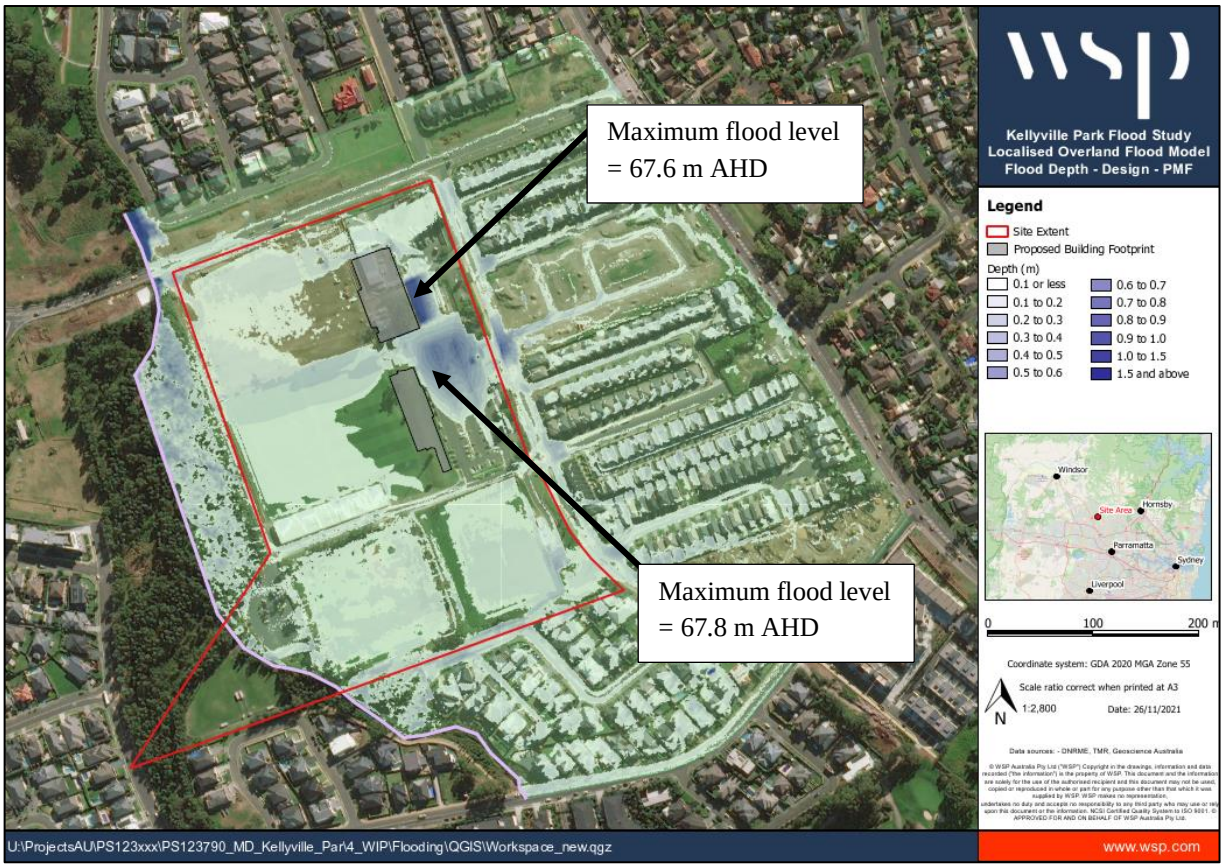

Figure 13: Overland flood model - flood depth – PMF event

5.2.2.2 FLOW VELOCITY

Flow velocities for the 5% AEP flood event are generally below 1 m/s.

Flow velocities for the 1%AEP flood event are generally below 1m/s.

Flow velocities for the PMF flood event are generally up to 2 m/s. Flow velocities up to 3.5 m/s occur where water spills from the car park into the open area at the west.

Figure 14, Figure 15 and Figure 16 show the maximum flow velocities at the site area in the overland flood model.

Figure 14: Overland flood model – flow velocity 5% AEP

Figure 15: Overland flood model – flow velocity 1% AEP

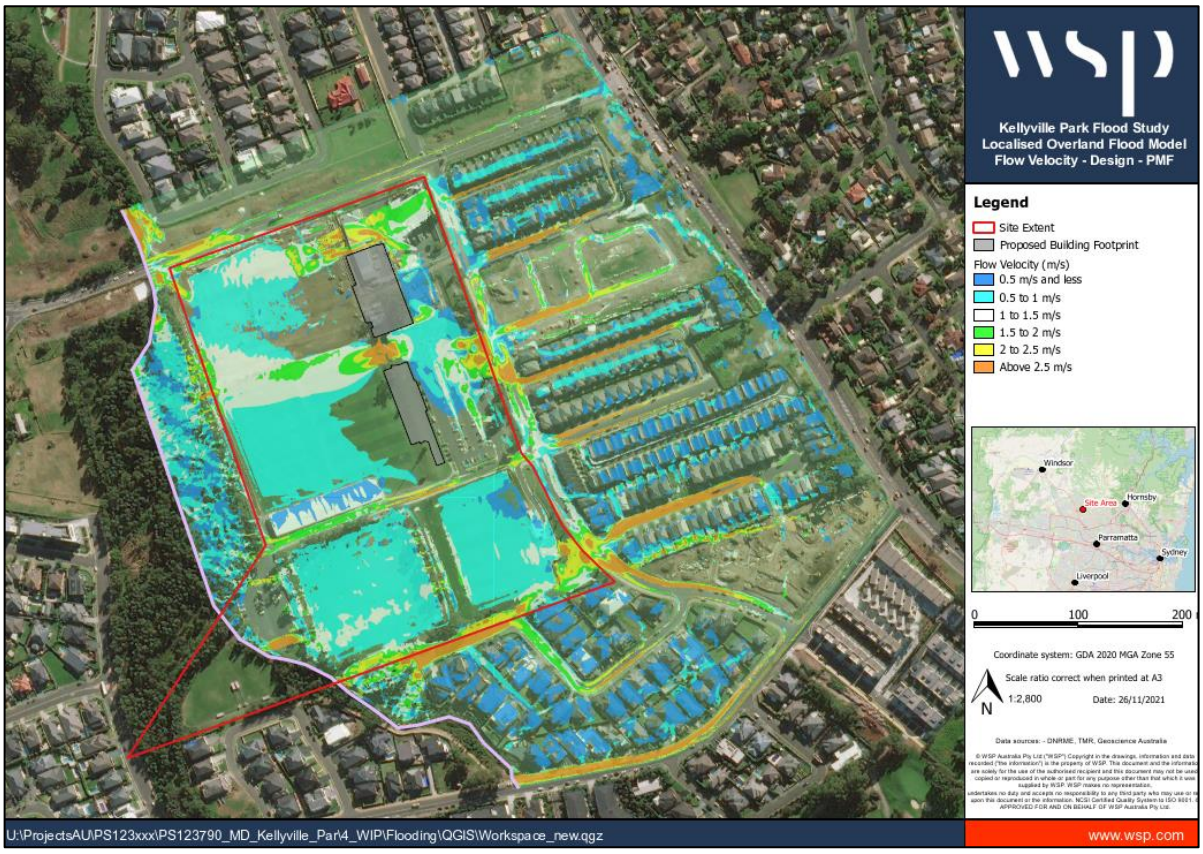

Figure 16: Overland flood model – flow velocity PMF flood event

5.2.2.3 FLOOD HAZARD

The flood hazard is categorized from H1 to H6 as outlined by Australian Institution for Disaster Resilience (AIDR), 2017.

Flood hazard categories are defined as follow:

- **H1**: Generally safe for vehicles, people and buildings.
- **H2**: Unsafe for small vehicles.
- **H3**: Unsafe for all vehicles, children and the elderly.
- **H4**: Unsafe for all people and vehicles.
- **H5:** Unsafe for all people and all vehicles. Buildings require special engineering design and construction.
- **H6**: Unconditionally dangerous. Not suitable for any type of development or evacuation access. All building type considered vulnerable to failure.

Flood hazard in the 5% AEP flood event generally ranges between H1 and H3. Figure 17 shows the 5% AEP flood hazard.

Figure 17 Flood hazard - 5% AEP - overland flooding

Flood hazard in the 1% AEP flood event range between H1 and H3. H3 flood hazard occurs only within the car park area. Figure 18 shows the 1% AEP flood hazard.

Figure 18 Flood hazard - 1% AEP - overland flooding

Flood hazard in the PMF flood event range between H1 and H6. Figure 19 shows the PMF flood hazard.

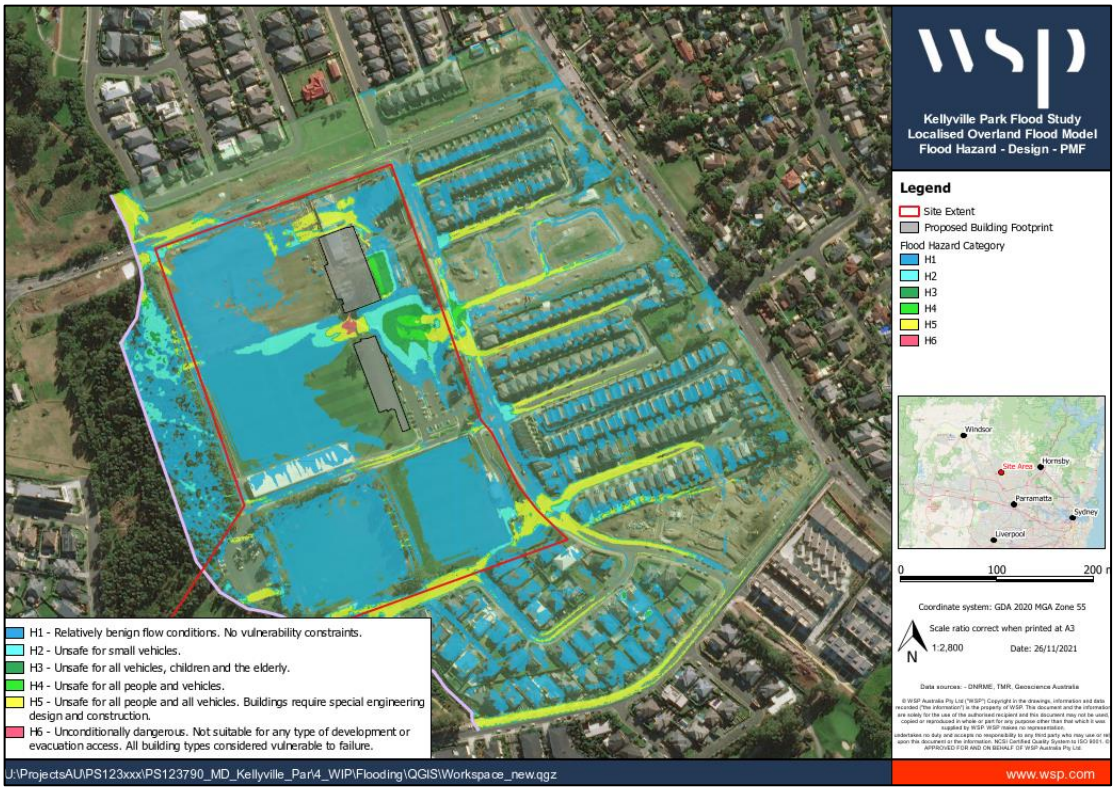

Figure 19 Flood hazard - PMF - overland flooding

5.2.3 SUMMARY OF FLOOD RISK

Table 5.1 summarises the flood risk at the site from the different sources discussed in the previous sections.

Table 5.1: Summary of flood risk at the site

	5% AEP	**1% AEP**	**PMF**
Sydney Water flood advice	not flooded	not flooded	PMF flood level not provided
Stranger Creek flood modelling	not flooded	not flooded	not flooded
Overland flood modeling	Flood level: 67.6 m AHD Flood Hazard: up to H3 Flow Velocities: below 1 m/s	Flood level: 67.6 m AHD Flood Hazard: up to H3 Flow Velocities: below 1 m/s	Flood level: 67.8 m AHD Flood Hazard: up to H6 Flow Velocities: up to 3.5 m/s

FLOOD IMPACT

6 FLOOD IMPACT

A flood impact assessment has been completed by comparing the baseline and proposed scenarios flood model results.

The flood impact assessment considered the changes in flood levels, flood hazard and flow velocity for the 5%, 1%, 0.5% and 0.2% AEP flood events. The 0.5% and 0.2% AEP flood events are considered as proxies for assessing sensitivity to an increase in rainfall intensity of flood producing rainfall events due to climate change.

The flood impact assessment has been completed for the different sources of flooding that affect the site area (i.e. Creek a and overland flooding).

6.1 CREEK FLOODING

As mentioned in Section 5, the proposed development is not affected by flooding from Strangers Creek up to the PMF event.

Thus, the proposed development is not expected to generate flood impacts related to Creek Flooding.

6.2 OVERLAND FLOODING

This section describes the flood impacts associated with overland flooding.

6.2.1 AFFLUX

The flood model results shows that the proposed development does not generate adverse flood impacts to the adjacent properties up to 0.2% AEP flood events.

Figure 20, Figure 21 and Figure 22 show the afflux maps for the 5%, 1% and 0.2% AEP flood events. High-resolution afflux maps are included in Appendix G.

Increases in flood levels are contained within the site area.

Figure 20 Afflux - 5% AEP - overland flooding

Figure 21 Afflux - 1% AEP - overland flooding

Figure 22 Afflux – 0.2% AEP - overland flooding

6.2.2 CHANGE IN FLOW VELOCITY

The flood model results shows that the proposed development does not generate adverse change in flow velocities to the adjacent properties in the 5%, 1% and 0.2% AEP flood events.

Figure 23, Figure 24 and Figure 25 show the change in flow velocities for the 5%, 1% and 0.2% AEP flood events. High-resolution afflux maps are included in Appendix G.

Change in flow velocities are contained within the site area. These changes are generally minor (below 0.4m/s).

Figure 23 Change in flow velocity - 5% AEP - overland flooding

Figure 24 Change in flow velocity - 1% AEP - overland flooding

Figure 25 Change in flow velocity – 0.2% AEP - overland flooding

6.2.3 CHANGE IN FLOOD HAZARD

The flood model results shows that the proposed development does not generate adverse change in flood hazard to the adjacent properties in the 5%, 1% and 0.2% AEP flood events.

Figure 26, Figure 27 and Figure 28 show the change in flood hazard for the 5%, 1% and 0.2% AEP flood events. High-resolution afflux maps are included in Appendix G.

Figure 26 Change in flood hazard - 5% AEP - overland flooding

Figure 27 Change in flood hazard - 1% AEP - overland flooding

Figure 28 Change in flood hazard – 0.2% AEP - overland flooding

6.2.4 CHANGE IN PEAK FLOW AND TOTAL VOLUME

The change in peak flow has been assessed for each design flood events at the downstream site boundary as indicated in Figure 29.

Figure 29 Peak flow assessment location

Table 6.1 shows the comparison of peak flow between the baseline and proposed scenarios. The peak flow analysis demonstrates that the proposed scenario does not increase the peak flow discharge.

Table 6.1: Peak flow – Baseline and design case scenarios

FLOOD EVENT	BASELINE SCENARIO - PEAK FLOW (M^3/S)	PROPOSED SCENARIO - PEAK FLOW (M^3/S)
5% AEP	3.18	2.92
1% AEP	3.69	3.13
0.5% AEP	4.32	3.55
0.2% AEP	5.16	4.17

The comparison of flow hydrographs demonstrates that there is no increase in the total volume of discharge from the site for the 5%, 1%, 0.5% and 0.2% AEP flood events. The proposed work mitigates the off- site flow discharges. Figure 30 shows the hydrograph comparison.

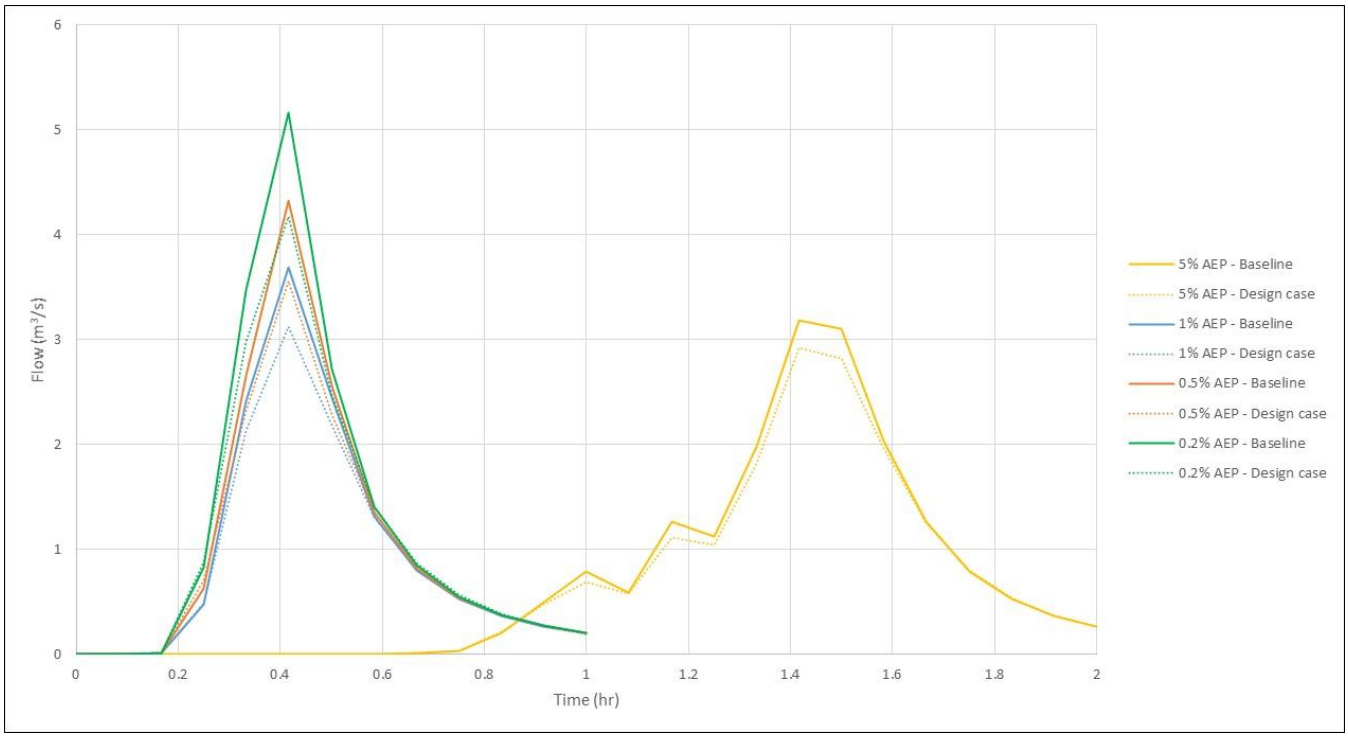

Figure 30 Hydrograph comparison

6.3 SUMMARY

The flood impact assessment demonstrated that the proposed development does not generate adverse flood impact to the adjacent properties.

FLOOD PLANNING LEVEL

7 FLOOD PLANNING LEVELS

This section discusses the flood planning level proposed for the proposed development to ensure protection from flooding.

It is assumed that the flood planning levels required for the proposed development is FPL1 which corresponds to a 5% AEP flood event.

7.1 CREEK FLOODING

As demonstrated in Section 5.2.1 the proposed development is not affected by flooding from Stranger Creek up to and including the PMF flood event.

Lower building level is at 63.6 m AHD which is above the peak PMF flood level which is 61.4 m AHD.

7.2 OVERLAND FLOODING

As discussed in Section 5.2.2 overland flooding might affect the proposed development.

Peak overland flooding near the Community Facilities building for the 1% AEP and PMF flood event are 67.6 m AHD and 67.8 m AHD as shown in Figure 31 and Figure 32. The minimum building finished floor level is at 67.65 m AHD which is above the 1% AEP flood level.

Peak overland flooding near the Centre of Excellence building for the 1% AEP and PMF flood are 67.6 m AHD and 67.8 m AHD as shown in Figure 31 and Figure 32. The building finished floor level is at 67.6 m AHD which is above the 1% AEP flood level.

Flood planning levels for the proposed building are above the requirements of the flood planning level FPL1.

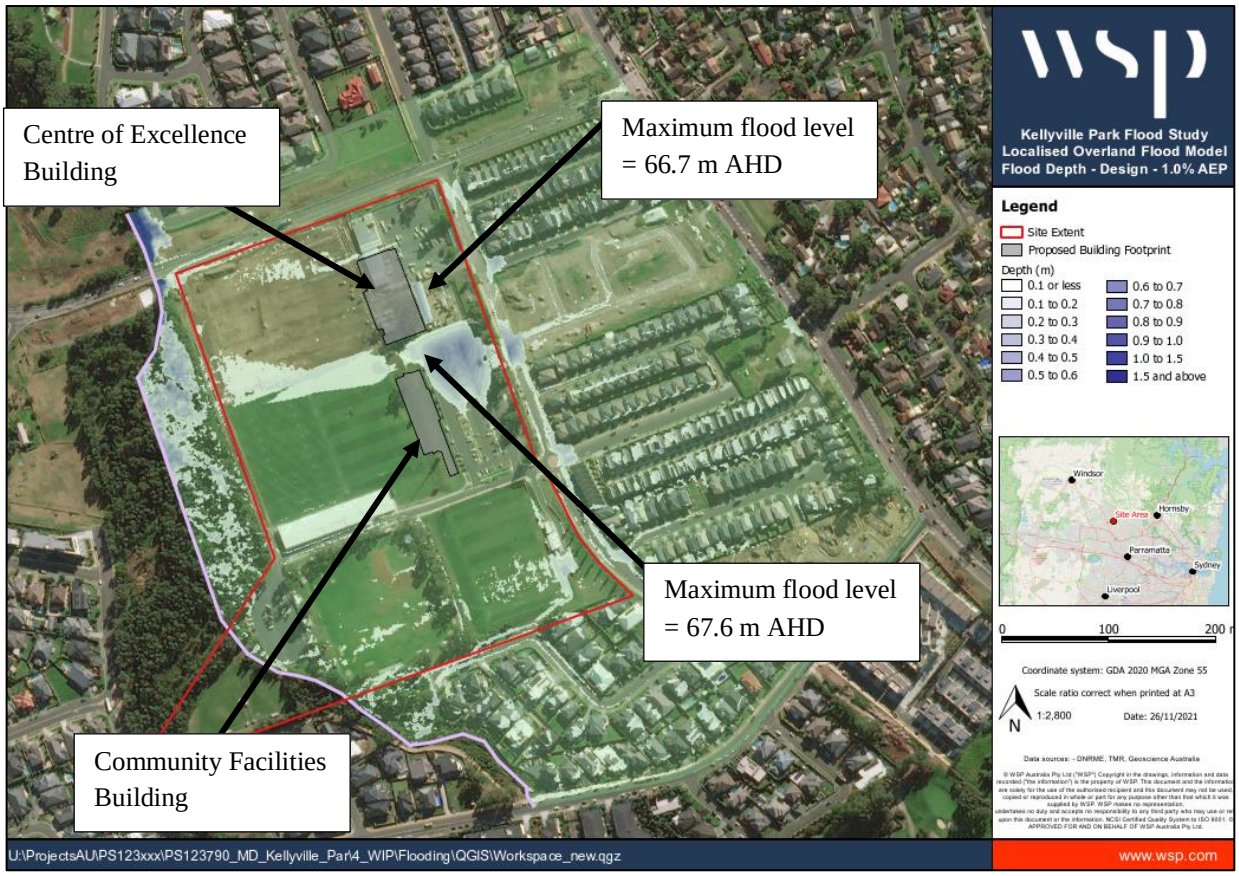

Figure 31: Overland flood model - flood depth - 1% AEP

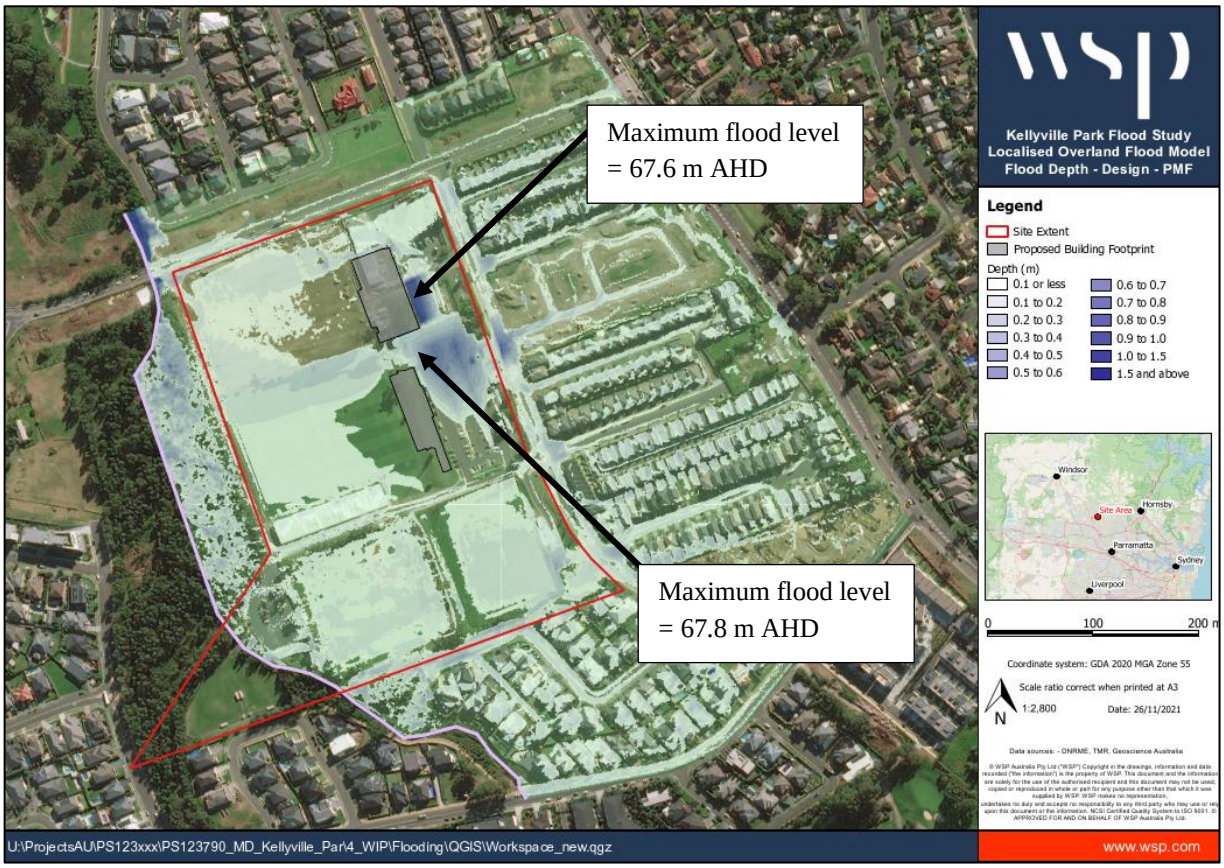

Figure 32: Overland flood model - flood depth – PMF event

FLOOD COMPATIBLE MATERIAL

8 FLOOD COMPATIBLE MATERIAL

As discussed in the previous sections the proposed development is not affected by creek flooding up to and including the PMF flood event.

Overland flow velocities up to 3.5 m/s are expected in the PMF flood event. Flood compatible material would need to be considered to eliminate the risk of flood damage from overland flooding. Details on flood compatible material will be provided in the structure report.

CONCLUSIONS

9 CONCLUSIONS

This flood assessment has been prepared to support the Eels Centre of Excellence and Community Sports Hub development planning approval.

Sydney Water flood advice obtained in March 2021 confirmed that the site is not affected by flooding up to and including the 1% AEP flood event. Sydney Water flood map shows that the peak flood level touches the east boundary of the site with peak flood level between 57.8 and 58.2 m AHD.

WSP obtained and updated Sydney Water flood model with the inclusion of latest topography data and model schematization that reflected the changes in the catchment development. Additional flood modelling was required to assess the flood conditions in the PMF flood event that was not included in Sydney Water flood advice.

Sydney Water was consulted by WSP in November 2021 to present the hydraulic model methodology adopted to assess the flood risk at the site and surrounding areas. Sydney Water flood engineer agreed in principle that the methodology adopted by WSP appears appropriate.

FLOOD RISK

The hydraulic modelling investigation confirmed that the proposed development is not affected by Creek flooding up to and including the PMF flood event.

A site-specific hydraulic model was developed by WSP to represent the overland flow mechanisms which were not included in the Sydney Water flood model. Overland flood conditions were assessed at the site for the 5%, 1% AEP and PMF flood events. Model results show that:

- In the 5% AEP the flood depth within the site is up to 700mm and the flow velocity is generally below 1m/s. The flood hazard at the site is in general up to hazard category H2 (Unsafe for small vehicles). There are a few localised minor areas where the flood hazard category can be up to H3 (Unsafe for all vehicles, children and the elderly).
- In the 1% AEP the flood depth within the site is up to 780mm and the flow velocity is generally below 1m/s. The flood hazard at the site is in general up to hazard category H2. There are a few localised minor areas where the flood hazard category can be up to H3.
- In the PMF flood event the flood depth within the site is up to 900mm and the flow velocity is up to 3.5m/s. The flood hazard at the site is in general up to hazard category H3. There are a few localised minor areas where the flood hazard category can be up to H6.

As the proposed development is not affected by Creek flooding up to and including the PMF flood event flood risk from Creek flooding is not considered to endanger occupants of the building.

A flood emergency management plan will need to be prepared before occupation of the building.

FLOOD IMPACT

A flood impact assessment was undertaken to assess the change in flood conditions caused by the proposed development to the adjacent areas. The flood impact assessment considered the changes in flood levels, flood hazard and flow velocity for the 5%, 1%, 0.5% and 0.2% AEP flood events.

The flood impacts assessment demonstrated that the proposed development does not exacerbate the flood conditions up to and including the 0.2% AEP flood event.

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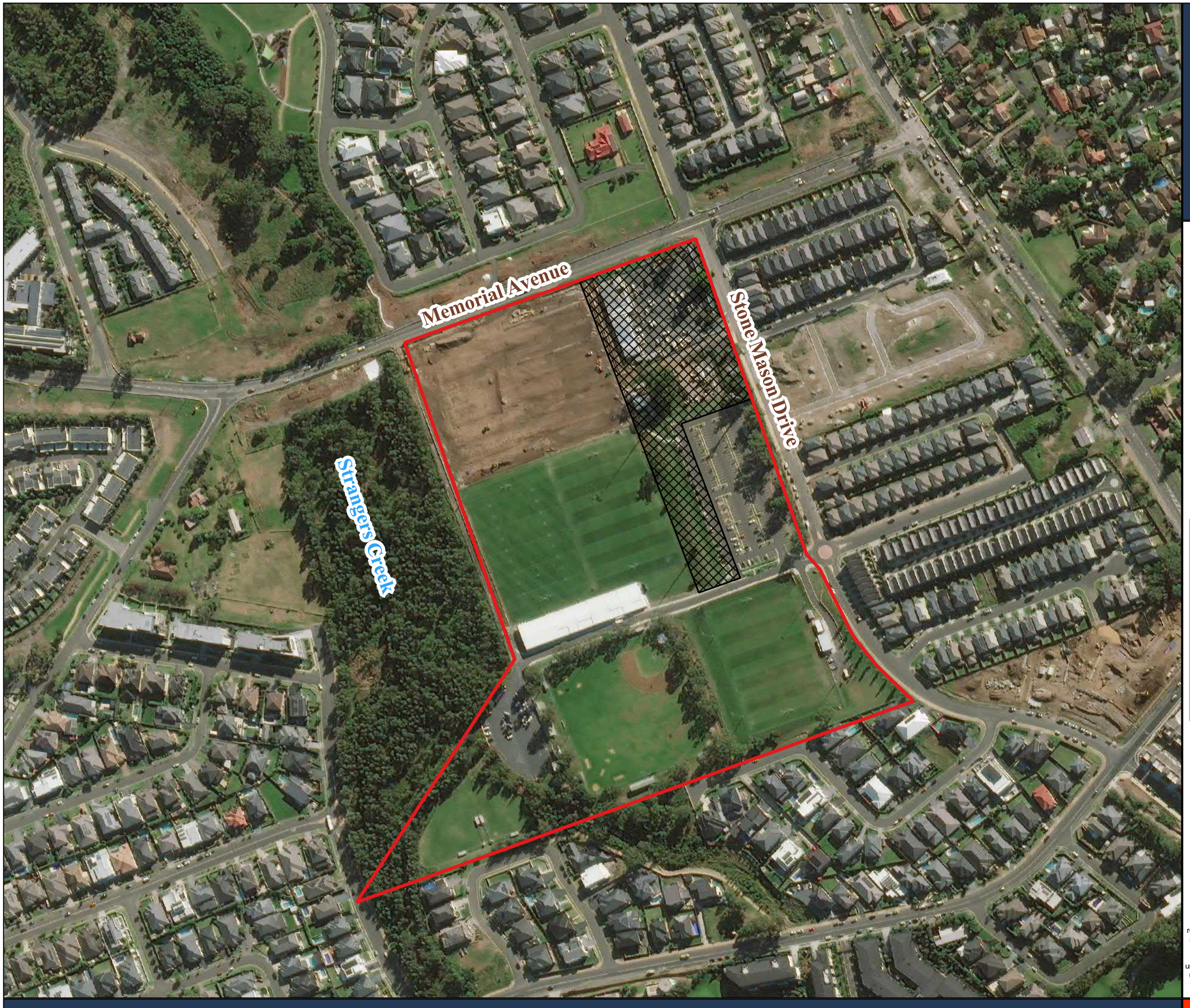
APPENDIX A



Kellyville Park Flood Study
Site Locality

Legend

- Site Extent
- Location of Proposed Works

0 100 200 m

Coordinate system: GDA 2020 MGA Zone 55

Scale ratio correct when printed at A3

1:3,000

N

Date: 26/11/2021

Data sources: - DNRME, TMR, Geoscience Australia

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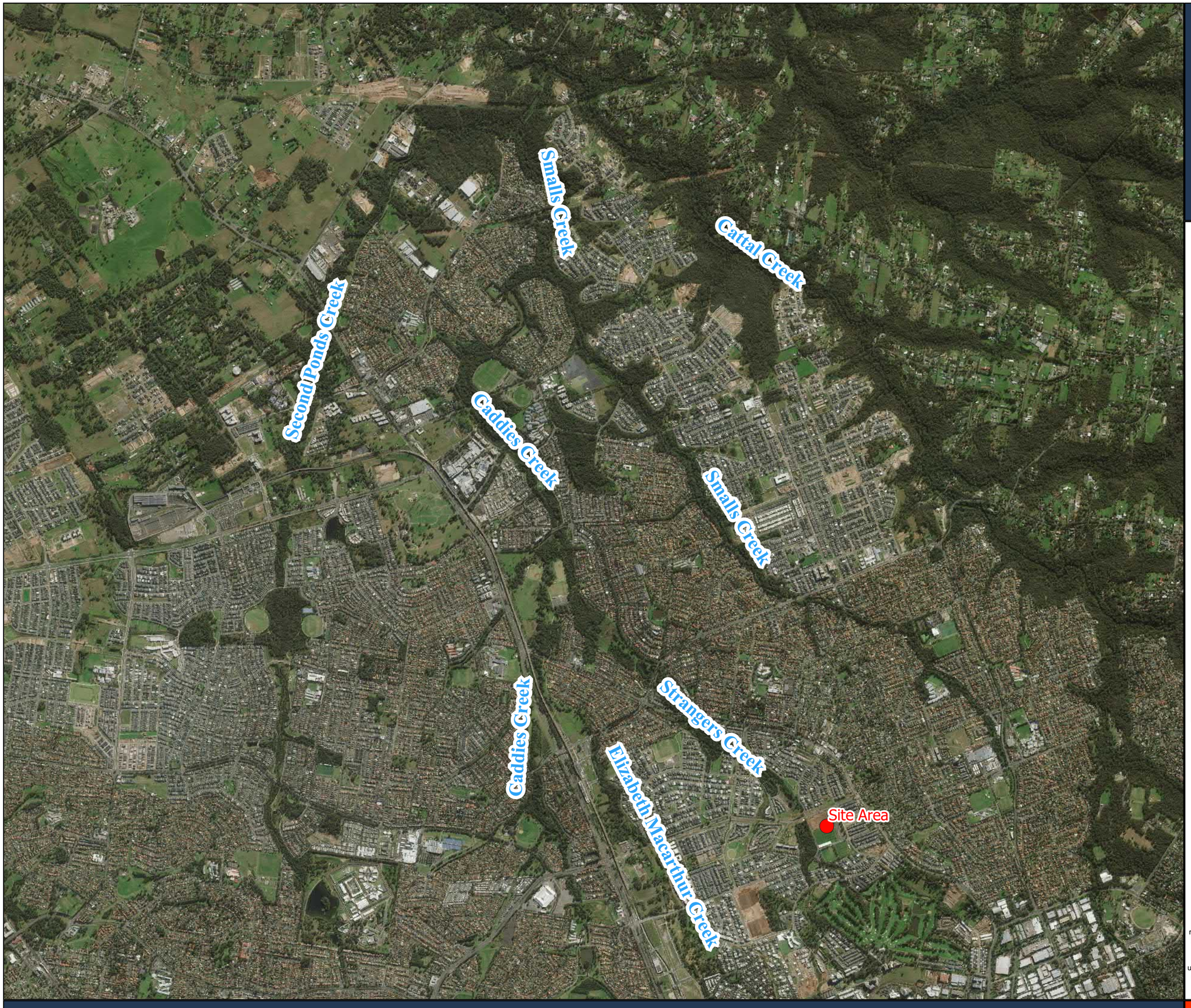
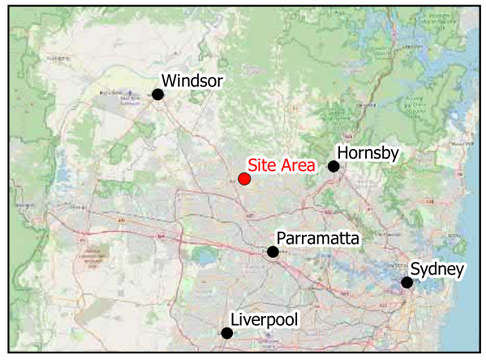


Kellyville Park Flood Study
Existing Waterbody

Legend

- Site Area



0 1 2 km

Coordinate system: GDA 2020 MGA Zone 55

Scale ratio correct when printed at A3

1:30,000

Date: 29/11/2021

N

Data sources: - DNRME, TMR, Geoscience Australia

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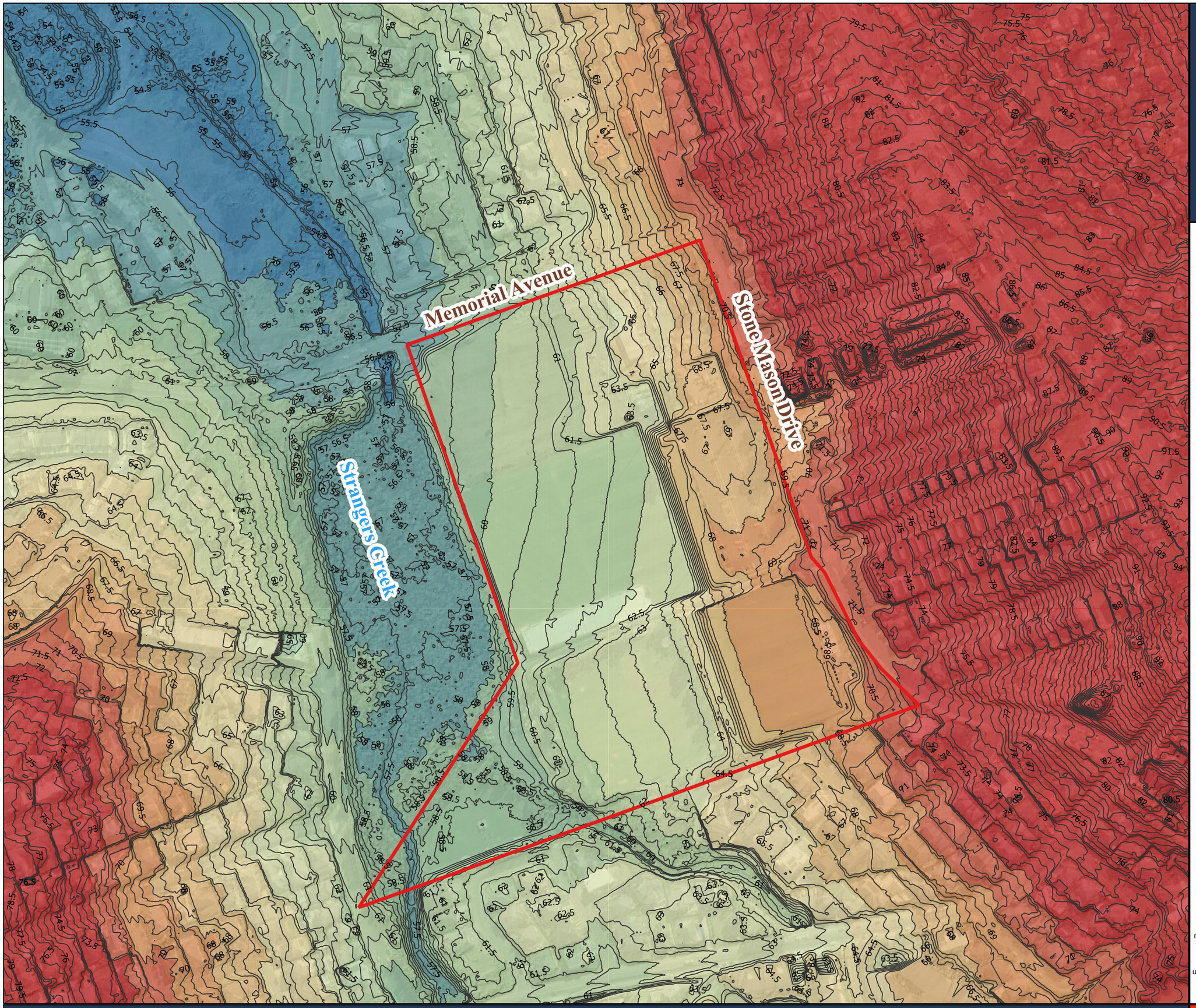
APPENDIX B



Kellyville Park Flood Study
Site Topography

Legend

- Site Extent
- Level Contours (0.5m Interval)

Elevation (m AHD)

- <= 56
- 56 - 58
- 58 - 60
- 60 - 62
- 62 - 64
- 64 - 66
- 66 - 68
- 68 - 70
- 70 - 72
- > 72

0 100 200 m

Coordinate system: GDA 2020 MGA Zone 55

Scale ratio correct when printed at A3

N

1:3,000

Date: 29/11/2021

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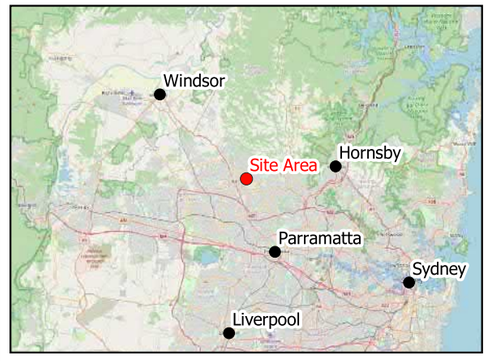
APPENDIX C

Kellyville Park Flood Study
Catchment Delineation

Legend

- Site Extent
- Drainage Path
- Contributing Catchment
- Other Catchment



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Coordinate system: GDA 2020 MGA Zone 55

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Scale ratio correct when printed at A3

1:6,000

Date: 02/12/2021

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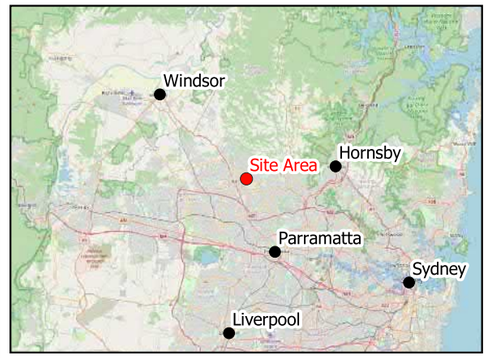
APPENDIX D

Kellyville Park Flood Study
Model Schematization

Legend

- Site Extent
- Model Extent
- Direct rainfall polygon
- Downstream boundary condition (HT)
- Building footprint (proposed case)



0 100 200 m

Coordinate system: GDA 2020 MGA Zone 55

Scale ratio correct when printed at A3

N

1:2,800

Date: 26/11/2021

Data sources: - DNRME, TMR, Geoscience Australia

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APPENDIX E

Kellyville Park Flood Study
Rouse Hill Flood Model
Flood Depth - 1% AEP

Legend

- Site Extent
- Location of Proposed Works
- Level Contours

Depth (m)

0.1 or less	0.6 to 0.7
0.1 to 0.2	0.7 to 0.8
0.2 to 0.3	0.8 to 0.9
0.3 to 0.4	0.9 to 1.0
0.4 to 0.5	1.0 to 1.5
0.5 to 0.6	1.5 and above

0 100 200 m

Coordinate system: GDA 2020 MGA Zone 55

Scale ratio correct when printed at A3

1:2,800

N

Date: 30/11/2021

Data sources: - DNRME, TMR, Geoscience Australia

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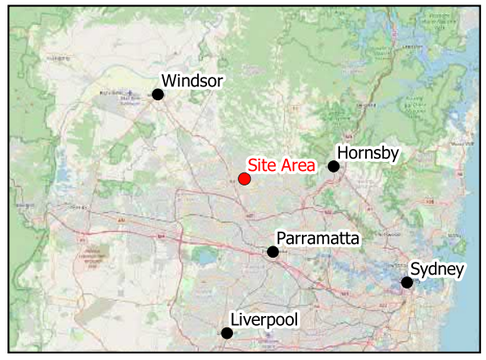
Kellyville Park Flood Study
Rouse Hill Flood Model
Flood Depth - PMF

Legend

- Site Extent
- Location of Proposed Works
- Level Contours

Depth (m)

0.1 or less	0.6 to 0.7
0.1 to 0.2	0.7 to 0.8
0.2 to 0.3	0.8 to 0.9
0.3 to 0.4	0.9 to 1.0
0.4 to 0.5	1.0 to 1.5
0.5 to 0.6	1.5 and above



0 100 200 m

Coordinate system: GDA 2020 MGA Zone 55

Scale ratio correct when printed at A3

1:5,000

Date: 26/11/2021

N

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APPENDIX F

Kellyville Park Flood Study
Localised Overland Flood Model
Flood Depth - Baseline - 5.0% AEP

Legend

Site Extent

Depth (m)

- 0.1 or less
- 0.1 to 0.2
- 0.2 to 0.3
- 0.3 to 0.4
- 0.4 to 0.5
- 0.5 to 0.6
- 0.6 to 0.7
- 0.7 to 0.8
- 0.8 to 0.9
- 0.9 to 1.0
- 1.0 to 1.5
- 1.5 and above

0 100 200 m

Coordinate system: GDA 2020 MGA Zone 55

Scale ratio correct when printed at A3

N

1:2,800

Date: 26/11/2021

Data sources: - DNRME, TMR, Geoscience Australia

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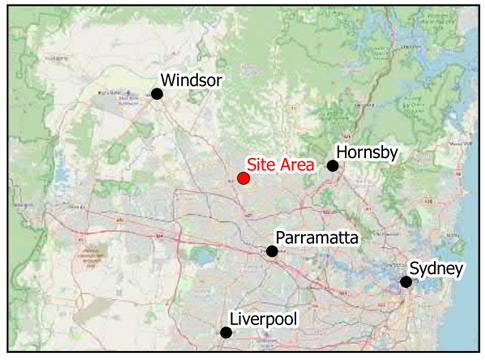
Kellyville Park Flood Study
Localised Overland Flood Model
Flood Depth - Baseline - 1.0% AEP

Legend

Site Extent

Depth (m)

- 0.1 or less
- 0.1 to 0.2
- 0.2 to 0.3
- 0.3 to 0.4
- 0.4 to 0.5
- 0.5 to 0.6
- 0.6 to 0.7
- 0.7 to 0.8
- 0.8 to 0.9
- 0.9 to 1.0
- 1.0 to 1.5
- 1.5 and above



0 100 200 m

Coordinate system: GDA 2020 MGA Zone 55

N

Scale ratio correct when printed at A3

1:2,800

Date: 26/11/2021

Data sources: - DNRME, TMR, Geoscience Australia

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Kellyville Park Flood Study
Localised Overland Flood Model
Flood Depth - Baseline - 0.5% AEP

Legend

Site Extent

Depth (m)

- 0.1 or less
- 0.1 to 0.2
- 0.2 to 0.3
- 0.3 to 0.4
- 0.4 to 0.5
- 0.5 to 0.6
- 0.6 to 0.7
- 0.7 to 0.8
- 0.8 to 0.9
- 0.9 to 1.0
- 1.0 to 1.5
- 1.5 and above

0 100 200 m

Coordinate system: GDA 2020 MGA Zone 55

Scale ratio correct when printed at A3

1:2,800

Date: 26/11/2021

N

Data sources: - DNRME, TMR, Geoscience Australia

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Kellyville Park Flood Study
Localised Overland Flood Model
Flood Depth - Baseline - 0.2% AEP

Legend

Site Extent

Depth (m)

- 0.1 or less
- 0.1 to 0.2
- 0.2 to 0.3
- 0.3 to 0.4
- 0.4 to 0.5
- 0.5 to 0.6
- 0.6 to 0.7
- 0.7 to 0.8
- 0.8 to 0.9
- 0.9 to 1.0
- 1.0 to 1.5
- 1.5 and above

0 100 200 m

Coordinate system: GDA 2020 MGA Zone 55

Scale ratio correct when printed at A3

N

1:2,800

Date: 26/11/2021

Data sources: - DNRME, TMR, Geoscience Australia

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Kellyville Park Flood Study
Localised Overland Flood Model
Flood Depth - Baseline - PMF

Legend

Site Extent

Depth (m)

- 0.1 or less
- 0.1 to 0.2
- 0.2 to 0.3
- 0.3 to 0.4
- 0.4 to 0.5
- 0.5 to 0.6
- 0.6 to 0.7
- 0.7 to 0.8
- 0.8 to 0.9
- 0.9 to 1.0
- 1.0 to 1.5
- 1.5 and above

0 100 200 m

Coordinate system: GDA 2020 MGA Zone 55

N

Scale ratio correct when printed at A3

1:2,800

Date: 26/11/2021

Data sources: - DNRME, TMR, Geoscience Australia

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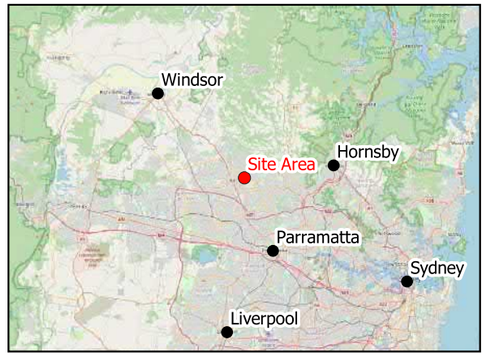
Kellyville Park Flood Study
Localised Overland Flood Model
Flood Depth - Design - 5.0% AEP

Legend

- Site Extent
- Proposed Building Footprint

Depth (m)

- 0.1 or less
- 0.1 to 0.2
- 0.2 to 0.3
- 0.3 to 0.4
- 0.4 to 0.5
- 0.5 to 0.6
- 0.6 to 0.7
- 0.7 to 0.8
- 0.8 to 0.9
- 0.9 to 1.0
- 1.0 to 1.5
- 1.5 and above



0 100 200 m

Coordinate system: GDA 2020 MGA Zone 55

N

Scale ratio correct when printed at A3

1:2,800

Date: 26/11/2021

Data sources: - DNRME, TMR, Geoscience Australia

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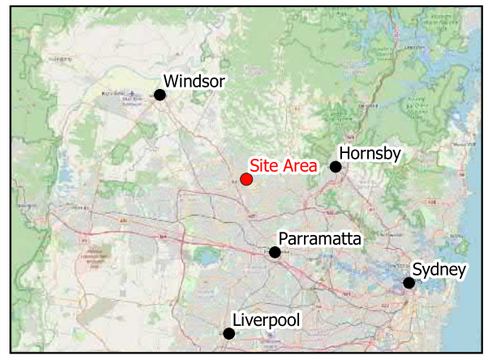
Kellyville Park Flood Study
Localised Overland Flood Model
Flood Depth - Design - 1.0% AEP

Legend

- Site Extent
- Proposed Building Footprint

Depth (m)

- 0.1 or less
- 0.1 to 0.2
- 0.2 to 0.3
- 0.3 to 0.4
- 0.4 to 0.5
- 0.5 to 0.6
- 0.6 to 0.7
- 0.7 to 0.8
- 0.8 to 0.9
- 0.9 to 1.0
- 1.0 to 1.5
- 1.5 and above



0 100 200 m

Coordinate system: GDA 2020 MGA Zone 55

N

Scale ratio correct when printed at A3

1:2,800

Date: 26/11/2021

Data sources: - DNRME, TMR, Geoscience Australia

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Kellyville Park Flood Study
Localised Overland Flood Model
Flood Depth - Design - 0.5% AEP

Legend

- Site Extent
- Proposed Building Footprint

Depth (m)

0.1 or less	0.6 to 0.7
0.1 to 0.2	0.7 to 0.8
0.2 to 0.3	0.8 to 0.9
0.3 to 0.4	0.9 to 1.0
0.4 to 0.5	1.0 to 1.5
0.5 to 0.6	1.5 and above

0 100 200 m

Coordinate system: GDA 2020 MGA Zone 55

N

Scale ratio correct when printed at A3

1:2,800

Date: 26/11/2021

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Kellyville Park Flood Study
Localised Overland Flood Model
Flood Depth - Design - 0.2% AEP

Legend

- Site Extent
- Proposed Building Footprint

Depth (m)

- 0.1 or less
- 0.1 to 0.2
- 0.2 to 0.3
- 0.3 to 0.4
- 0.4 to 0.5
- 0.5 to 0.6
- 0.6 to 0.7
- 0.7 to 0.8
- 0.8 to 0.9
- 0.9 to 1.0
- 1.0 to 1.5
- 1.5 and above

0 100 200 m

Coordinate system: GDA 2020 MGA Zone 55

N

Scale ratio correct when printed at A3

1:2,800

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Kellyville Park Flood Study
Localised Overland Flood Model
Flood Depth - Design - PMF

Legend

- Site Extent
- Proposed Building Footprint

Depth (m)

0.1 or less	0.6 to 0.7
0.1 to 0.2	0.7 to 0.8
0.2 to 0.3	0.8 to 0.9
0.3 to 0.4	0.9 to 1.0
0.4 to 0.5	1.0 to 1.5
0.5 to 0.6	1.5 and above

0 100 200 m

Coordinate system: GDA 2020 MGA Zone 55

Scale ratio correct when printed at A3

N

1:2,800

Date: 26/11/2021

Data sources: - DNRME, TMR, Geoscience Australia

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Kellyville Park Flood Study
Localised Overland Flood Model
Flow Velocity - Baseline - 5.0% AEP

Legend

Site Extent

Flow Velocity (m/s)

- 0.5 m/s and less
- 0.5 to 1 m/s
- 1 to 1.5 m/s
- 1.5 to 2 m/s
- 2 to 2.5 m/s
- Above 2.5 m/s

0 100 200 m

Coordinate system: GDA 2020 MGA Zone 55

N

Scale ratio correct when printed at A3

1:2,800

Date: 26/11/2021

Data sources: - DNRME, TMR, Geoscience Australia

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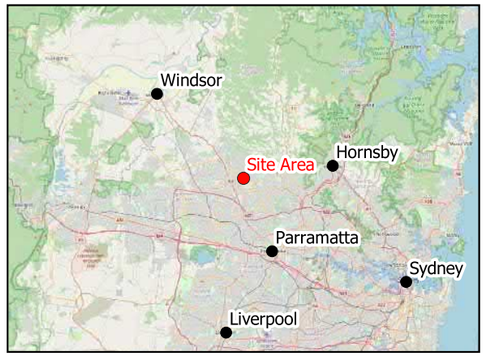
Kellyville Park Flood Study
Localised Overland Flood Model
Flow Velocity - Baseline - 1.0% AEP

Legend

- Site Extent

Flow Velocity (m/s)

- 0.5 m/s and less
- 0.5 to 1 m/s
- 1 to 1.5 m/s
- 1.5 to 2 m/s
- 2 to 2.5 m/s
- Above 2.5 m/s



0 100 200 m

Coordinate system: GDA 2020 MGA Zone 55

N

Scale ratio correct when printed at A3

1:2,800

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Kellyville Park Flood Study
Localised Overland Flood Model
Flow Velocity - Baseline - 0.5% AEP

Legend

- Site Extent

Flow Velocity (m/s)

- 0.5 m/s and less
- 0.5 to 1 m/s
- 1 to 1.5 m/s
- 1.5 to 2 m/s
- 2 to 2.5 m/s
- Above 2.5 m/s

0 100 200 m

Coordinate system: GDA 2020 MGA Zone 55

Scale ratio correct when printed at A3

1:2,800

Date: 26/11/2021

N

Data sources: - DNRME, TMR, Geoscience Australia

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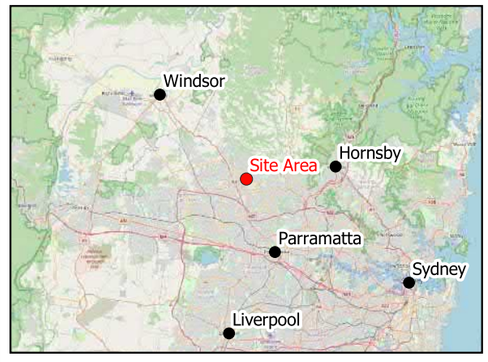
Kellyville Park Flood Study
Localised Overland Flood Model
Flow Velocity - Baseline - 0.2% AEP

Legend

- Site Extent

Flow Velocity (m/s)

- 0.5 m/s and less
- 0.5 to 1 m/s
- 1 to 1.5 m/s
- 1.5 to 2 m/s
- 2 to 2.5 m/s
- Above 2.5 m/s



0 100 200 m

Coordinate system: GDA 2020 MGA Zone 55

Scale ratio correct when printed at A3

N

1:2,800

Date: 26/11/2021

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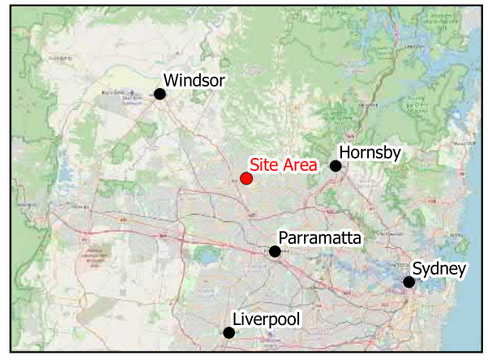
Kellyville Park Flood Study
Localised Overland Flood Model
Flow Velocity - Baseline - PMF

Legend

- Site Extent

Flow Velocity (m/s)

- 0.5 m/s and less
- 0.5 to 1 m/s
- 1 to 1.5 m/s
- 1.5 to 2 m/s
- 2 to 2.5 m/s
- Above 2.5 m/s



0 100 200 m

Coordinate system: GDA 2020 MGA Zone 55

N

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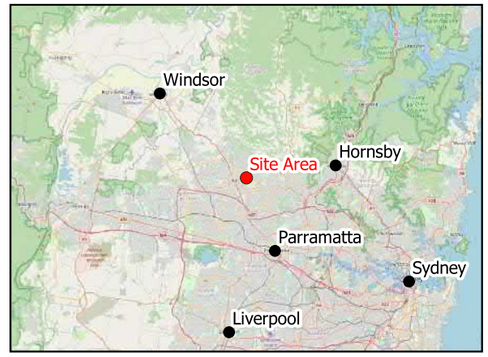
Kellyville Park Flood Study
Localised Overland Flood Model
Flow Velocity - Design - 5.0% AEP

Legend

- Site Extent
- Proposed Building Footprint

Flow Velocity (m/s)

- 0.5 m/s and less
- 0.5 to 1 m/s
- 1 to 1.5 m/s
- 1.5 to 2 m/s
- 2 to 2.5 m/s
- Above 2.5 m/s



0 100 200 m

Coordinate system: GDA 2020 MGA Zone 55

Scale ratio correct when printed at A3

1:2,800

N

Date: 26/11/2021

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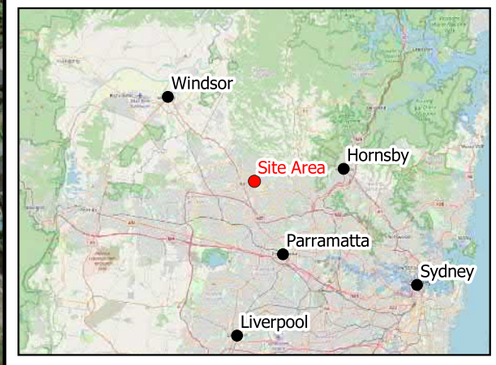
Kellyville Park Flood Study
Localised Overland Flood Model
Flow Velocity - Design - 1.0% AEP

Legend

- Site Extent
- Proposed Building Footprint

Flow Velocity (m/s)

- 0.5 m/s and less
- 0.5 to 1 m/s
- 1 to 1.5 m/s
- 1.5 to 2 m/s
- 2 to 2.5 m/s
- Above 2.5 m/s



0 100 200 m

Coordinate system: GDA 2020 MGA Zone 55

N

Scale ratio correct when printed at A3

1:2,800

Date: 26/11/2021

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Kellyville Park Flood Study
Localised Overland Flood Model
Flow Velocity - Design - 0.5% AEP

Legend

- Site Extent
- Proposed Building Footprint

Flow Velocity (m/s)

- 0.5 m/s and less
- 0.5 to 1 m/s
- 1 to 1.5 m/s
- 1.5 to 2 m/s
- 2 to 2.5 m/s
- Above 2.5 m/s

0 100 200 m

Coordinate system: GDA 2020 MGA Zone 55

Scale ratio correct when printed at A3

1:2,800

N

Date: 26/11/2021

Data sources: - DNRME, TMR, Geoscience Australia

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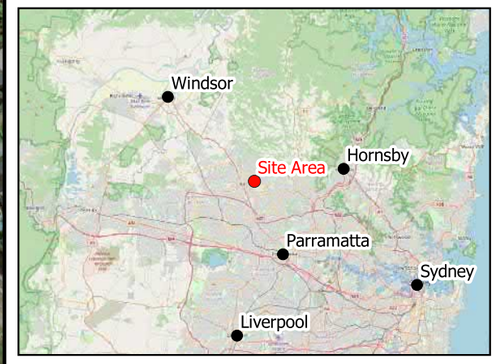
Kellyville Park Flood Study
Localised Overland Flood Model
Flow Velocity - Design - 0.2% AEP

Legend

- Site Extent
- Proposed Building Footprint

Flow Velocity (m/s)

- 0.5 m/s and less
- 0.5 to 1 m/s
- 1 to 1.5 m/s
- 1.5 to 2 m/s
- 2 to 2.5 m/s
- Above 2.5 m/s



0 100 200 m

Coordinate system: GDA 2020 MGA Zone 55

N

Scale ratio correct when printed at A3

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Kellyville Park Flood Study
Localised Overland Flood Model
Flow Velocity - Design - PMF

Legend

- Site Extent
- Proposed Building Footprint

Flow Velocity (m/s)

- 0.5 m/s and less
- 0.5 to 1 m/s
- 1 to 1.5 m/s
- 1.5 to 2 m/s
- 2 to 2.5 m/s
- Above 2.5 m/s

0 100 200 m

Coordinate system: GDA 2020 MGA Zone 55

N

Scale ratio correct when printed at A3

1:2,800

Date: 26/11/2021

Data sources: - DNRME, TMR, Geoscience Australia

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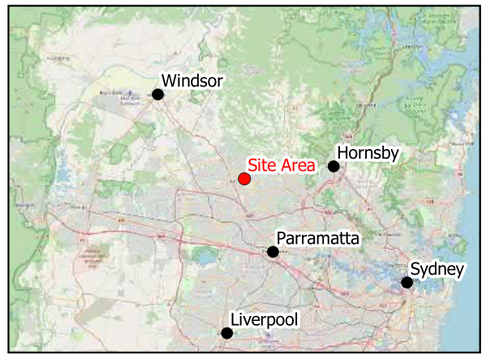
Kellyville Park Flood Study
Localised Overland Flood Model
Flood Hazard - Baseline - 5.0% AEP

Legend

Site Extent

Flood Hazard Category

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



0 100 200 m

Coordinate system: GDA 2020 MGA Zone 55

Scale ratio correct when printed at A3

1:2,800

Date: 26/11/2021

N

- H1 - Relatively benign flow conditions. No vulnerability constraints.
- H2 - Unsafe for small vehicles.
- H3 - Unsafe for all vehicles, children and the elderly.
- H4 - Unsafe for all people and vehicles.
- H5 - Unsafe for all people and all vehicles. Buildings require special engineering design and construction.
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Data sources: - DNRME, TMR, Geoscience Australia

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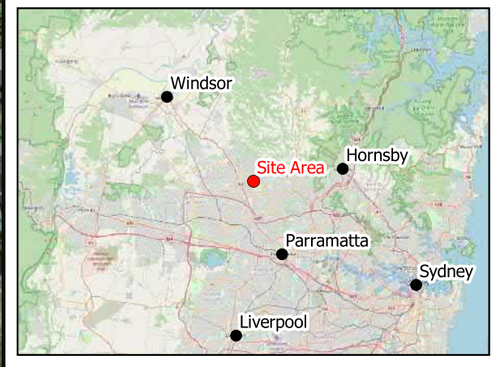
Kellyville Park Flood Study
Localised Overland Flood Model
Flood Hazard - Baseline - 1.0% AEP

Legend

Site Extent

Flood Hazard Category

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



0 100 200 m

Coordinate system: GDA 2020 MGA Zone 55

Scale ratio correct when printed at A3

1:2,800

Date: 26/11/2021

N

- H1 - Relatively benign flow conditions. No vulnerability constraints.
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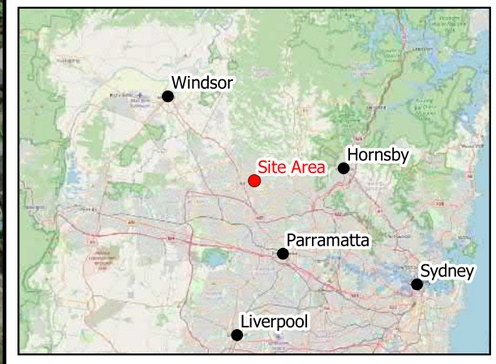
Kellyville Park Flood Study
Localised Overland Flood Model
Flood Hazard - Baseline - 0.5% AEP

Legend

- Site Extent

Flood Hazard Category

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



0 100 200 m

Coordinate system: GDA 2020 MGA Zone 55

Scale ratio correct when printed at A3

1:2,800

Date: 26/11/2021

N

- H1 - Relatively benign flow conditions. No vulnerability constraints.
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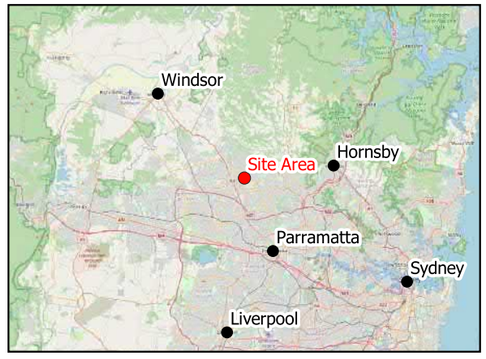
Kellyville Park Flood Study
Localised Overland Flood Model
Flood Hazard - Baseline - 0.2% AEP

Legend

Site Extent

Flood Hazard Category

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



0 100 200 m

Coordinate system: GDA 2020 MGA Zone 55

N

Scale ratio correct when printed at A3

1:2,800

Date: 26/11/2021

- H1 - Relatively benign flow conditions. No vulnerability constraints.
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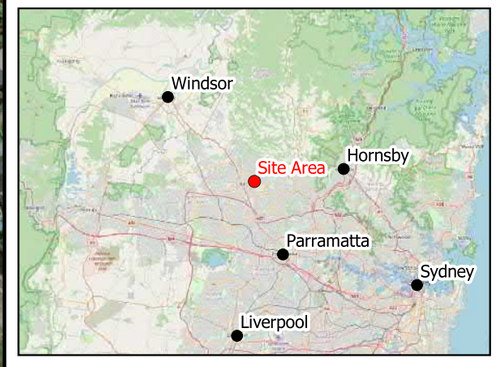
Kellyville Park Flood Study
Localised Overland Flood Model
Flood Hazard - Baseline - PMF

Legend

Site Extent

Flood Hazard Category

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



0 100 200 m

Coordinate system: GDA 2020 MGA Zone 55

N

Scale ratio correct when printed at A3

1:2,800

Date: 26/11/2021

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Kellyville Park Flood Study
Localised Overland Flood Model
Flood Hazard - Design - 5.0% AEP

Legend

- Site Extent
- Proposed Building Footprint

Flood Hazard Category

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

0 100 200 m

Coordinate system: GDA 2020 MGA Zone 55

N

Scale ratio correct when printed at A3

1:2,800

Date: 26/11/2021

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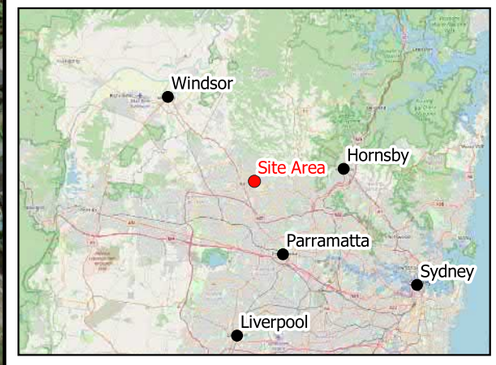
Kellyville Park Flood Study
Localised Overland Flood Model
Flood Hazard - Design - 1.0% AEP

Legend

- Site Extent
- Proposed Building Footprint

Flood Hazard Category

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



0 100 200 m

Coordinate system: GDA 2020 MGA Zone 55

N

Scale ratio correct when printed at A3

1:2,800

Date: 26/11/2021

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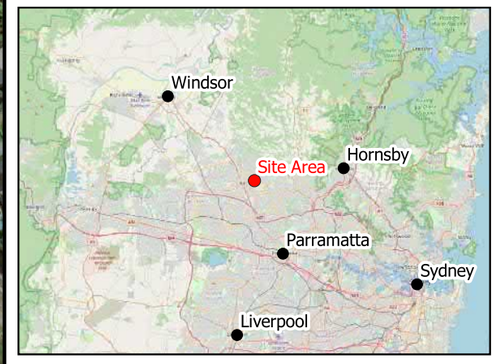
Kellyville Park Flood Study
Localised Overland Flood Model
Flood Hazard - Design - 0.5% AEP

Legend

- Site Extent
- Proposed Building Footprint

Flood Hazard Category

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



0 100 200 m

Coordinate system: GDA 2020 MGA Zone 55

N

Scale ratio correct when printed at A3

1:2,800

Date: 26/11/2021

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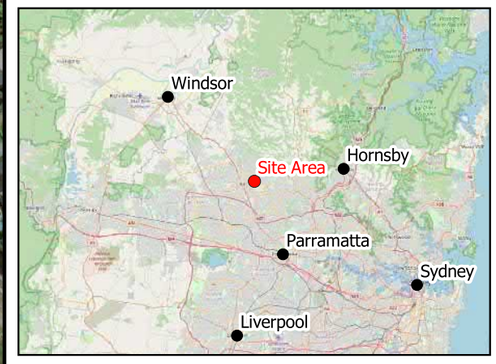
Kellyville Park Flood Study
Localised Overland Flood Model
Flood Hazard - Design - 0.2% AEP

Legend

- Site Extent
- Proposed Building Footprint

Flood Hazard Category

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



0 100 200 m

Coordinate system: GDA 2020 MGA Zone 55

N

Scale ratio correct when printed at A3

1:2,800

Date: 26/11/2021

Data sources: - DNRME, TMR, Geoscience Australia

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- H4 - Unsafe for all people and vehicles.
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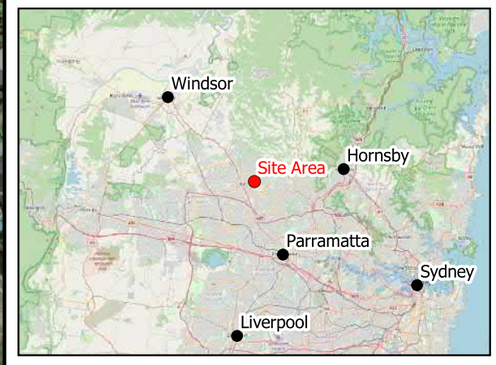
Kellyville Park Flood Study
Localised Overland Flood Model
Flood Hazard - Design - PMF

Legend

- Site Extent
- Proposed Building Footprint

Flood Hazard Category

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



0 100 200 m

Coordinate system: GDA 2020 MGA Zone 55

N

Scale ratio correct when printed at A3

1:2,800

Date: 26/11/2021

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APPENDIX G

Kellyville Park Flood Study
Localised Overland Flood Model
Change in Flood Level - 5.0% AEP

Legend

- Site Extent
- Model Extent
- Proposed Building Footprint
- Boundary Condition (HT)

Change in Flood Level (mm)

- Newly Dry
- < -20 mm
- -20 to -10 mm
- -10 to 10 mm
- 10 to 20 mm
- 20 to 30 mm
- 30 to 50 mm
- 50 to 100 mm
- 100 to 200 mm
- > 200 mm
- Newly Wet

0 100 200 m

Coordinate system: GDA 2020 MGA Zone 55

N

Scale ratio correct when printed at A3

1:2,800

Date: 26/11/2021

Data sources: - DNRME, TMR, Geoscience Australia

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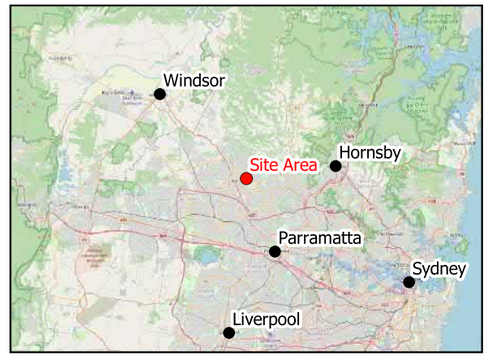
Kellyville Park Flood Study
Localised Overland Flood Model
Change in Flood Level - 1.0% AEP

Legend

- Site Extent
- Model Extent
- Proposed Building Footprint
- Boundary Condition (HT)

Change in Flood Level (mm)

- Newly Dry
- < -20 mm
- -20 to -10 mm
- -10 to 10 mm
- 10 to 20 mm
- 20 to 30 mm
- 30 to 50 mm
- 50 to 100 mm
- 100 to 200 mm
- > 200 mm
- Newly Wet



0 100 200 m

Coordinate system: GDA 2020 MGA Zone 55

N

Scale ratio correct when printed at A3

1:2,800

Date: 26/11/2021

Data sources: - DNRME, TMR, Geoscience Australia

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Kellyville Park Flood Study
Localised Overland Flood Model
Change in Flood Level - 0.5% AEP

Legend

- Site Extent
- Model Extent
- Proposed Building Footprint
- Boundary Condition (HT)

Change in Flood Level (mm)

- Newly Dry
- < -20 mm
- -20 to -10 mm
- -10 to 10 mm
- 10 to 20 mm
- 20 to 30 mm
- 30 to 50 mm
- 50 to 100 mm
- 100 to 200 mm
- > 200 mm
- Newly Wet

0 100 200 m

Coordinate system: GDA 2020 MGA Zone 55

N

Scale ratio correct when printed at A3

1:2,800

Date: 26/11/2021

Data sources: - DNRME, TMR, Geoscience Australia

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Kellyville Park Flood Study
Localised Overland Flood Model
Change in Flood Level - 0.2% AEP

Legend

- Site Extent
- Model Extent
- Proposed Building Footprint
- Boundary Condition (HT)

Change in Flood Level (mm)

- Newly Dry
- < -20 mm
- -20 to -10 mm
- -10 to 10 mm
- 10 to 20 mm
- 20 to 30 mm
- 30 to 50 mm
- 50 to 100 mm
- 100 to 200 mm
- > 200 mm
- Newly Wet

0 100 200 m

Coordinate system: GDA 2020 MGA Zone 55

N

Scale ratio correct when printed at A3

1:2,800

Date: 26/11/2021

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Kellyville Park Flood Study
Localised Overland Flood Model
Change in Flow Velocity - 5.0% AEP

Legend

- Site Extent
- Model Extent
- Proposed Building Footprint
- Boundary Condition (HT)

Change in Flow Velocity (m/s)

- <= -0.4
- -0.4 to -0.2
- -0.2 to -0.1
- -0.1 to 0.1
- 0.1 to 0.2
- 0.2 to 0.4
- > 0.4

0 100 200 m

Coordinate system: GDA 2020 MGA Zone 55

N

Scale ratio correct when printed at A3

1:2,800

Date: 26/11/2021

Data sources: - DNRME, TMR, Geoscience Australia

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Kellyville Park Flood Study
Localised Overland Flood Model
Change in Flow Velocity - 1.0% AEP

Legend

- Site Extent
- Model Extent
- Proposed Building Footprint
- Boundary Condition (HT)

Change in Flow Velocity (m/s)

- <= -0.4
- -0.4 to -0.2
- -0.2 to -0.1
- -0.1 to 0.1
- 0.1 to 0.2
- 0.2 to 0.4
- > 0.4

0 100 200 m

Coordinate system: GDA 2020 MGA Zone 55

N

Scale ratio correct when printed at A3

1:2,800

Date: 26/11/2021

Data sources: - DNRME, TMR, Geoscience Australia

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Kellyville Park Flood Study
Localised Overland Flood Model
Change in Flow Velocity - 0.5% AEP

Legend

- Site Extent
- Model Extent
- Proposed Building Footprint
- Boundary Condition (HT)

Change in Flow Velocity (m/s)

- <= -0.4
- -0.4 to -0.2
- -0.2 to -0.1
- -0.1 to 0.1
- 0.1 to 0.2
- 0.2 to 0.4
- > 0.4

0 100 200 m

Coordinate system: GDA 2020 MGA Zone 55

N

Scale ratio correct when printed at A3

1:2,800

Date: 26/11/2021

Data sources: - DNRME, TMR, Geoscience Australia

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Kellyville Park Flood Study
Localised Overland Flood Model
Change in Flow Velocity - 0.2% AEP

Legend

- Site Extent
- Model Extent
- Proposed Building Footprint
- Boundary Condition (HT)

Change in Flow Velocity (m/s)

- <= -0.4
- -0.4 to -0.2
- -0.2 to -0.1
- -0.1 to 0.1
- 0.1 to 0.2
- 0.2 to 0.4
- > 0.4

0 100 200 m

Coordinate system: GDA 2020 MGA Zone 55

N

Scale ratio correct when printed at A3

1:2,800

Date: 26/11/2021

Data sources: - DNRME, TMR, Geoscience Australia

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Kellyville Park Flood Study
Localised Overland Flood Model
Change in Flood Hazard - 5.0% AEP

Legend

- Site Extent
- Model Extent
- Proposed Building Footprint
- Boundary Condition (HT)

Change in Flood Hazard Category

- -3
- -2
- -1
- No Change
- +1
- +2
- +3

0 100 200 m

Coordinate system: GDA 2020 MGA Zone 55

N

Scale ratio correct when printed at A3

1:2,800

Date: 26/11/2021

Data sources: - DNRME, TMR, Geoscience Australia

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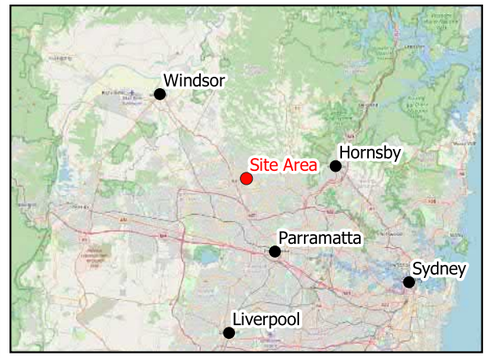
Kellyville Park Flood Study
Localised Overland Flood Model
Change in Flood Hazard - 1.0% AEP

Legend

- Site Extent
- Model Extent
- Proposed Building Footprint
- Boundary Condition (HT)

Change in Flood Hazard Category

- -3
- -2
- -1
- No Change
- +1
- +2
- +3



0 100 200 m

Coordinate system: GDA 2020 MGA Zone 55

N

Scale ratio correct when printed at A3

1:2,800

Date: 26/11/2021

Data sources: - DNRME, TMR, Geoscience Australia

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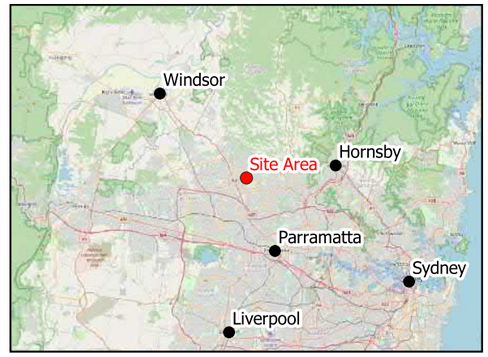
Kellyville Park Flood Study
Localised Overland Flood Model
Change in Flood Hazard - 0.5% AEP

Legend

- Site Extent
- Model Extent
- Proposed Building Footprint
- Boundary Condition (HT)

Change in Flood Hazard Category

- -3
- -2
- -1
- No Change
- +1
- +2
- +3



0 100 200 m

Coordinate system: GDA 2020 MGA Zone 55

N

Scale ratio correct when printed at A3

1:2,800

Date: 26/11/2021

Data sources: - DNRME, TMR, Geoscience Australia

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Kellyville Park Flood Study
Localised Overland Flood Model
Change in Flood Hazard - 0.2% AEP

Legend

- Site Extent
- Model Extent
- Proposed Building Footprint
- Boundary Condition (HT)

Change in Flood Hazard Category

- -3
- -2
- -1
- No Change
- +1
- +2
- +3

0 100 200 m

Coordinate system: GDA 2020 MGA Zone 55

N

Scale ratio correct when printed at A3

1:2,800

Date: 26/11/2021

Data sources: - DNRME, TMR, Geoscience Australia

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APPENDIX H

30 March 2021

Alex Khoshaba
Project Engineer - Civil,
WSP Australia Pty Ltd
L15, 28 Freshwater Place, Southbank, VIC 3006

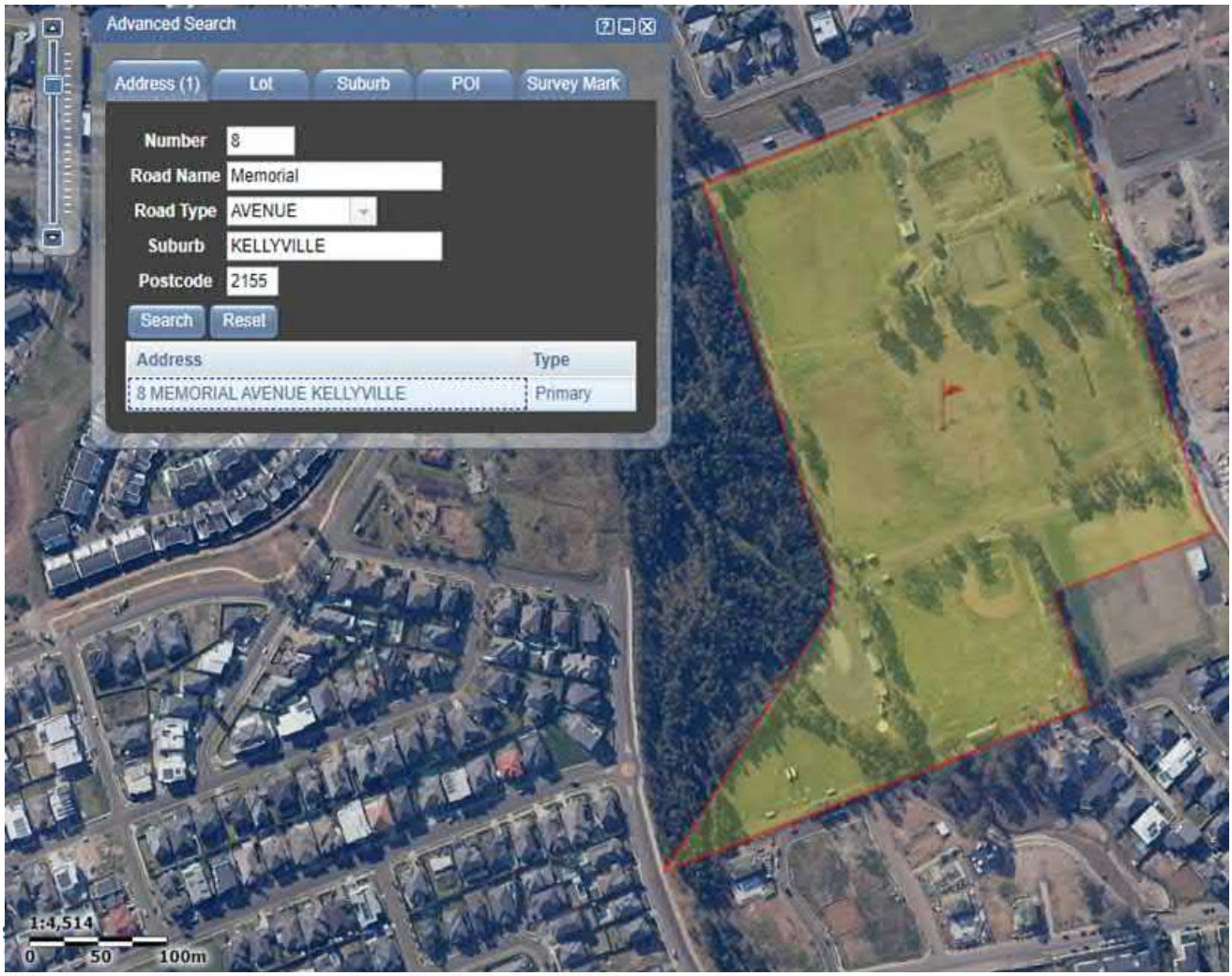
Reference: MS3055

RE: 100 Year ARI flood level around Kellyville Memorial Park Reserve close to Strangers Creek, Kellyville from Rouse Hill Flood Model

Dear Alex,

We refer to your request for access to flood level around Kellyville Memorial Park Reserve, Eastern side of Strangers Creek in Kellyville (as shown in the picture below), for the purpose of designing minimum building freeboard requirements (**Permitted Purpose**).

Sydney Water agrees to provide the above information in a separate PDF file to WSP Australia Pty Ltd for the Permitted Purpose only. By accepting this information on behalf of WSP Austalia Pty Ltd, you agree to comply with the Terms of Use outlined below.



Description of Information

1. Sydney Water Identifier: MS3055 (Service Request)
2. Name: MS3055 WSP - Kellyville – Memorial Park Reserve
3. Description: 100 ARI Flood Level on Strangers Creek next to Memorial Park Reserve, Kellyville
4. Unit: Australian Height Datum (AHD)
5. Format: PDF
6. Coverage (Spatial): in between Memorial Park Reserve and Strangers Creek, Kellyville
7. Coverage (Temporal): 2014

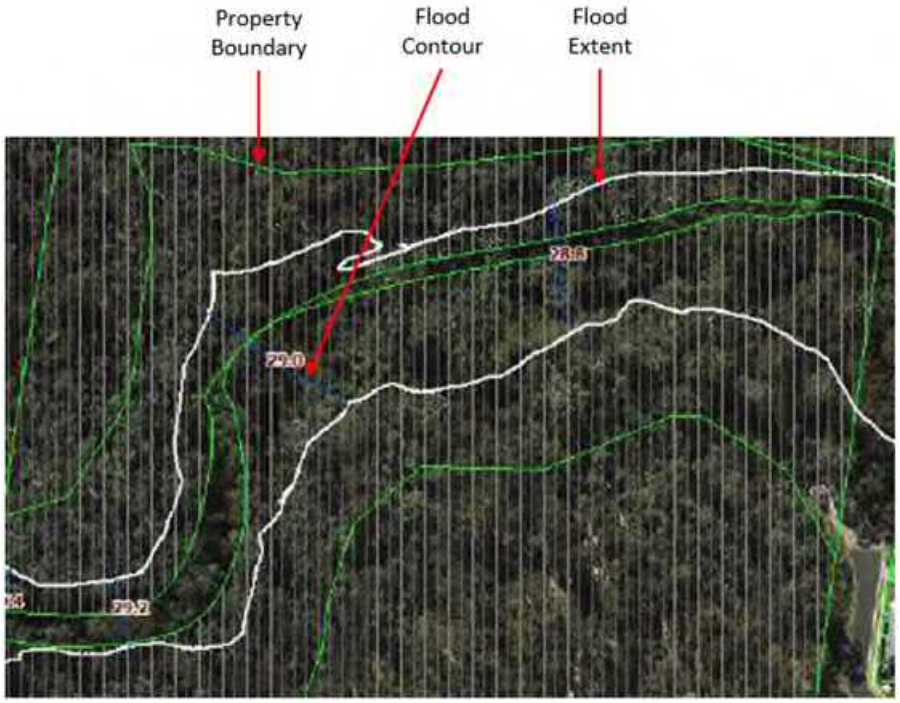
Methodology

1. The flood study used:
    - rainfall-runoff modelling techniques described in Australian Rainfall and Runoff (1987)
    - aerial laser survey of ground levels dated 2011 (with some data from 2006 and 2007)
    - information on culverts, bridges and other infrastructure from site inspections in 2013.
    - These and other assumptions used to produce the flood study are described in the flood study report.
2. The information provided is based on flood study outputs using reasonably available information and standard industry practice at the time of the study.

General Limitations

The information provided may not be reflective of the most recent landuse due to the rapid growth and development in the area.

Information Details:	
Title:	*Flood Extent (with level) Map from Rouse Hill Flood Model around Memorial Park Reserve and Strangers Creek, Kellyville, NSW*
Description:	• Sydney Water is designated as the Catchment Manager for the land that is identified for Trunk Drainage purposes within the Rouse Hill development Area (RHDA) – stages 1 to 4. • Sydney Water engaged WMA Water in August 2013 to undertake the Rouse Hill Flood Study. • A flood model report was produced in 2014 as part of model development. • The map contains several lines and numbers. The ***numbers*** represent the Level (RL) in meters and different coloured lines are illustrated in the ***sample picture*** below. • The ***colour*** of the *Flood Contour* line changes based on the flood level. Sample picture with Legend:

	
Prepared by:	Mohammad Hassan
Data Current at:	2014
Purpose:	*For the design of minimum building freeboard requirements*
Model Inputs:	Landuse Data: • Prior to development, the catchment was predominantly rural with some forested areas in the northern and eastern parts of the catchment with older residential areas. • This land was zoned 5(a) (Special Uses - Trunk Drainage) by the Blacktown City and The Hills Shire Councils Local Environmental Plans and includes Smalls, Second Ponds, Caddies, Strangers, and Elizabeth Macarthur Creeks and their tributaries. Rainfall & standard: • Australian Rainfall and Runoff (ARR) is a national guideline document, data and software suite that has been used for the estimation of Rainfall input for the flood model. Topographical Data: • Topographical Data was developed using LiDAR (Airborne Light Detection & Ranging) survey data and this data was collected by SKM in 2006/2007 and by Land & Property Information (LPI) in 2011. Modelling Tools: • Rouse Hill Flood model was developed using XP-Rafts (hydrology) and TUFLOW (Hydraulics) software.
Limitations:	• The image depicts 1 in 100 year Annual Recurrence Interval (also commonly known as the 1% Annual Exceedance Probability) flood. It is important to appreciate that many smaller and some much bigger floods can and will likely occur from time to time. • The 2014 flood model and flood study report are currently the most relevant recent information to describe how flooding occurs in the catchment. However, more recent changes in the catchment may have resulted in changes to the frequency, extent, depth and other parameters of flooding that are identified in the flood study.

	• The accuracy of the LiDAR data can be influenced by the presence of open water or vegetation (tree or shrub canopy) at the time of the survey. This is particularly notable in creeks or along heavily tree lined streets. • The rating curve (relationship between discharge in m3/s and water level) developed for the stream gauge is based on limited flow (measurement of stream velocity and conversion to flow by knowing the waterway area) gauging data (up to a maximum of 2.8 m3/s).
Supplied to:	
Date supplied:	
Terminologies used:	• **AEP:** Annual Exceedance Probability – The likelihood of occurrence of a flood of given size or larger occurring in any one year. AEP is expressed as a percentage (%) and may be expressed as the reciprocal of ARI (Average Recurrence Interval). • **ARI:** Average Recurrence Interval – The likelihood of occurrence, expressed in terms of the long-term average number of years, between flood events as large as or larger than the design flood event. For example, floods with a discharge as large as or larger than the 100-year ARI flood will occur on average once every 100-years. ARI is related to AEP and Odds of Flooding as follows: ARI in years equals the reciprocal of AEP expressed in terms of chance. For example, a 1% AEP flood has a chance of occurrence in any year of 0.01, and an associated ARI of 100 years. ***Source:*** *Australian Rainfall and Runoff* (http://arr.ga.gov.au/home)

Security Classification: Unclassified
DLM: No DLM Required
Rights: N/A

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1. This information has been provided on the request of Alex Khoshaba (the Recipient) for the Permitted Purpose only. The Recipient must not use the information for any purpose other than the Permitted Purpose without the prior written consent of Sydney Water.
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If you have any further enquiries about the dataset, please contact us.

Sincerely,

Mohammad Hassan
Modeller
Ph: 0288494140
Email: mohammad.hassan@sydneywater.com.au

Sydney WATER

ROUSE HILL FLOOD STUDY 2014

100 year ARI Flood Level

SITE: Flood Contour Map around Kellyville Memorial Park Reserve