Flood Impact and Risk Assessment

Prepared to Support a Review of Environmental Factors (REF) for the Rebuild of Lismore South Public School (the activity)

Prepared for Department of Education / 20 Jun 2025

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Rev	Date	Prepared By	Approved By	Remarks
1	29/11/24	AV	JM	Draft
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4	20/02/25	AV	JM	Draft
5	10/06/25	AV	EC	Final
6	20/06/25	AV	EC	Final

Glossary and Abbreviations

Annual Exceedance Probability	AEP	The chance of a flood of a given or larger size occurring in any one year, usually expressed as a percentage
Australian Height Datum	AHD	A common national surface level datum often used as a referenced level for ground, flood and flood levels, approximately corresponding to mean sea level.
Average Recurrence Interval	ARI	The long-term average number of years between the occurrence of a flood equal to or larger in size than the selected event. ARI is the historical way of describing a flood event. AEP is generally the preferred terminology.
Bureau of Meteorology	BoM	An executive agency of the Australian Government responsible for providing weather services to Australia and surrounding areas.
Development Control Plan	DCP	A Development Control Plan is a document prepared by the Council which provides detailed guidelines which assist a person proposing to undertake a development. A DCP must be consistent with the provisions and objectives of a Local Environmental Plan (LEP).
Finished Floor Level	FFL	The level, or height, at which the floor of a building or structure (including alterations and additions) is proposed to be built.
Flood hazard		A source of potential harm or a situation with a potential to cause loss of life, injury and economic loss due to flooding. Flood hazard is defined as a function of the relationship between flood depth and velocity.
Flood Planning Level	FPL	The combination of the flood level from the defined flood event and freeboard selected for flood risk management purposes.
Freeboard		A factor of safety typically used in relation to the setting of floor levels or levee crest levels. Freeboard provides a factor of safety to compensate for uncertainties in the estimation of flood levels across the floodplain, such as wave action, localised hydraulic behaviour etc.
Local Environmental Plan	LEP	LEPs provide a framework that guides planning decisions for local government areas through zoning and development controls. Zoning determines how land can be used (for example, for housing, industry, or recreation).
Probable Maximum Flood	PMF	The largest flood that could conceivably occur at a particular location, usually estimated from probable maximum precipitation. Generally, it is not physically or economically possible to provide complete protection against this event. The PMF defines the extent of flood prone land, that is, the floodplain.
Representative Concentration Pathways	RCP	RCPs make predictions of how concentrations of greenhouse gases in the atmosphere will change in future as a result of human activities. The four RCPs range from very high (RCP8.5) through to very low (RCP2.6) future concentrations.

Executive Summary

This report provides a comprehensive Flood Impact and Risk Assessment (FIRA) for the proposed rebuild of Lismore South Public School (LSPS) in South Lismore. The assessment incorporates updated site survey data, refined flood modelling approaches, and a detailed analysis of existing and post-development flood behaviour, including climate change impacts. This assessment has been prepared in accordance with a scope agreed between SINSW, TTW and DPHI.

This project has involved ongoing engagement with key stakeholders, including the Regional Authority (RA), State Emergency Services (SES), Department of Planning and Housing Infrastructure (DPHI), and the local Council. These collaborations have been critical in developing a comprehensive understanding of flood risks and aligning the rebuild design with both regulatory requirements and community safety objectives.

The flood model was updated with survey data collected in February 2023 to enhance the accuracy of pre-development conditions. Buildings in the model were represented using Layered Flow Constrictions, which accounted for depth-varying flow resistance for elevated structures. This approach included specific blockage levels for floodwaters and debris to reflect real-world conditions.

Under existing conditions, flood levels during a 1% AEP event range from 12.60–12.65m AHD, with most of the site classified as high hazard (H4-H5). In a PMF event, flood levels exceed 16.7m AHD, and the entire site is categorized as H6 hazard.

For the 1% AEP event, a minor afflux of approximately 12 mm is observed within a small portion of the site. During the PMF event, afflux levels between 12 and 14 mm are observed along Willson Street (west), Kyogle Street (south), and the adjacent property to the south of Kyogle Street. As the PMF flood depths exceed 2 metres, the resulting afflux is considered negligible.

The February 2022 flood event, which exceeded the 1% AEP threshold and approached 0.2% AEP conditions, had peak flood levels of approximately 14.45m AHD. A Finished Floor Level (FFL) of 15.25 m AHD has been adopted, exceeding the requirements of both the current and draft Development Control Plan (DCP) guidelines. A sensitivity analysis under the 2090 RCP 8.5 climate change scenario projects a 600 mm increase in flood levels for the 1% AEP event, resulting in a level of 13.20 m AHD, which remains 1.75 m below the proposed FFL.

Flood resilience is further enhanced through the use of flood-resistant materials and the elevated placement of essential services such as air conditioning units and electrical switchboards. Permeable or collapsible fencing and enclosures designed to allow automatic floodwater entry and exit contribute to improved flood performance. A Flood Emergency Response Plan (FERP) has also been developed to address risks to students and staff during severe flood events.

The activity complies with Lismore's DCP requirements, which do not mandate PMF-level protection due to the site's classification as a commercial development. It has been demonstrated that the redevelopment will not result in significant environmental impacts or unacceptable changes to flood behaviour. The structural designs have been developed to withstand the effects of floodwater, debris, and buoyancy forces for events up to the PMF.

In conclusion, the proposed rebuild of LSPS effectively addresses flood risks while minimizing impacts on the surrounding area. The integration of updated modelling, resilient design measures, and compliance with regulatory requirements ensures that the site is well-prepared for future flood events, including those influenced by climate change.

1.0 Introduction

This Flood Impact and Risk Assessment (FIRA) report has been prepared to support a Review of Environmental Factors (REF) for the rebuild of Lismore South Public School (the activity). The purpose of the REF is to assess the potential environmental impacts of the activity prescribed by State Environmental Planning Policy (Transport and Infrastructure) 2021 (T&I SEPP) as "development permitted without consent" on land carried out by, or on, behalf of a public authority under Part 5 of the Environmental Planning and Assessment Act 1979 (EP&A Act). The activity is to be undertaken pursuant to Chapter 3, Part 3.4, Section 3.37 of the T&I SEPP.

The activity will be carried out at Lismore South Public School (LSPS) located at 69-79 Kyogle Street, South Lismore (the site).

The purpose of this report is to address the flood related engineering design considerations of the development site, alongside the relevant requirements of Lismore City Council's Development Control Plan (DCP).

1.1 Guidance Documents

The following documents have been reviewed and referenced in preparing this report:

- Australian Institute of Disaster Resilience (AIDR) Guideline 7-3: Flood Hazard (2017)
- Ball J, Babister M, Nathan R, Weeks W, Weinmann E, Retallick M, Testoni I, (Editors) Australian Rainfall and Runoff: A Guide to Flood Estimation, © Commonwealth of Australia (Geoscience Australia), 2019. Book 6 – Flood Hydraulics, Chapter 6 - Blockage of Hydraulic Structures.
- Bureau of Meteorology (BoM) Service Level Specification for Flood Forecasting and Warning Services for New South Wales and the Australian Capital Territory – Version 3.13
- Considering Flooding in Land Use Planning Guideline DPE 2021
- CSIRO (2022) Characterisation of the 2022 floods in the Northern Rivers region, https://nema.gov.au/
- Department of Environment and Heritage – Flood Risk Management Guideline LU01, June 2023
- Department of Planning, Housing and Infrastructure – Planning Circular PS 24-001, Update on addressing flood risk in planning decisions, 1st March 2024
- Engeny Water Management (2021) Lismore Floodplain Risk Management Study – Report, https://flooddata.ses.nsw.gov.au/related-dataset/lismore-floodplain-risk-management-study-report
- Engeny Water Management (2023) Lismore Floodplain Risk Management Plan – Land Use Planning and Development Control, Draft Interim Report May 2023.
- FloodSafe guidelines and the relative FloodSafe Tool Kits
- Lismore City Council (2012) Lismore Development Control Plan – Part A. Chapter 8 Flood Prone Lands. https://lismore.nsw.gov.au/files/Part_A_Chapter_8_Flood_Prone_Lands_LEP_2012.pdf.
- Lismore City Council (2012) Local Environmental Plan (LEP) 2012: https://mapping.lismore.nsw.gov.au/intramaps99/?project=LismorePublic
- Lismore City Council (2014) Lismore Floodplain Risk Management Plan 2014, https://flooddata.ses.nsw.gov.au/flood-projects/lismore-floodplain-risk-management-plan
- Lismore City Council (2023) Draft Revised Flood Prone Lands DCP for exhibition, https://yoursay.lismore.nsw.gov.au/flood-planning
- NSW Department of Planning and Environment (2023) Flood Risk Management Manual https://www.environment.nsw.gov.au/topics/water/floodplains/floodplain-manual
- NSW Department of Planning and Environment Flood Risk Management Manual (2023)
- The Telegraph (2022) 'Pop-up classrooms for flooded NSW students', Available at https://www.seymourtelegraph.com.au/national/pop-up-classrooms-for-flooded-nsw-students/

1.2 Consultation and Engagement

A risk workshop was conducted on December 9, 2024, to assess the flood risks associated with this project. The workshop brought together a wide range of experts and stakeholders from various organizations, including, but not limited to, the Department of Education (DoE), the Department of Planning, Housing and Infrastructure (DPHI), and the Department of Climate Change, Energy, the Environment and Water (DCCEEW). This collaborative approach ensured that the flood risks were evaluated from multiple perspectives, incorporating technical expertise, environmental considerations, and community impact..

During the workshop, risks were systematically identified and categorized into specific groups, such as evacuation, environmental, structural, climate change, evacuation procedures, social impact, and community-related concerns, with additional focus on warning systems, infrastructure resilience, and the capacity for safe evacuation in flood-prone areas. The discussions emphasized the importance of pre-emptive action and collaborative planning to effectively mitigate flood-related risks, with experts sharing practical solutions, including structural reinforcements, improved evacuation protocols, and measures to enhance community preparedness.

Once identified, the risks were further assessed based on their potential impact and likelihood of occurrence, and they were classified into three distinct levels: High, Medium, and Low. High risks were prioritized for immediate attention, with an emphasis on implementing mitigation strategies to reduce their potential consequences. Medium and low risks were also addressed, with appropriate control measures planned to ensure the safety and functionality of the project during flood events.

The workshop emphasized the importance of pre-emptive action and collaborative planning to mitigate flood-related risks effectively. Experts shared insights on practical solutions, including structural reinforcements, improved evacuation protocols, and measures to enhance community preparedness.

The complete list of identified risks, along with detailed control measures and recommendations for mitigation, is provided in Appendix A-Part A for further reference and action.

Furthermore, a meeting was held on 26 February 2024 with Council, DPHI, and SES. The purpose of the meeting was to discuss the findings of the Department of Education’s (DOE) due diligence for the proposed redevelopment of Lismore South Public School (LSPS). The Project Team conducted this due diligence to assess the viability of rebuilding on the existing LSPS site, which aligns with the DOE’s preference. Key considerations included flood modelling, evacuation strategies, and the integrity of the site’s structural and service systems.

The meeting’s primary purpose was to review these findings before submitting a request for SEARS to the Department of Planning, Industry and Environment (DPHI). The objective was to identify any additional due diligence needs, with a specific focus on flood safety and other planning authority considerations, to ensure the project proceeds with all necessary assessments and approvals in place. During this meeting, it was mentioned that the project intends to use a flood planning level of 14.9m for habitable spaces, based on the February 2022 flood level plus 500mm freeboard. please refer to Appendix A-Part B

1.3 Proposed Activity

The proposed activity comprises the rebuild of the LSPS on the eastern parcel of the existing site, in South Lismore, and will be delivered in a single stage. The western parcel is out of the scope of the activity. Any works required on the western parcel (such as removal of demountable classrooms) will be subject to separate approval (if required).

A detailed description of the proposal is as follows:

1. Retention of the existing play equipment, Building K and covered outdoor learning area (COLA) on the western parcel.

2. Bulk earthworks, comprising fill and excavation and other site preparation works on the eastern parcel.
3. Construction of a new building on the eastern parcel for LSPS including:
    a. A one storey building (with undercroft areas below) fronting Kyogle Street containing a general learning space (GLS) hub, hall, library, support hub, administration, and pre-school.
    b. Undercroft outdoor learning areas as well as amenities and storage located on ground level.
4. Landscaping and public domain works, including tree planting, a games court in the northeast corner and an outdoor playing area adjacent to the preschool.
5. A car park on the eastern side of the site, with access from Kyogle Street.
6. Waste collection area access from Kyogle Street.
7. Multiple entrance points, including:
    a. Primary and secondary entries distributed on site frontages.
    b. Vehicular access point to provide access to waste collection/delivery areas and car parking.
8. Ancillary public domain mitigation measures.

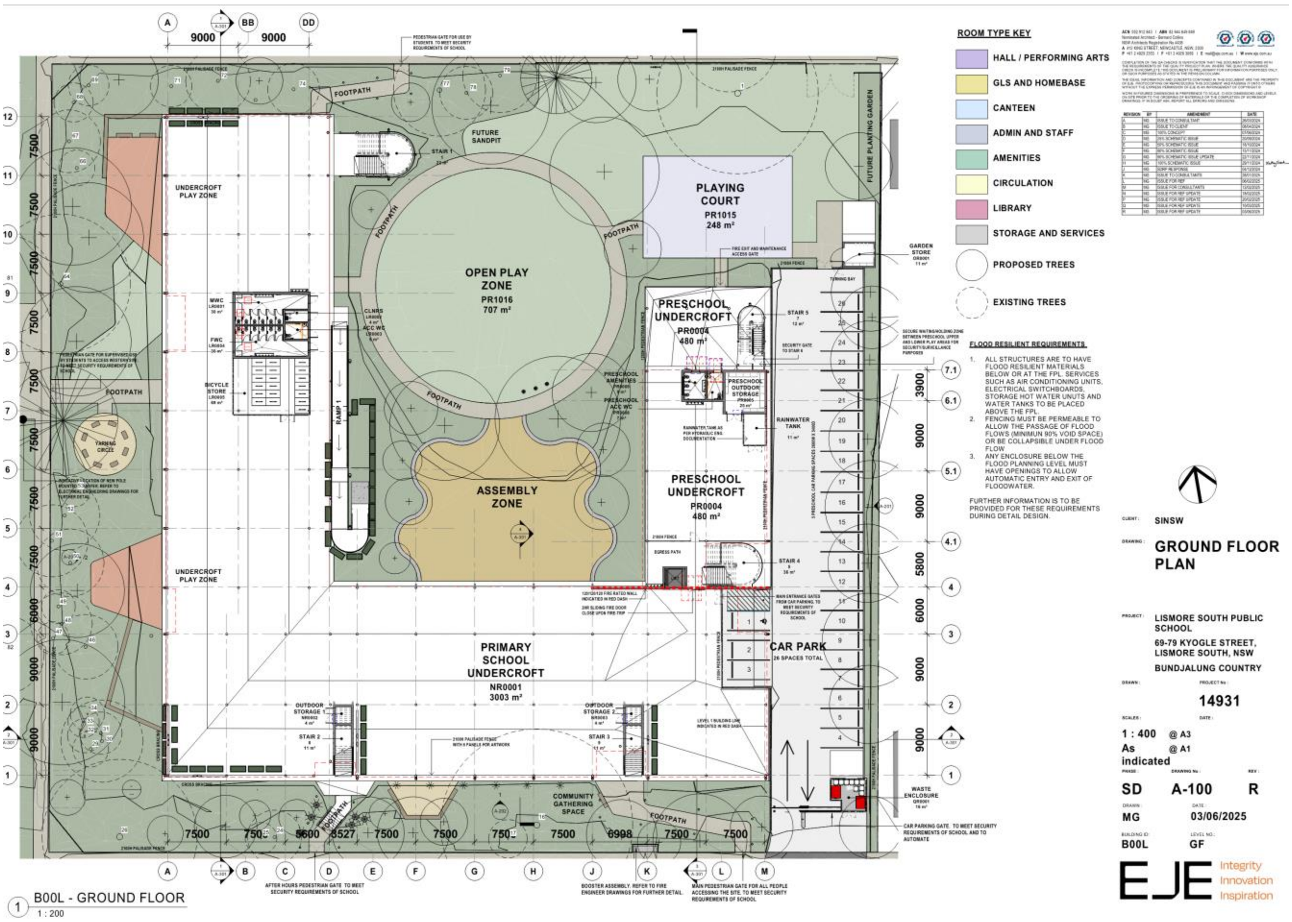


Figure 1: Proposed Ground Floor Layout (Source: EJE Architecture)

Figure 2 and Figure 3 show the proposed level 1 floor level layout and prospective view of proposed development.

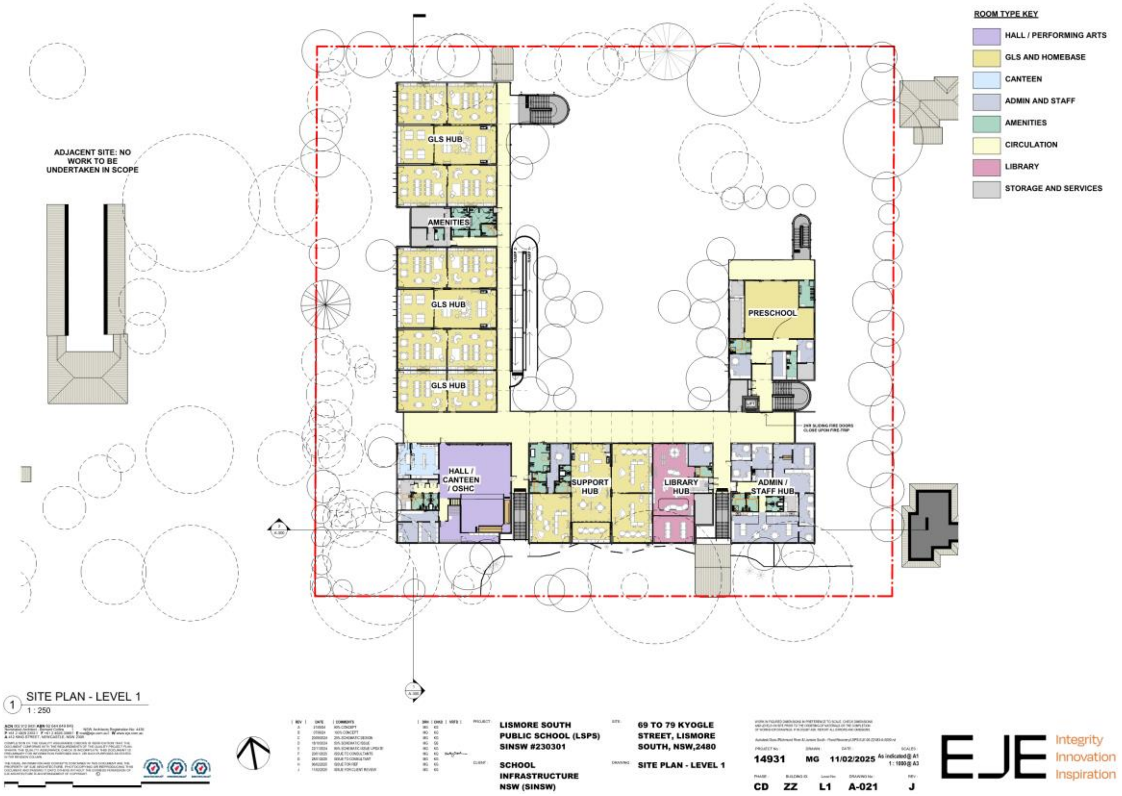


Figure 2: Proposed Level 1 Floor Layout (Source: EJE Architecture)

Figure 3: Perspective view of the proposed development along Kyogle St (Source: EJE Architecture)

2.0 Site Information

2.1 Site Characteristics

The site, located at 69-79 Kyogle Street, South Lismore, consists of two separate land parcels situated on either side of Wilson Street. The proposed activity will be undertaken on the eastern parcel, where most of the school's existing structures are located. The western parcel contains sports fields and temporary learning facilities. Figure 1 outlines the school's boundary, covering approximately 2.5 hectares. Due to flood damage, the existing buildings on the eastern parcel are currently unused, and students are temporarily using facilities on the sports field and oval, located on the western side of Wilson Street, adjacent to the primary school. Figure 4 shows the areal image of the site.

Figure 4: LSPS site location. (Source: Nearmap)

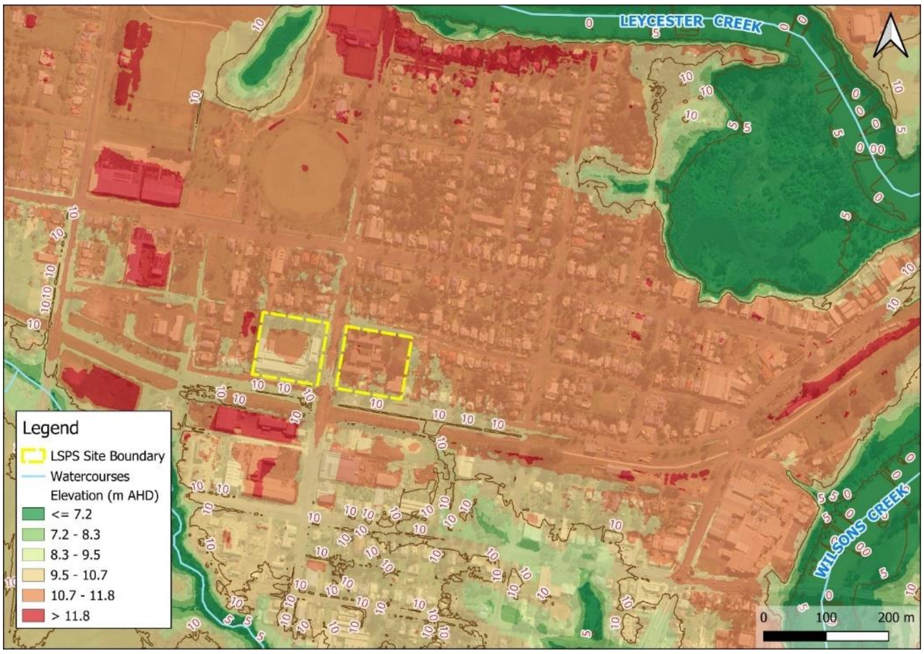


Figure 5: Elevation of the LSPS site and surrounding area

2.2 Catchment Information

Lismore stands as one of the most flood-prone urban areas in Australia, characterised by a lengthy history of destructive floods due to its geographical location at the junction of two major streams, Leycester Creek and Wilsons River. The catchment above Lismore is intricate, with flooding outcomes influenced by various factors such as catchment conditions, rainfall distribution, and rainfall intensity. The Wilsons River and Leycester Creek, nourished by numerous major creeks, converge in the vicinity of Lismore. Major flooding events can arise from increased water levels in either the Wilsons River or Leycester Creek, leading to overbank flooding in Wilsons or a Leycester Creek.. Significant flooding may occur when both watercourses experience flooding simultaneously. Historically, the majority of floods occur when Leycester Creek takes on a more dominant role.

There are several significant hydraulic controls within the Lismore floodplain, including the South Lismore Levee, CBD Levee, Gasworks Creek floodgates, Hollingworth Creek floodgates, Bruxner Highway, and the railway embankment. Some of these hydraulic controls are shown in Figure 6. However, if major flooding occurs, these levees may also be overtopped with substantial flooding.

The flood gate on Hollingworth Creek prevents backflow from the Wilsons River, up to flood level of 10.0–10.2 m AHD where Hollingworth Creek meets Wilsons River, but heavy rainfall in the Hollingworth Creek catchment can cause flooding in South Lismore.

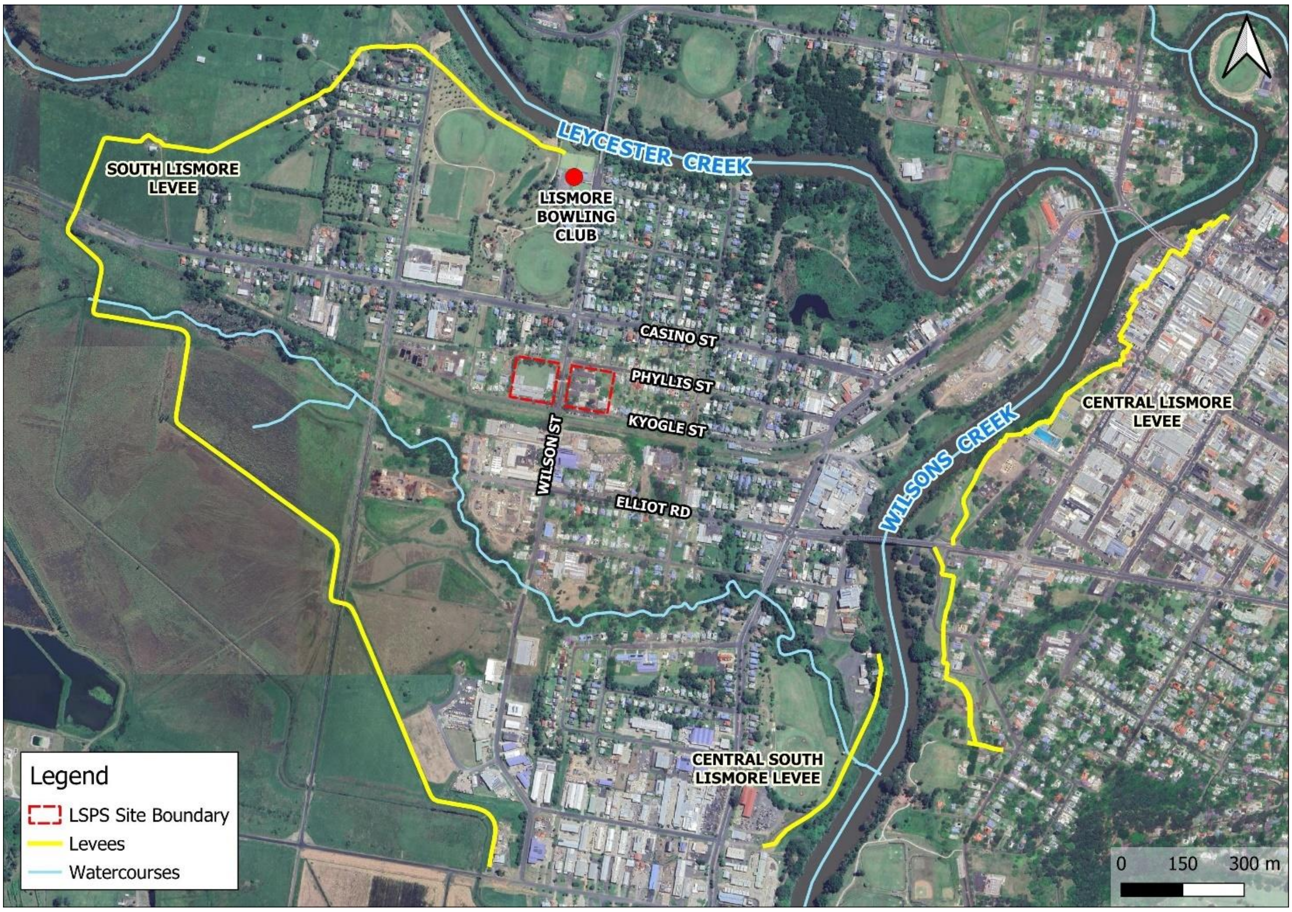


Figure 6: Hydraulic controls in the vicinity of the site

2.2.1 Flood Behaviour

The Wilsons River Rowing Club Gauge (Station Number 058176) gives the most reliable records for riverine flood levels that impact the South Lismore area. The gauge first became operational in 1917. The Bureau of Meteorology have defined the minor, moderate and major flood levels at the gauge as 4.2m AHD, 7.2m AHD and 9.7m AHD, respectively.

Establishing a direct link between the overtopping of the South Lismore levee and a measured flood height at the Lismore Rowing Club is not straightforward. A gauge height of 10.80m AHD marks the crest height of the South Lismore Levee, which first overtops near the South Lismore Bowling Club (situated 450m north of LSPS, labelled in Figure 6). In a Leycester Creek dominant flood, the levee will overtop at a lower height, potentially as low as 7.6–8.6m AHD. Figure 7 shows the typical flow path directions when the levee is overtopped during 1% AEP storm events.

Figure 7: Typical 1% AEP flow path directions in close proximity to the site

2.2.2 Historical Floods

The most severe recorded flood in Lismore occurred on February 28, 2022, with the flood level peaking at 14.4m AHD. Prior to this event, the record stood at 12.11m AHD, a height reached during floods in February 1954 and March 1974. Additionally, the flood in March 2017 reached a level of 11.6 m AHD.

Lismore has experienced intense rainfall throughout the last century. Figure 8 shows the flood height for events higher than 6.0m AHD from 1870 to 2022. These values are based on measurements from the Lismore Rowing Club gauge, and flood height will vary across the flood plain.

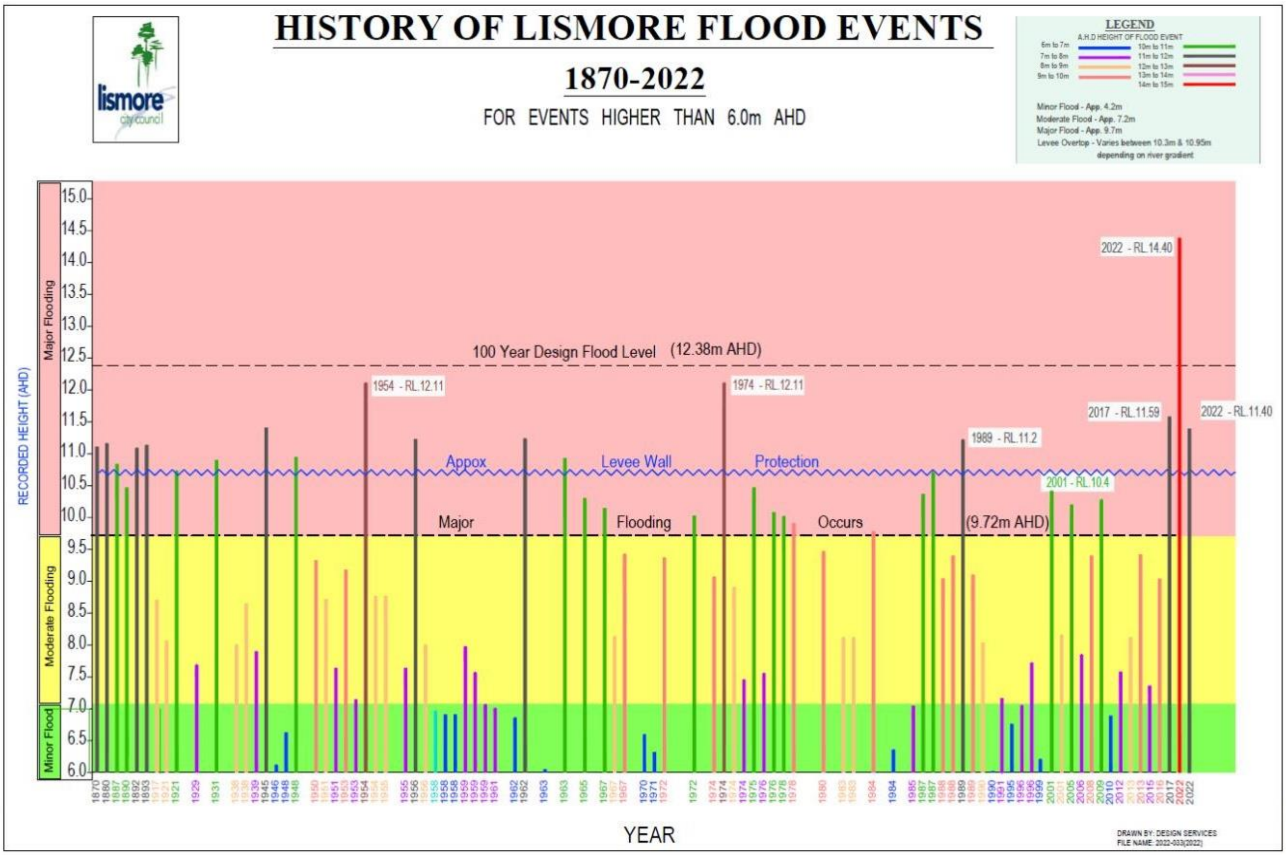


Figure 8: History of Lismore flood events, taken from the Rowing Club Gauge

3.0 Hydraulic Model Setup

3.1 Lismore Floodplain Risk Management Study (2021)

TTW obtained Rous County Council's TUFLOW model files for the Lismore Floodplain Risk Management Study, developed by Engeny. This represents the most comprehensive model available for Lismore at the time of writing. An UBRS hydrological model was created by Engeny to generate hydrological input for the TUFLOW hydraulic model. It was calibrated using historical events in 2017, 2013, 2012, and 1989 and later utilised for design event modelling. Both models are based on Australian Rainfall and Runoff 2019 guidelines (ARR2019).

The general Council TUFLOW model configurations are as follows:

1. 10m grid cell size
2. TUFLOW release 2018-03-AD_iSP_GPU
3. Council's URBS hydrographs were used as input to the model for the 10% AEP, 5% AEP, 1% AEP, 1% AEP + climate change, and 0.2% AEP events, alongside the February 2022 event and the Probable Maximum Flood (PMF).

3.2 Site Survey

For the existing (pre-development) scenario, the model was updated to incorporate new site survey information at a finer spatial resolution. The survey was conducted in February 2023 by Beveridge Williams and covered the eastern part of the site, where the proposed works will be undertaken. The site survey information is shown in Figure 9. A design Triangular Irregular Network (TIN) was prepared for the proposed activity. This was incorporated into the post development models.

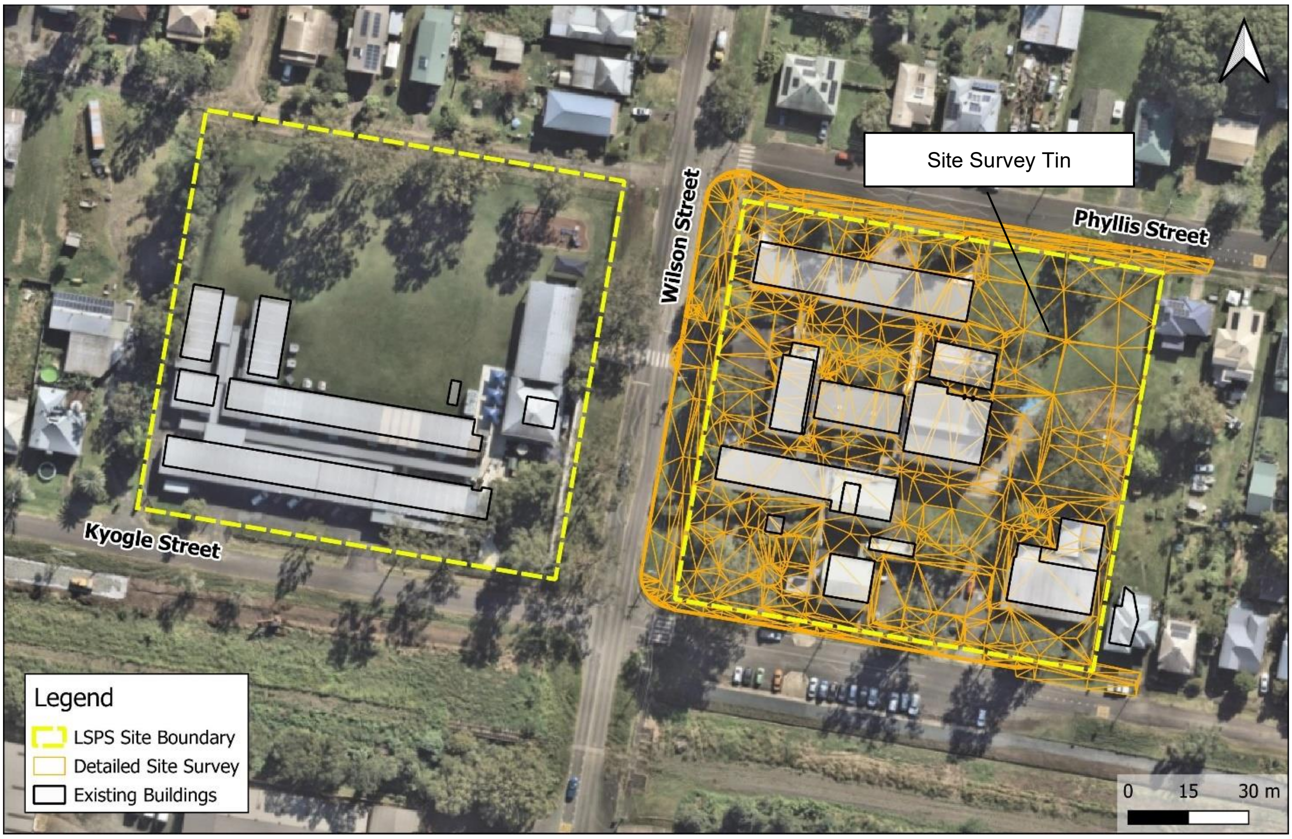


Figure 9: Detailed site survey information for the LSPS site (TIN format)

Figure 10 and Figure 11 present the existing contours and post-development contours, respectively.

Figure 10: Existing development TIN contours

Figure 11: Post development TIN contours

3.3 Critical Durations

Based on the information provided in the Rous County Council's Lismore Floodplain Risk Management Study report (2021), the rainfall durations and temporal patterns provided in Table 1 have been used for this assessment.

Table 1: Critical rainfall and patterns

Event	Critical Duration	Temporal Pattern
5% AEP	48 hours	T4
1% AEP	24 hours	T8
1% AEP+CC	24 hours	T8
0.2% AEP	36 hours	T10
PMF	36 hours	T10

3.4 Building Representation

The Lismore Floodplain Risk Management Study model represents buildings via an increase in hydraulic roughness (or Manning's 'n' values) within the model. Individual buildings were not represented in the roughness map, but urban areas were assigned a roughness value of 1.0, representing increased energy dissipation of water flowing through and around structures. TTW updated Council's model to represent the existing and proposed buildings using two methods.

For high-set buildings on piers or suspended slabs, the buildings were incorporated into the model using Layered Flow Constrictions in TUFLOW to specify the depth-varying form loss of the structures. Three layers have been included which are outlined in Table 2. The middle layer represents the suspended slab, which was modelled as a complete flow obstruction (100% blockage), while the upper layer (Layer 3) represents the building itself, where floodwaters have been allowed to enter the building once it reaches the specified obvert level. For this layer, a blockage of 60% was applied to reflect the significant impediment to flow afforded by the many flow obstructions contained within a typical building (e.g., walls, doors, furniture etc).

The lower layer (Layer 1) represents the undercroft area, with potential blockages in significant flood events due to floating debris that may become trapped. Blockage within this layer varies according to the magnitude of the flood event. Section 3.5 provides a detailed assessment of the factors considered in this blockage assessment. Figure 12 and Table 2 present the relevant layer friction layer height, and the blockage factors applied.

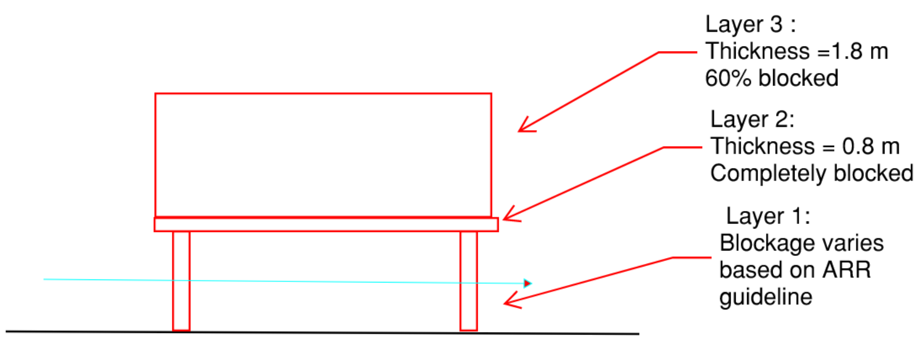


Figure 12- Layer Frictions and the blockage factors applied

Table 2: Layer flow constrictions applied to elevated buildings within the site

<table>
<tr><th>Layer</th><th>Building Component</th><th>Blockage</th><th colspan="3">Layer 1 and 2 Thickness (m)</th></tr>
<tr><td>Layer 3</td><td>Building</td><td>60%</td><td colspan="3">1.8</td></tr>
<tr><td>Layer 2</td><td>Suspended slab</td><td>100%</td><td colspan="3">0.8</td></tr>
<tr><td rowspan="4">Layer 1</td><td rowspan="4">Undercroft area</td><td rowspan="4">Dependant on event – see Section 3.5 for blockage assessment.</td><td colspan="3">Layer 1 Obvert Level (m AHD)</td></tr>
<tr><td rowspan="2">Existing</td><td>Block B</td><td>14.40</td></tr>
<tr><td>Block F</td><td>13.35</td></tr>
<tr><td>Post-development</td><td>All buildings</td><td>14.10</td></tr>
</table>

Buildings with walls at the ground level have been blocked out from the 2D domain, preventing floodwaters from flowing through the buildings. To nullify these buildings, the BC code for each building was set to 0 in TUFLOW, deactivating the cells that correspond with the building footprint.

The demountable buildings on the western side of Wilson Street were not represented in the model. Figure 13 provides a summary of how each building in the existing scenario model is represented. In the post-development model, all proposed buildings were represented using the Layer Flow Constriction method.

Figure 13: Building representation in the LSPS existing scenario

3.5 Blockage Assessment

When estimating design flows, determination of likely blockage levels and mechanisms is an important consideration. Given the magnitude of flooding in Lismore, large and hazardous debris can be carried in the floodwaters and has the potential to cause a blockage within the undercroft of elevated buildings, obstructing flow of water beneath. Figure 14 depicts example of debris around Lismore following the February 2022 floods.

Figure 14: Debris at Northern rivers following the February 2022 flooding (Source: The Telegraph, 2022)

A blockage assessment has been carried out in accordance with the recommendations set out in Australian Rainfall and Runoff 2019 (Book 6, Chapter 6). The factors that have a dominant influence on the likely blockage of a structure are outlined in Table 3.

Table 3: Factors influencing the blockage of a structure

Influencing Factor	Description	Lismore Assessment	
Debris Type and Dimensions	Whether floating, non-floating or urban debris present in the source area and its size.	Large floating debris are more than 3m long and include logs or trees, transported during larger floods when the floodplain is engaged and the ability of the debris to become snagged is reduced. Photographs from the February 2022 floods (including Figure 14) show a large amount of floating debris, including large planks of wood. The ratio of the opening width of the structure (e.g. pier spacing) to the average length of the longest 10% of the debris that could arrive at the site (termed as L_{10}) is a well correlated guide to the likelihood that this material could bridge the openings of the structure and cause blockage.	L_{10} = 2m

Debris Availability	The volume of debris available in the source area. Quantified as either High / Medium / Low.	Per Table 6.6.1. of ARR Book 6 Chapter 6, the High Availability classification is characterised by urban areas that are not well maintained and/or where old paling fences, sheds, cars and/or stored loose material etc., are present on the floodplain close to the watercourse. The Low Availability category includes well maintained rural lands and paddocks with minimal outbuildings or stored materials in the source area. Given the wide expanse of the floodplain in Lismore, both categories are represented, and hence the source area can be defined as within the Medium classification.	MEDIUM
Debris Mobility	The ability for debris to become mobilised from the source area into a stream has an effect on the amount of debris that can then be transported to a structure.	The Low Mobility category includes large, flat source areas. The High Mobility category includes source areas with streams that frequently overtop their banks, high annual rainfall and/or storm intensities. Lismore falls within both, and hence the source area can be defined as within the Medium classification.	MEDIUM
Debris Transportability	The ease with which the mobilised debris is transported once it enters the stream	The Low Transportability category includes low flow velocity (less than 1m/s). The High Transportability category is characterised by a wide stream relative to horizontal debris dimension. ($W > L_{10}$). In this case, the width can be interpreted as the spacing between the piers of the building. This has been estimated at 7m, exceeding the L_{10} of 2m. Lismore can therefore be described as within the Medium Transportability category.	MEDIUM

Based on the above assessment, the source area can be defined as within the 1% AEP Medium Debris Potential classification. This classification is adjusted depending on the AEP of the event, and the ultimate blockage level is dependent on the inlet width and debris dimensions. The Control Dimension Inlet Clear Width formula that forms the basis of the blockage assessment at the site is outlined below:

$$W > 3\ x\ L_{10}$$

Where:

- W (width of opening between the piers) = 7m (based on the information provided in the site plans by EJE Architecture, and

- L_{10} = 2m (based on a reasonable estimation following review of February 2022 flood images).

Following the guidance outlined in ARR Book 6 Chapter 6 (Table 6.6.5 and 6.6.6), the recommended blockage percentage for each event is summarised in Table 4.

Table 4: Adjusted debris potential and blockage factor to be applied in each event

Event AEP	Adjusted Debris Potential	Blockage
AEP > 5%	Low	0%
5% AEP – 0.5% AEP	Medium	0%
AEP < 0.5%	High	10%

3.6 Flood Hazard Assessment

The relative vulnerability of the community to flood hazard has been assessed by using the flood hazard vulnerability curves set out in '*Handbook 7 – Managing the Floodplain: A Guide to Best Practice in Flood Risk Management in Australia*' of the Australian Disaster Resilience Handbook Collection (2017).

These curves assess the vulnerability of people, vehicles and buildings to flooding based on the velocity and depth of flood flows. The flood hazard categories are outlined in Figure 15, ranging from a level of H1 (generally safe for people, vehicles and buildings) to H6 (unsafe for vehicles and people, with all buildings considered vulnerable to failure). Table 5 outlines the threshold limits for each hazard category.

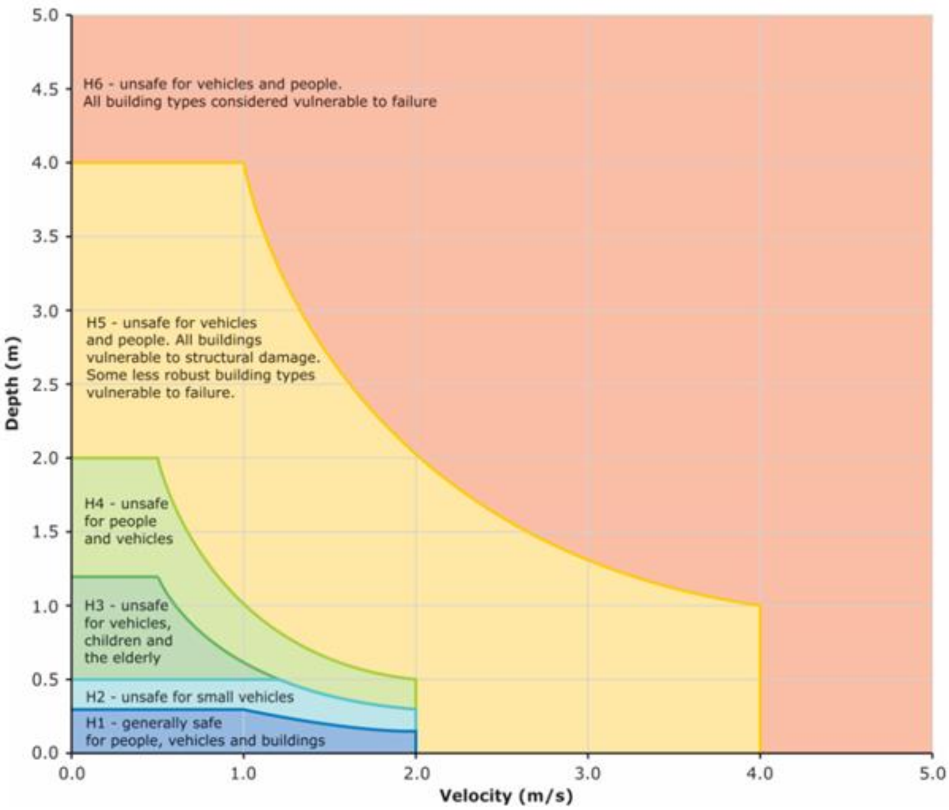


Figure 15: Flood hazard vulnerability curve (Source: Flood Risk Management Guide FB03 - Flood Hazard, NSW Department of Planning and Environment, 2022)

Table 5: Hazard vulnerability threshold limits

Hazard Classification	Description	Classification Limit (m2/s)	Limiting still water depth (D) (m)	Limiting velocity (V) (m/s)
H1	Generally safe for people, vehicles and buildings	D x V ≤ 0.3	0.3	2.0
H2	Unsafe for small vehicles	D x V ≤ 0.6	0.5	2.0
H3	Unsafe for vehicles, children and the elderly	D x V ≤ 0.6	1.2	2.0
H4	Unsafe for people and vehicles	D x V ≤ 1.0	2.0	2.0
H5	Unsafe for people and vehicles. All buildings vulnerable to structural damage.	D x V ≤ 4.0	4.0	4.0
H6	Unsafe for people and vehicles. All building types considered vulnerable to failure.	D x V > 4.0	–	–

4.0 Flood Planning Requirements

The current Development Control Plan (DCP) in place in Lismore was published in 2012. However, there is a draft Revised Flood Prone Lands Development Control Plan published in 2023 that outlines the updated regulations for building on flood-prone land in the Lismore LGA. Both documents have been reviewed for the purpose of this study, although it should be noted that the Draft DCP is not yet adopted and is subject to change.

In both DCPs, the type and stringency of controls have been graded relative to the severity and frequency of potential floods and is dependent on the land use type of the development alongside the flood risk categorisation of the site. It should be noted that the redevelopment of LSPS is regarded as a commercial development by Lismore City Council, as stated by Council in the project startup meeting and as reflected in the draft DCP. The development therefore does not require protection up to the PMF (as is usually standard for an educational facility in Lismore LGA, according to Section 4 of the draft 2023 DCP guidance).

The Flood Planning Level (FPL), defined as the 2022 flood level plus 500 mm, (i.e. 14.95 m AHD) was discussed and agreed upon in principle with the NSW State Emergency Service (SES), Lismore City Council, and the Department of Planning, Housing and Infrastructure (DPHI) in late 2023 to early 2024. A level of 15.25 m AHD, which exceeds 14.95 m AHD, has been adopted as the FPL for this project.

For further details, please refer to Part B of Appendix A, specifically the Northern Rivers Flood Recovery Richmond River HC and Lismore South PS Council, SES, and DPHI Meeting Minutes, Section 6: Flood Impact Assessment Results.

5.0 Flood Model Results

5.1 Existing Flood Conditions

Figure 16, Figure 17 and Figure 18 illustrate the 1% AEP peak flood depths and levels, velocities and hazard categorisation under existing site conditions, respectively. PMF results are presented in Figure 19, Figure 20 and Figure 21. Flood depth and level, velocity and hazard maps for the 10% AEP, 5% AEP and 0.2% AEP events are attached in Appendix A. The assessment of the flood model results shows that South Lismore, where the school is located, is initially protected from flooding by the South Lismore levee, which directs breakout flow from Leycester Creek down the airport floodway. Once the levee is overtopped, floodwaters spread rapidly across South Lismore.

In the 1% AEP event, results indicate that the maximum flood level at the school varies from 12.60m AHD (at the south of the lots) to 12.65m AHD (at the centre of the eastern block). Flood depths are generally highest in the western block, with depths exceeding 2m around the perimeter of this block. Flood flows in the 1% AEP event are generally below 0.5 m/s but exceed 1m across parts of Wilson Street and Kyogle Street. In terms of hazard categorisation, most of the flows are categorised as either H4 hazard (unsafe for people and vehicles) or H5 hazard (unsafe for people and vehicles, with all buildings vulnerable to structural damage).

In the PMF event, flood levels are over 4m higher than in the 1% AEP event, ranging from a low of 16.73m AHD in the southeast of the site, to a high of 16.79m AHD in the centre of the eastern block. Depths exceed 5m across the entirety of the site and reach a maximum of 6.5m at the southeast of the western block. Velocity in the eastern block remains below 0.5m/s in the PMF but flows over the western block of the site reach 0.9m/s adjacent to Wilson Street. Given the substantial depths of floodwaters in the PMF, the entire site and surrounding area is categorised as H6 hazard, the highest hazard classification.

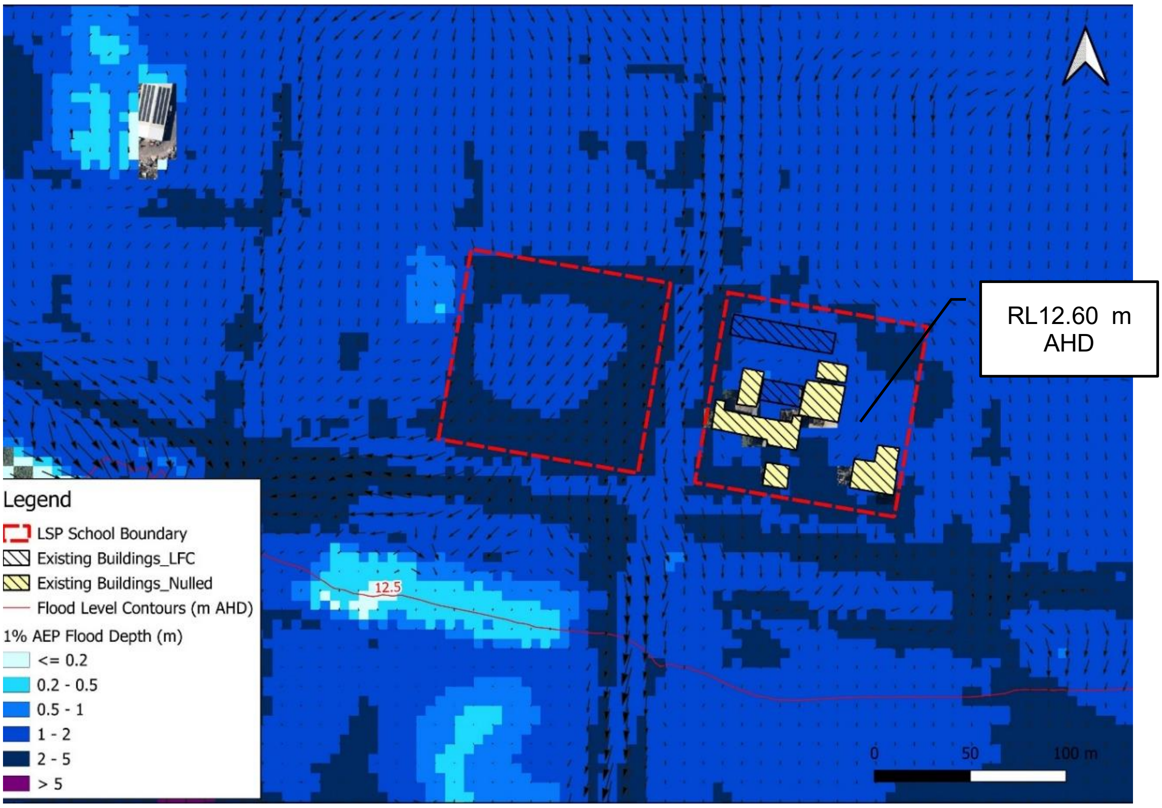


Figure 16: 1% AEP flood depths and levels at the LSPS site under existing site conditions

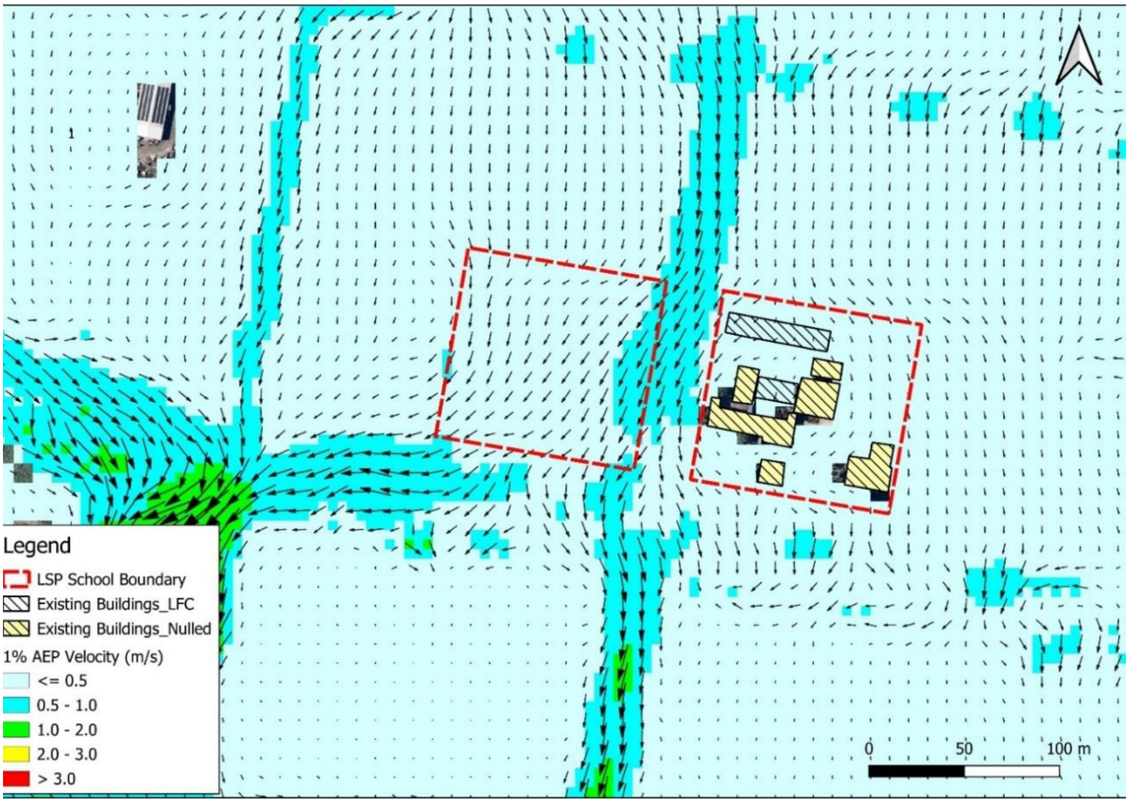


Figure 17: 1% AEP flood velocities at the LSPS site under existing site conditions

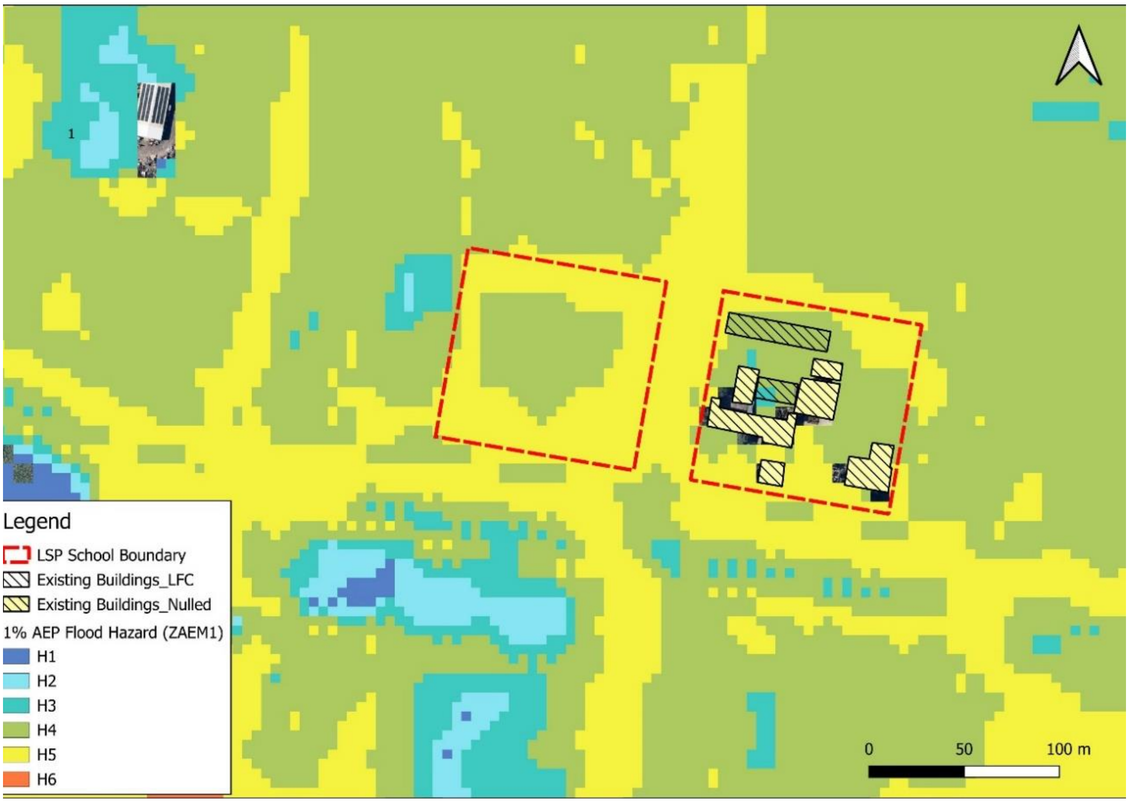


Figure 18: 1% AEP flood hazard categorisation at the LSPS site under existing site conditions

Figure 19: PMF depths and levels at the LSPS site under existing site conditions

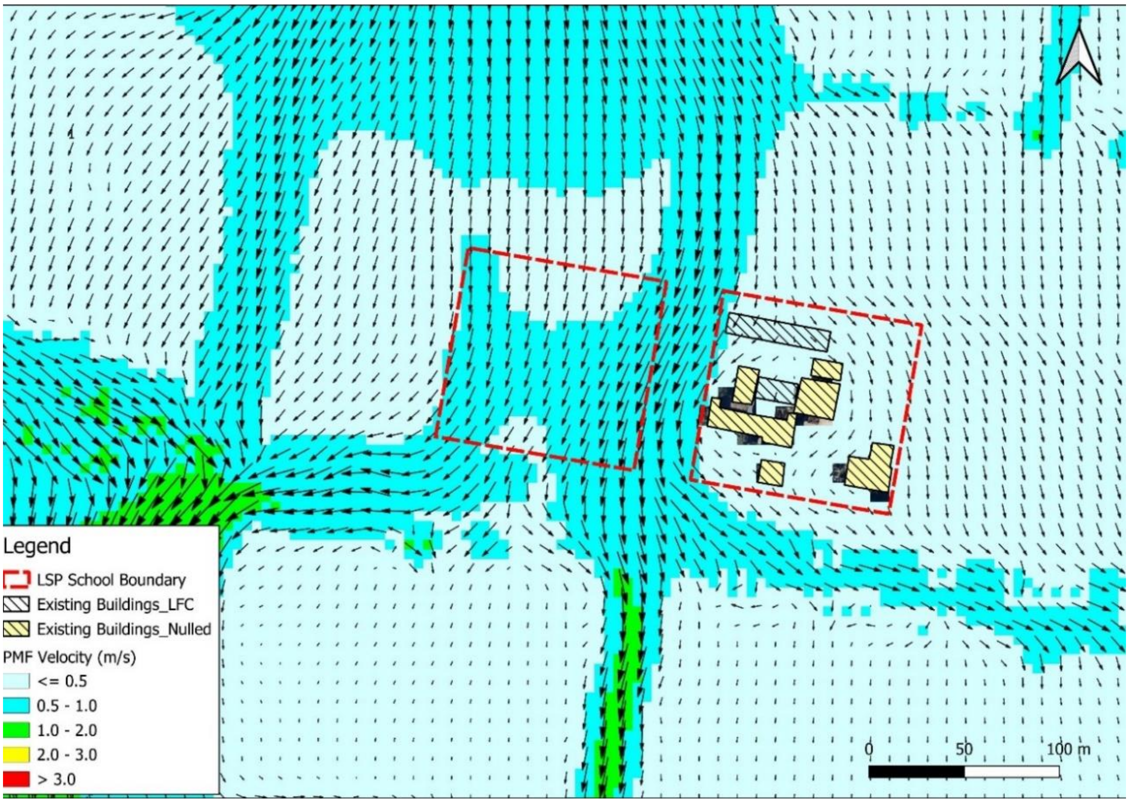


Figure 20: PMF velocities at the LSPS site under existing site conditions

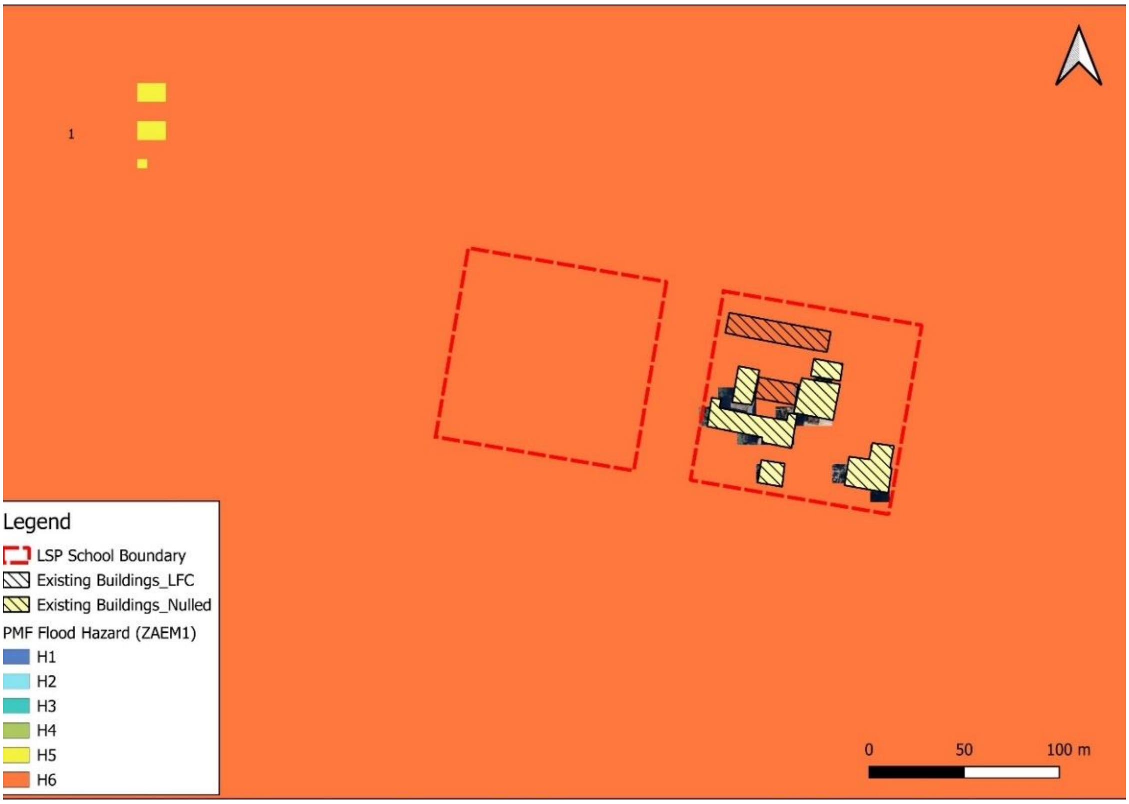


Figure 21: PMF hazard categorisation at the LSPS site under existing site conditions

5.2 Post-Development Flood Conditions

The existing conditions flood model was updated to create a post-development flood model by removing the existing buildings and incorporating the proposed buildings (based on the latest site plan in Figure 1). As aforementioned, all the proposed buildings are elevated, and were modelled using the Layer Flow Constriction approach in TUFLOW, allowing water to flow through the undercroft area beneath the proposed buildings. It should be noted that the proposed TIN design, prepared by the TTW Civil Team, is also incorporated into the post-development model.

The peak flood depths and levels, velocity, and hazard level in the 1% AEP event under post-development conditions is illustrated in Figure 22, Figure 23, and Figure 24, respectively. PMF results are presented in Figure 25, Figure 26, and Figure 27. Additional mapping for post-development flood behaviour in the 10% AEP, 5% AEP and 0.2% AEP events is attached in Appendix B.

It is important to note that the planning circular issued on 1 March 2024 states that extreme flood events, such as the 0.05% or 0.02% AEP, should also be considered, particularly for higher-risk proposals. While the site is acknowledged to be in a high-risk area, the structures have been designed based on the PMF flood event.

Regarding flood planning levels, the February 2022 flood level plus a 500 mm freeboard has been agreed upon as the flood planning level. Additionally, flood modelling has been conducted for the PMF event to assess flood impacts and risks, which is more severe than the 0.05% and 0.02% AEP events. Therefore, there is no need to consider these extreme flood events unless specifically requested by the relevant authority.

As demonstrated in the depth and level maps (Figure 22 and Figure 25), the incorporation of elevated buildings reduces flow obstructions onsite, which results in a small decrease in flood levels at the central portion of the eastern block. The flood level in the 1% AEP event varies from 12.60–12.64m AHD, while the PMF level varies from 16.72–16.77m AHD. Overall, the post-development model shows there are no significant impacts on flood depths, velocity or hazard level compared to the existing scenario. Section 5.4 provides a more detailed assessment of the impact of the proposed activity on flood levels at the site and over neighbouring properties.

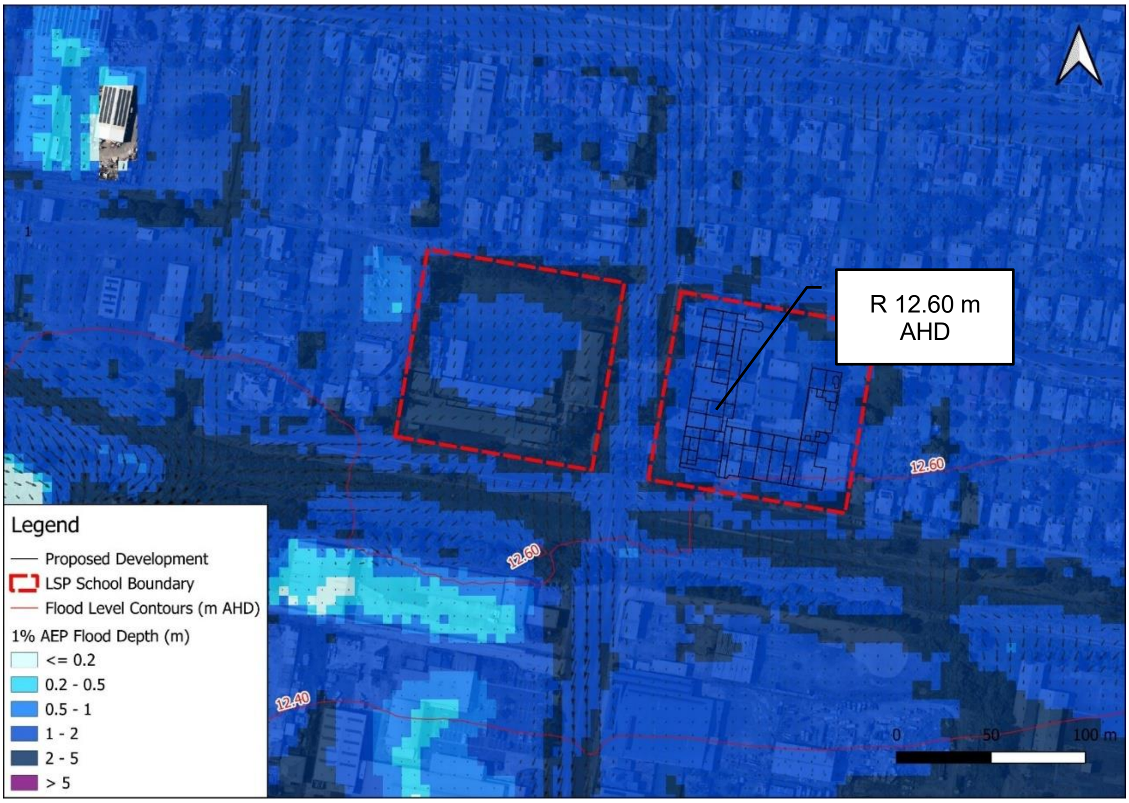


Figure 22: 1% AEP flood depths and levels at the LSPS site under post-development site conditions

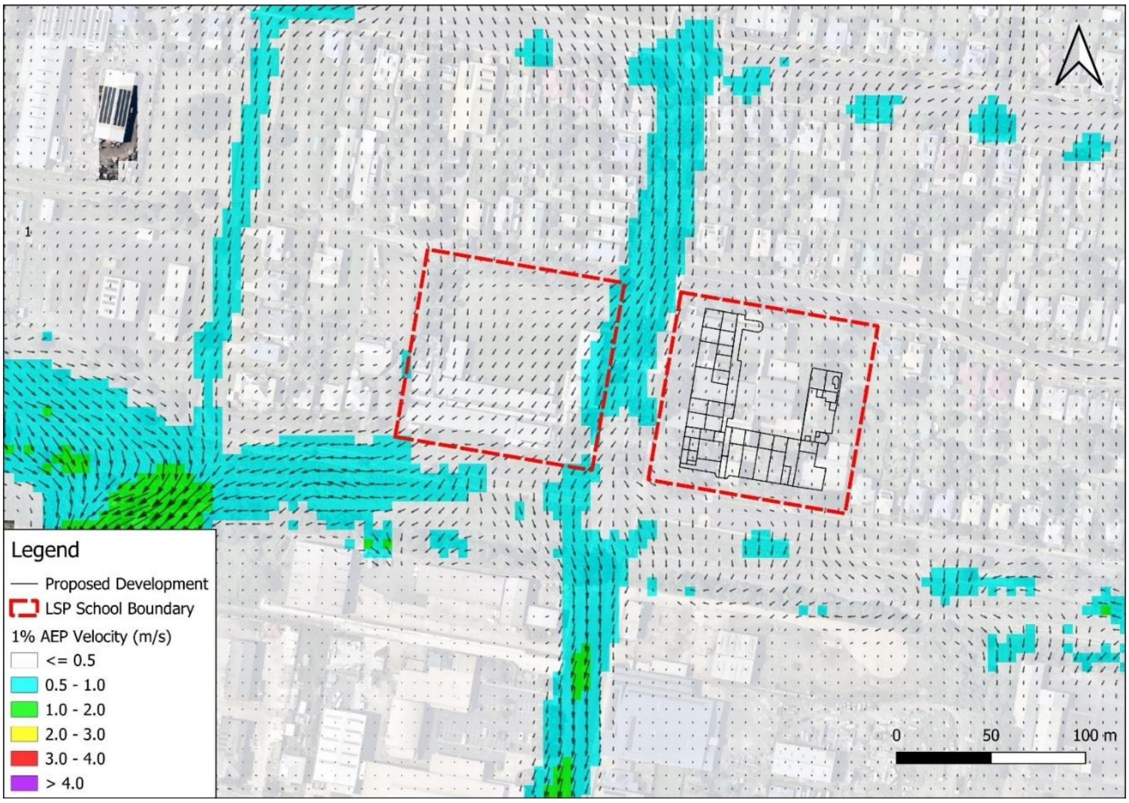


Figure 23: 1% AEP flood velocities at the LSPS site under post-development site conditions

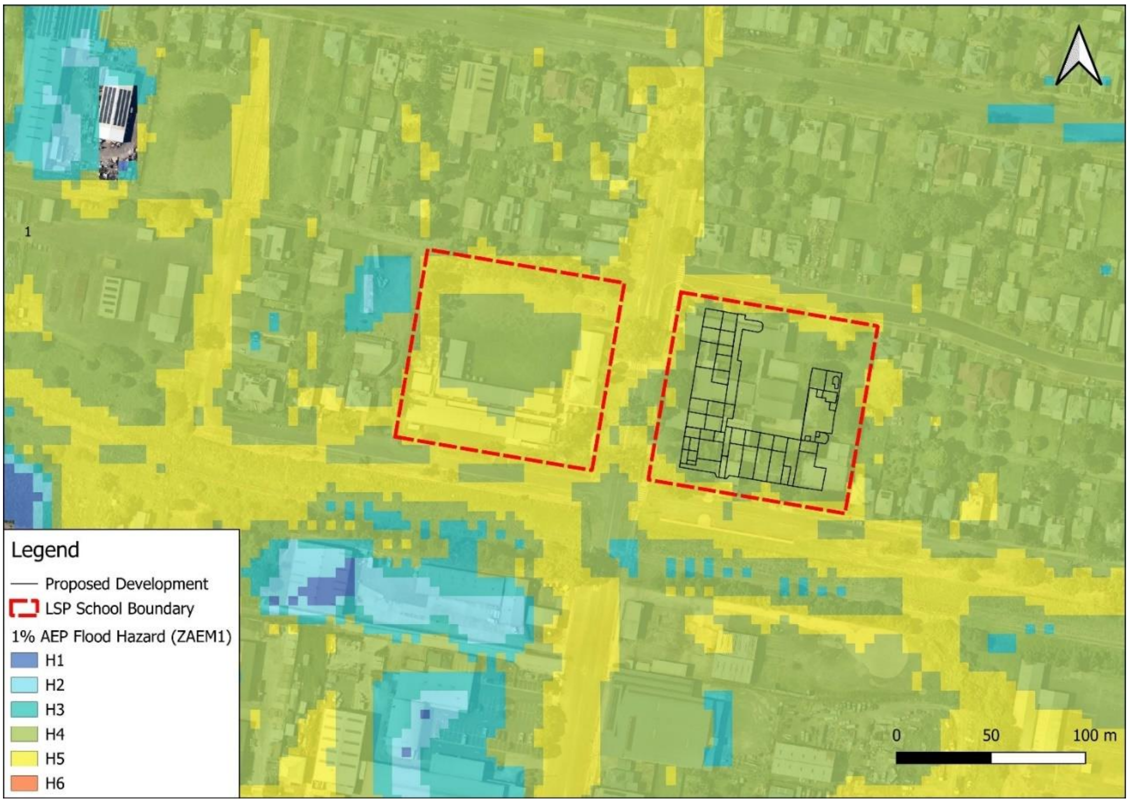


Figure 24: 1% AEP flood hazard categorisation at the LSPS site under post-development site conditions

Figure 25: PMF depths and levels at the LSPS site under post-development site conditions

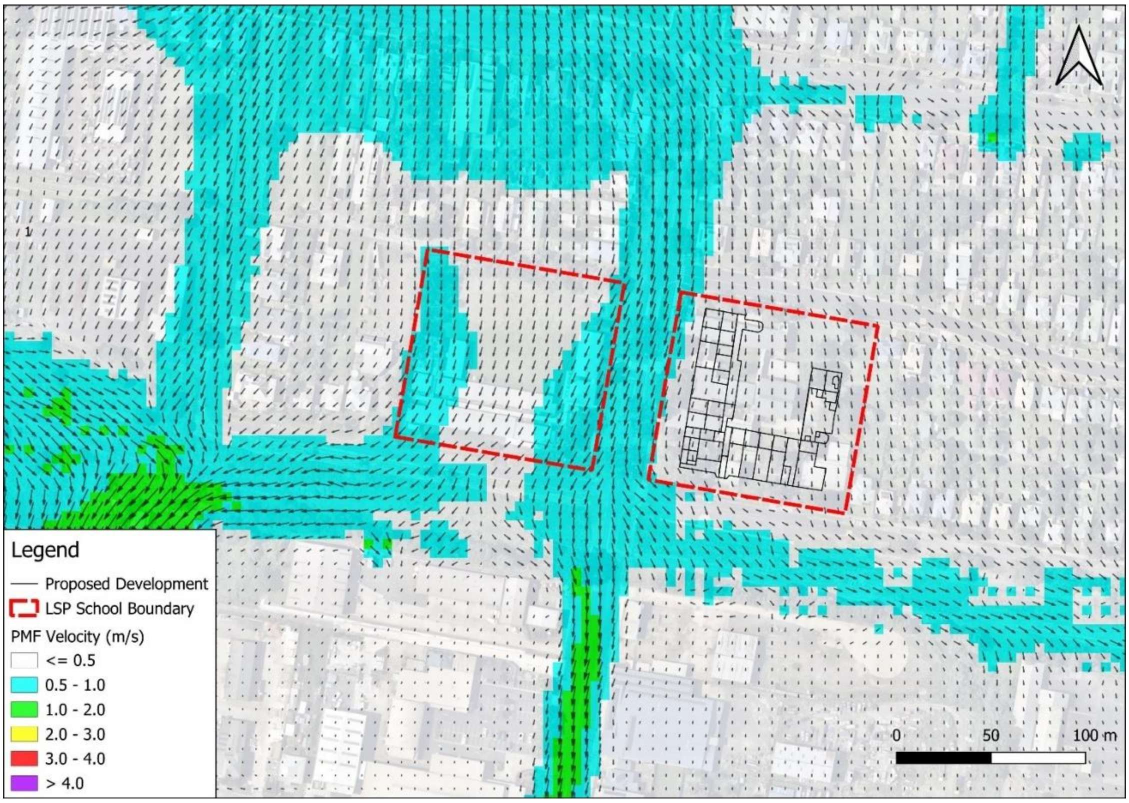


Figure 26: PMF velocities at the LSPS site under post-development site conditions

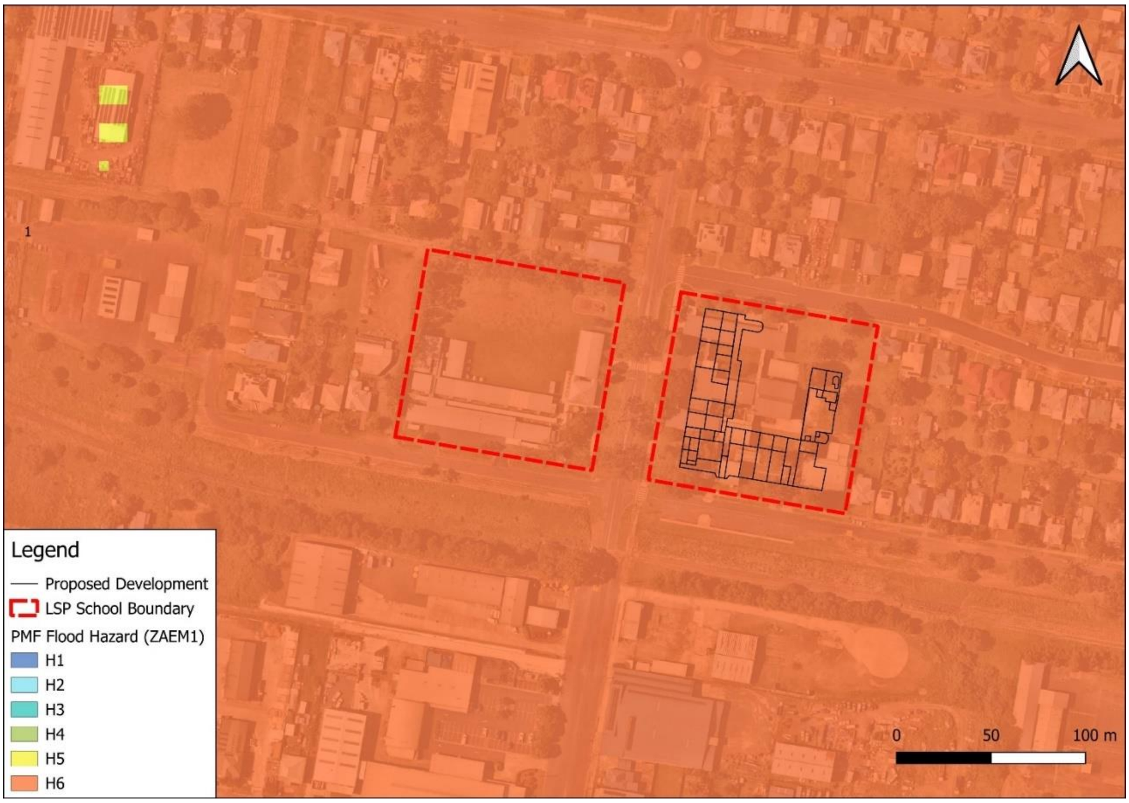


Figure 27: PMF hazard categorisation at the LSPS site under post-development site conditions

5.3 February 2022 Flood Event Simulations

The 2022 flood event stood out due to exceptional conditions, widespread, high-intensity (rare) rainfall over a considerable duration across an already saturated catchment. Between February 23rd and March 1st, there was unprecedented daily rainfall in the Richmond, Tweed, and Brunswick basins, particularly in the mid-Richmond and Wilsons River catchment near Lismore. The recorded daily rainfall figures were estimated to significantly exceed the thresholds associated with a 1% AEP event, a crucial benchmark for design considerations. The flood's frequency in 2022 was evaluated through an analysis of its AEP.

In a study by CSIRO (November 2022), the peak flow during the 2022 event was found to be notably higher than the 1% AEP at seven measurement points in the region, including the Lismore partial inflows (a partial estimate of streamflow at Lismore based on the sum of flows at two upstream inflows). These frequency estimates carry a considerable level of uncertainty, ranging from just under a 1 in 100 year frequency (1% AEP) to as rare as 1 in several thousand year frequency (up to 0.01% AEP for one station). Despite the uncertainty, this study suggested that the 2022 peak flow of Lismore partial inflows surpassed the 1% AEP threshold. This projection yields an expected AEP of 0.4% when excluding the 2022 flood from the frequency fitting, corresponding to a 1 in 250 ARI flood. When considering the 2022 flood, the expected AEP increases to 0.6%, equivalent to a 1 in 170 ARI flood.

Figure 28 shows the modelled flood depths and levels at the site during the February 2022 flood event (under existing site conditions), with a maximum flood level of approximately 14.45m AHD at the site. This is almost 2m higher than the 1% AEP flood level (12.60–12.65m AHD), and exceeds the 0.2% AEP flood level (13.11–13.16m AHD) by over 1m (see Appendix B for depth and level mapping for this event). These results suggest the February 2022 event was of a magnitude between the 0.2% AEP and PMF design events.

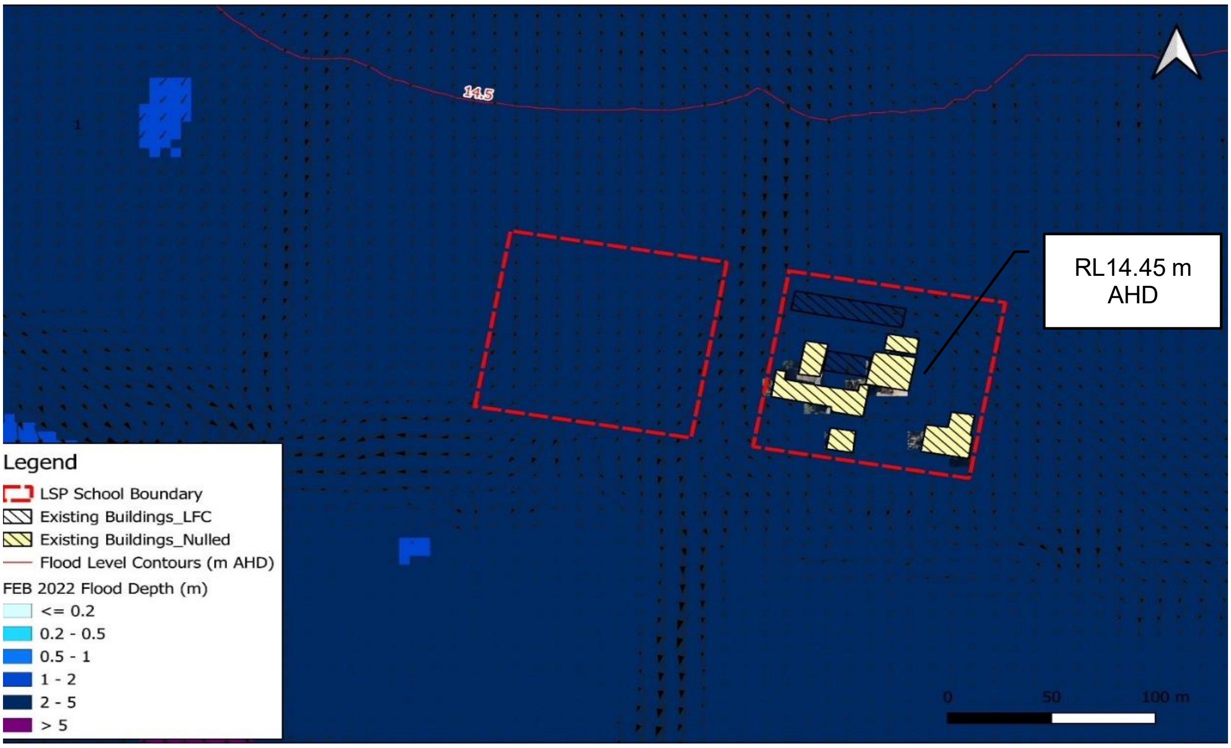


Figure 28: February 2022 flood depths and levels at the LSPS site under existing site conditions

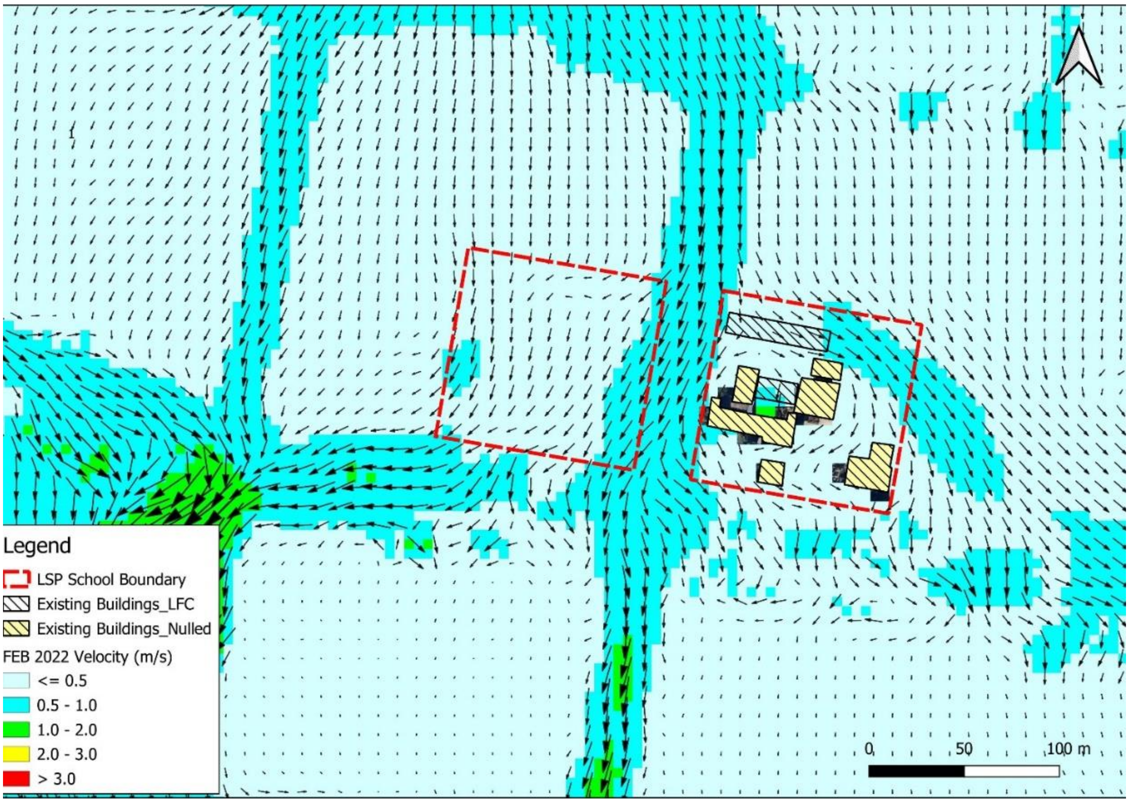
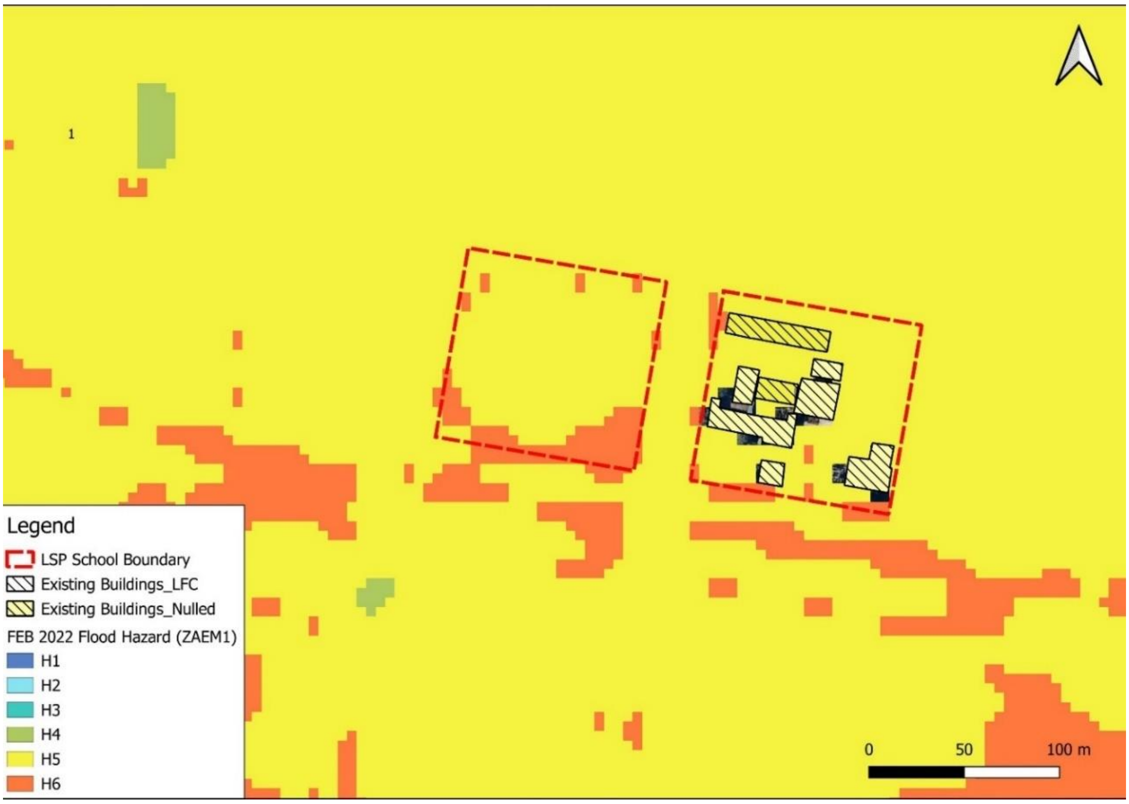


Figure 29: February 2022 flood velocities at the LSPS site under existing site conditions



Figur30: February 2022 flood hazard categorisation at the LSPS site under existing site conditions

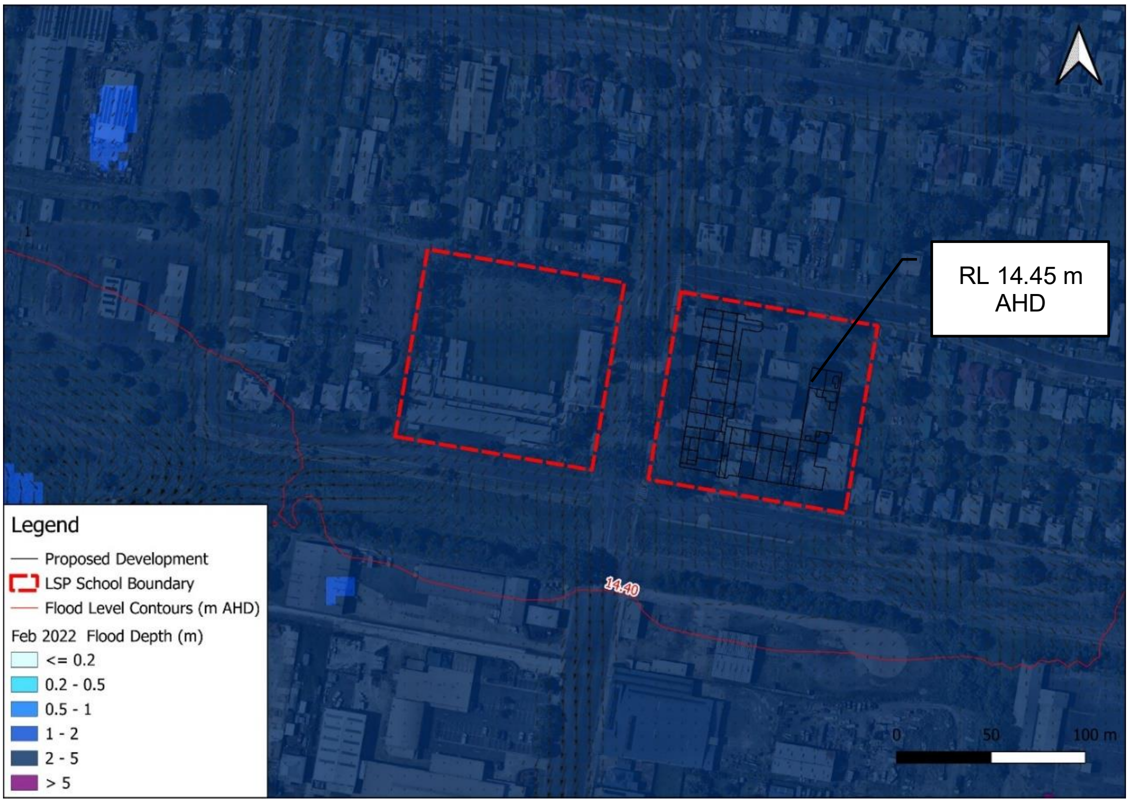


Figure 31- February 2022 Flood depths and levels at the LSPS site under Post Development site conditions

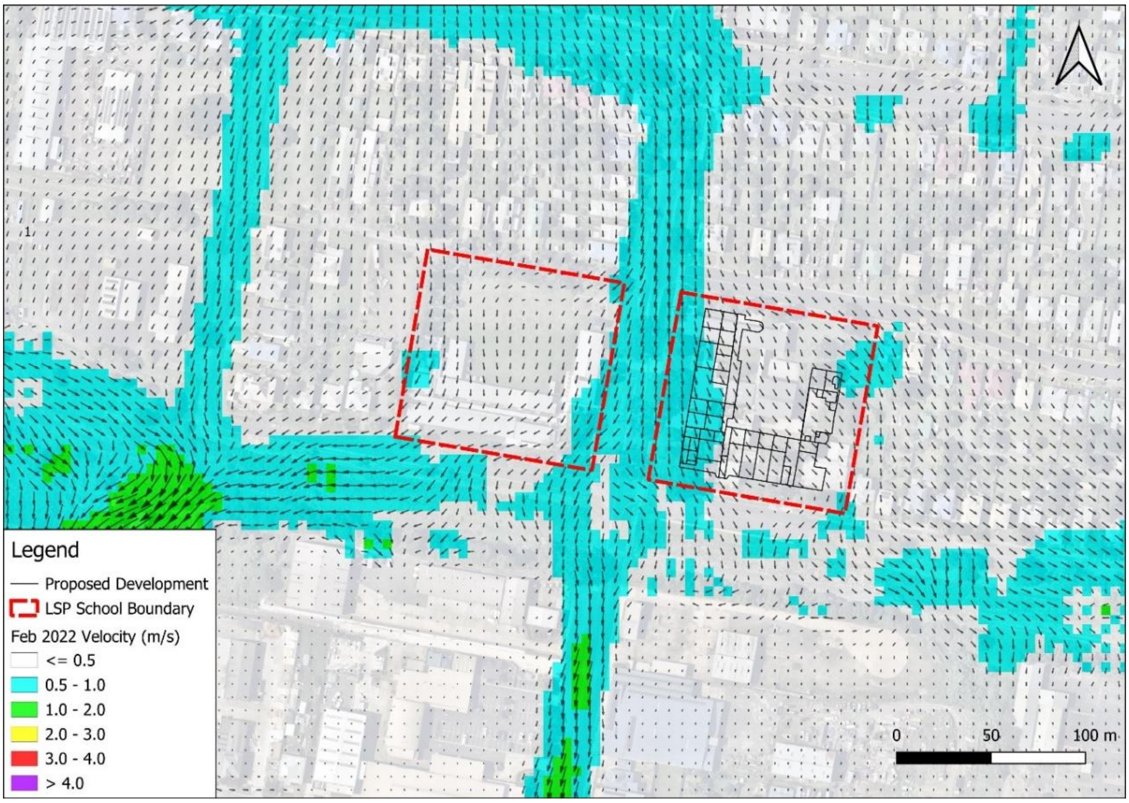


Figure 32- February 2022 flood velocities at the LSPS site under Post Development site conditions

Figure 33 - February 2022 Flood hazard at the LSPS site under Post Development site conditions

5.4 Offsite Impacts

A flood impact assessment has been carried out to ensure the proposed activity would not result in either an unacceptable flood level increase onsite or worsening of the flood conditions over the neighbouring properties in the 1% AEP and PMF events. Flood level impact maps are shown in Figure 34, and Figure 35, respectively.

The flood impact assessment confirms that changes in flood levels on neighbouring properties are less than 10 mm. For the 1% AEP event, a small portion within the site experiences an afflux of approximately 12 mm. For the PMF event, an afflux of 12 to 14 mm is observed along Willson Street to the west, Kyogle Street to the south, and the property located south of Kyogle Street. Given that the PMF flood depth exceeds 2 metres, this afflux is considered negligible.

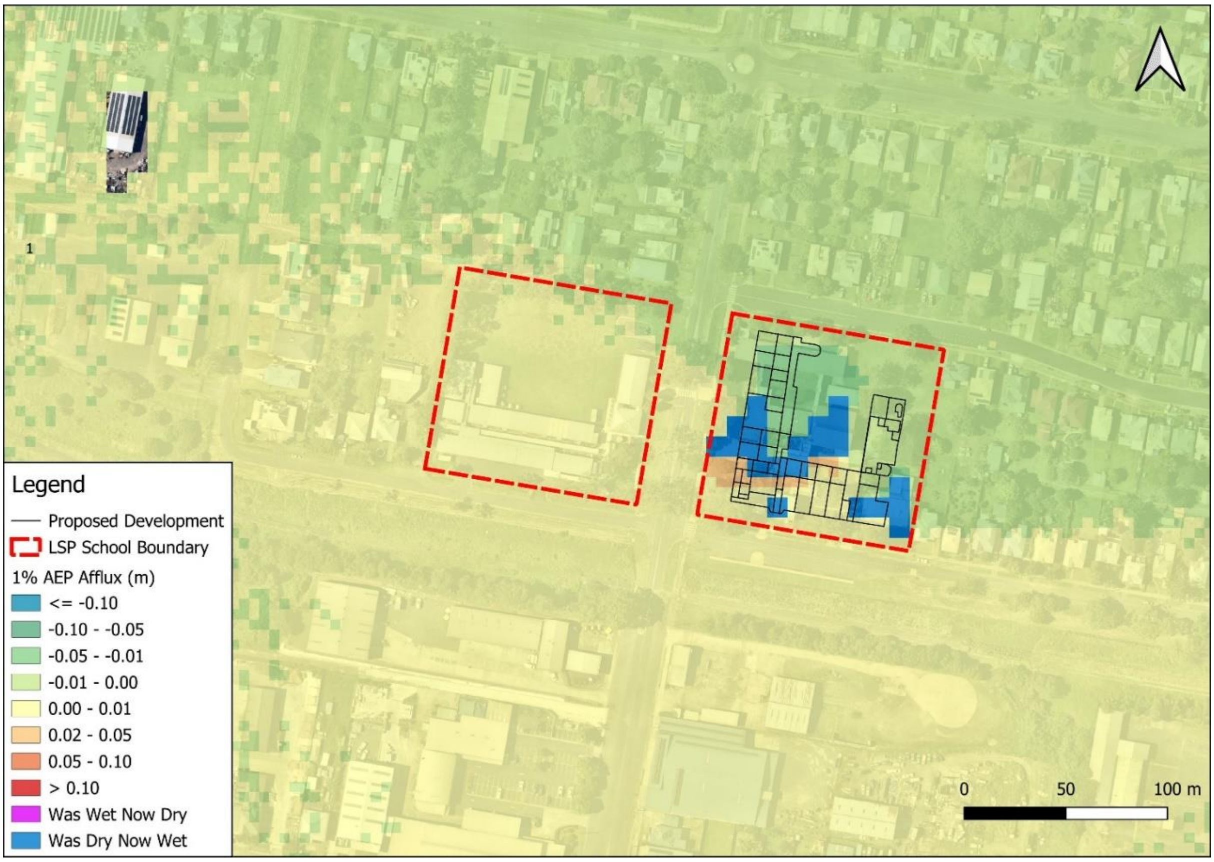


Figure 34: Flood level afflux – Impact of proposed activity on flood levels in the 1% AEP event

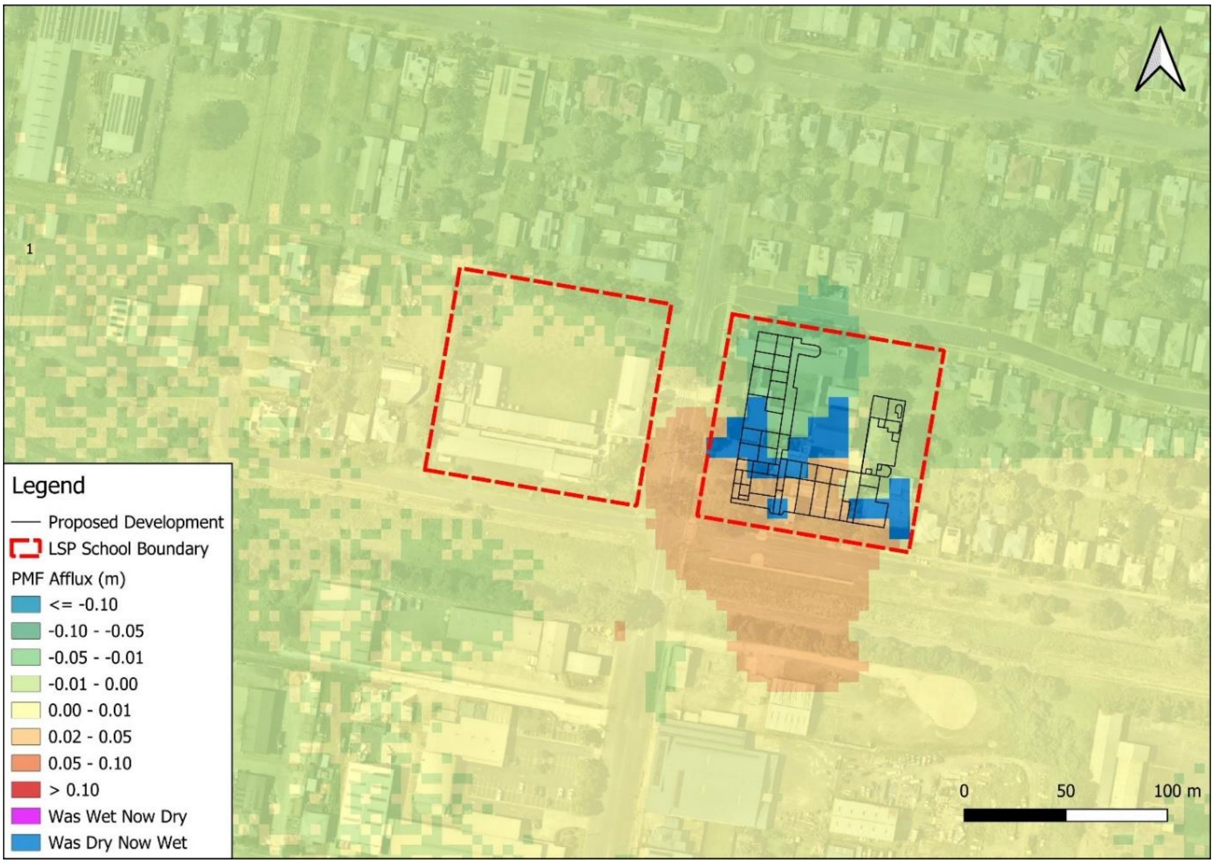


Figure 35: Flood level afflux – Impact of proposed activity on flood levels in the PMF event

5.5 Climate Change

Climate Change is expected to have an adverse impact on rainfall intensities, which has the potential to have significant impact on flood behaviour at specific locations. Climate change projections in NSW are generated by the NSW and ACT Regional Climate Modelling (NARCliM) project. The NARCliM projections for extreme rainfall are that both rainfall intensities and the frequency of extreme events will increase.

For this study, a sensitivity analysis has been carried out to determine the impact of climate change on local flood conditions under the 2090 RCP 8.5 climate change scenario. The impact of climate change was assessed through a 19.7% increase in 1% AEP rainfall (RCP 8.5), in accordance with the recommendation of ARR2019. Figure 36 presents the 1% AEP flood depths and levels around the site with the addition of climate change.

The climate change results show a flood level of 13.14–13.19m AHD at the site in the 1% AEP event, equating to an increase of 550–600mm compared to current climate conditions. This level is approximately equivalent to the flood level in the 0.2% AEP event (see Appendix B for 0.2% AEP maps, and Section 6.1 for a summary of flood levels in each event). With a proposed FFL of 14.95m AHD, the proposed buildings are therefore set above the 1% AEP climate change scenario flood level, and above the 0.2% AEP event surface water levels simulated.

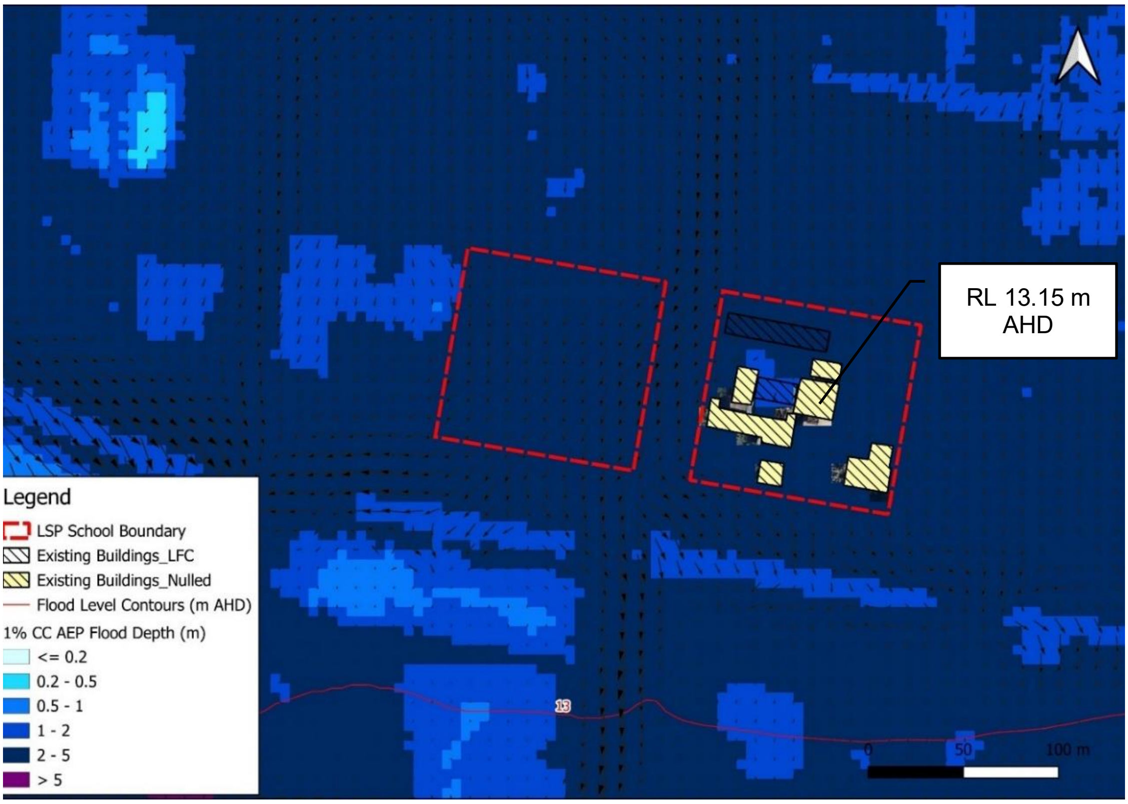


Figure 36: 1% AEP flood depths and levels at the LSPS site with the addition of climate change under existing site conditions

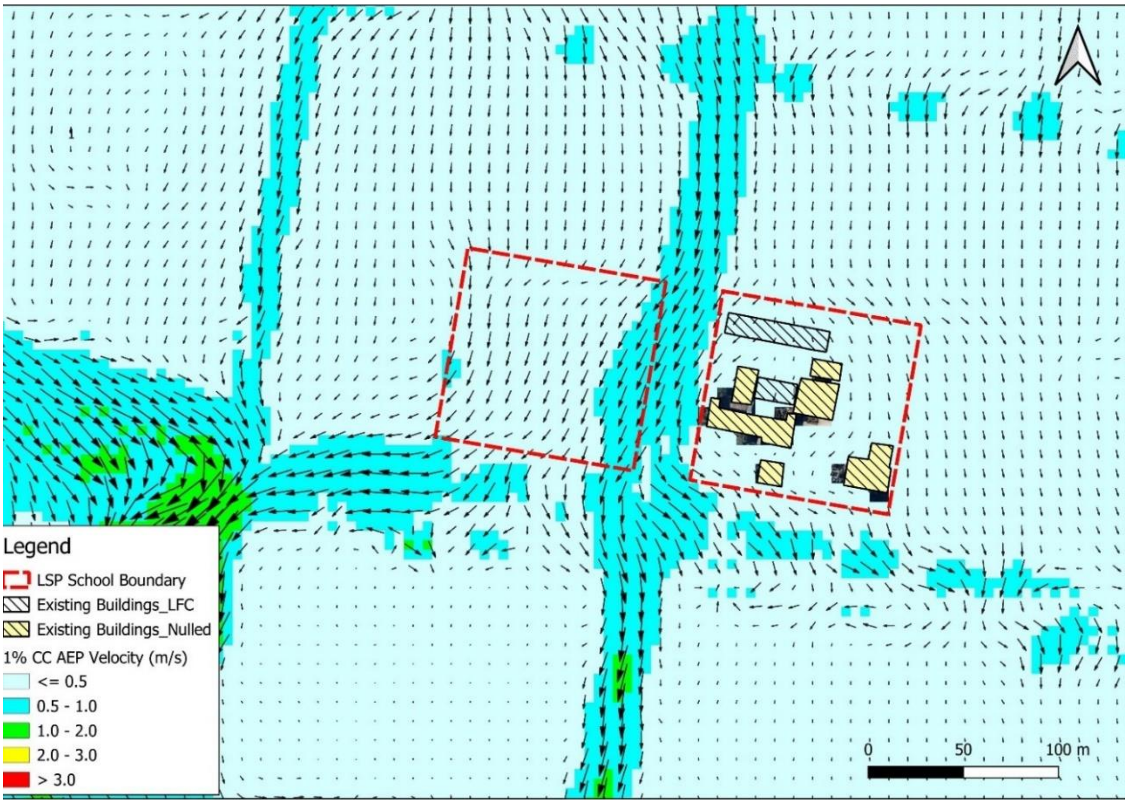


Figure 37- 1% AEP velocities at the LSPS site with the addition of climate change under existing site conditions

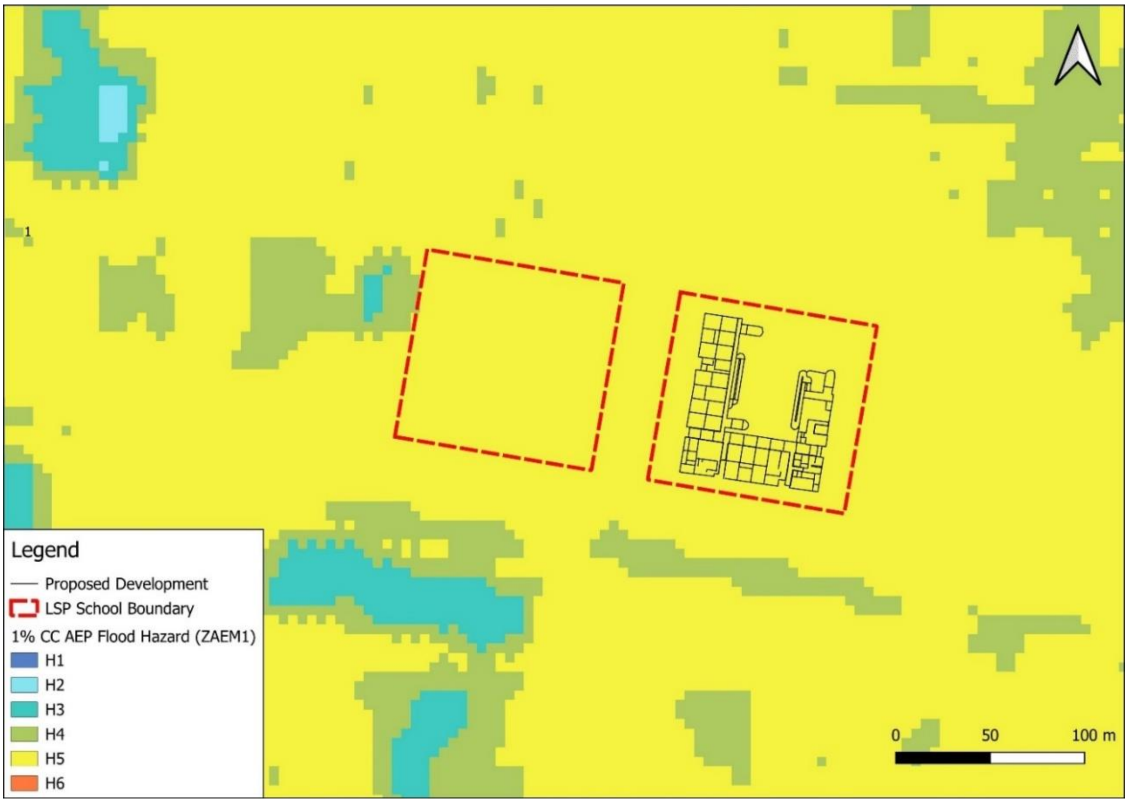


Figure 38-1% AEP flood hazard at the LSPS site with the addition of climate change under existing site conditions

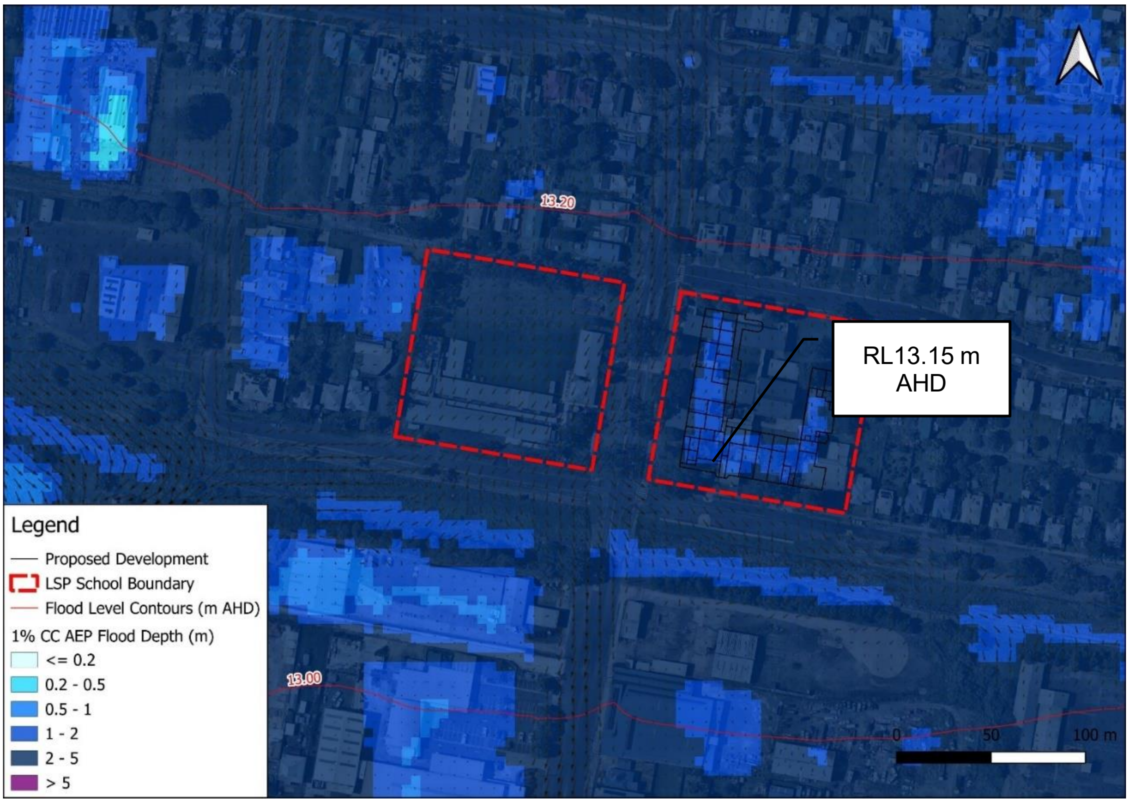


Figure 39-1% AEP flood depths and levels at the LSPS site with the addition of climate change under post-development site conditions

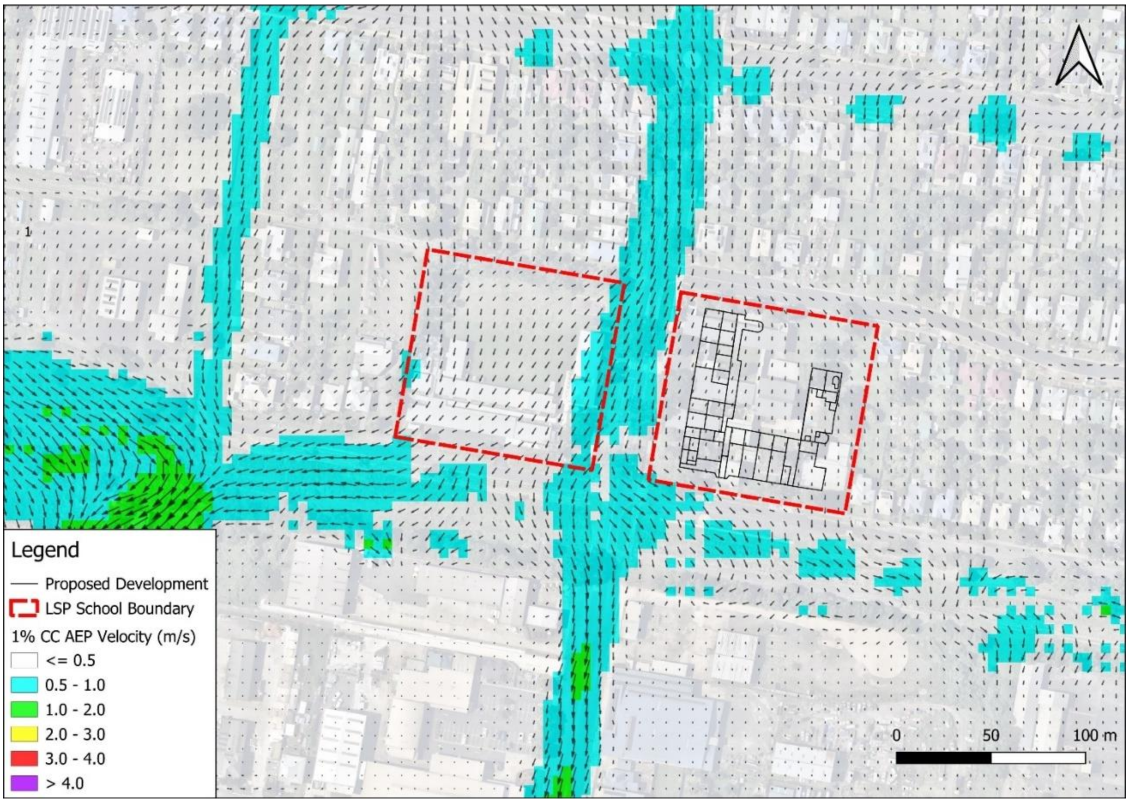


Figure 40- 1% AEP Velocities and levels at the LSPS site with the addition of climate change under post-development site conditions

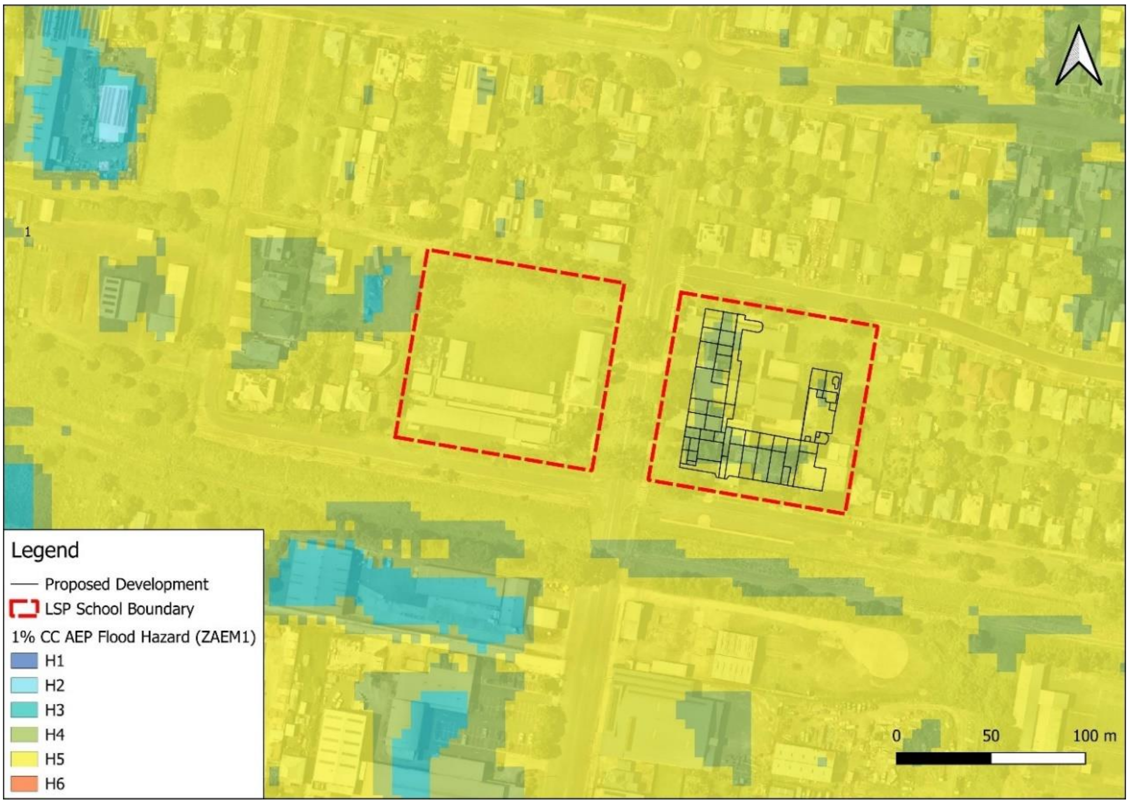


Figure 41- 1% AEP flood hazard at the LSPS site with the addition of climate change under post-development site conditions

6.0 Flood Planning Controls

6.1 Flood Modelling Results

The flood modelling results indicate the proposed building is impacted by flooding in all modelling events (even in the 10% AEP event). Table 6 outlines the flood level at the site in each flood scenario (under post-development conditions), ranging from a 10% AEP event up to the PMF event.

Table 6: Flood level within the site for various flood event scenarios

Flood Event	Flood Level at the Site (m AHD)	Comment
10% AEP	10.82 – 10.92	-
5% AEP	11.62 – 11.71	-
1% AEP	12.60 – 12.65	1% AEP + 500 mm freeboard is required for FPL under the 2012 DCP.
1% AEP + Climate Change	13.14 – 13.19	1% AEP + Climate Change + 500 mm freeboard required under the 2023 Draft and Interim DCP.
February 2022 Flood	14.42 – 14.45	Feb 2022 level + 500 mm freeboard has been adopted as the FPL for this project.
0.2% AEP	13.11 – 13.16	-
PMF	16.72 – 16.77	-

As aforementioned, the guidance on the Flood Planning Level (FPL), which informs the recommended Finished Floor Level for the development, varies between the current (2012) and draft (2023) DCPs. Both plans have been reviewed in relation to the LSPS site.

6.2 Current Development Control Plan (2012)

The controls within the Current DCP (2012) vary depending on what Flood Hazard Category the development is situated in. The 2012 DCP identifies four flood hazard categories:

- **Floodway**: areas of the floodplain where a significant discharge of water occurs during floods with high velocities and depths. These are usually aligned with naturally defined channels, and include areas that even if partially blocked, would cause a significant redistribution of flood flow or a significant increase in flood levels.
- **High Flood Risk Area**: areas in which there is a potential for flooding to cause danger to personal safety and/or loss or damage to light structures. Able bodied adults could have difficulty wading to safety.
- **Flood Fringe Area**: defined by the limit of the 1% AEP flood level contour but excludes areas within the Floodway or High Flood Risk Area.
- **Low Flood Risk Area**: defined by the limit of the PMF level contour but excludes areas within the Floodway, High Flood Risk Area or Flood Fringe Area.

The Council's LEP (2012) indicates that the site is located within the Flood Fringe Area, shown in Figure 42. These are areas where development will not impact on broad flood behaviour due to alteration of flow conveyance and storage (Flood Risk Management Manual, 2023). As a commercial development in the flood fringe area, the redevelopment of the LSPS site must meet the requirements outlined in Table 7 (see Section 8.6.2 of the current DCP).

Table 7: Flood controls for a commercial development in the Flood Fringe, taken from the current 2012 DCP

DEVELOPMENT CONTROL	TTW COMMENTS
An equivalent of 25% of gross floor area of the building to be at or above the FPL.	The recommended FPL in the current 2012 DCP is defined as the 1% AEP (average recurrent interval) flood event plus 500mm freeboard. In this case, the 1% AEP flood level is 12.65 m AHD, and with added freeboard (+ 500mm) the FPL = 13.15m AHD. This level is 1.3m lower than the February 2022 flood level (14.45m AHD), and equivalent to the 0.2% AEP flood level of 13.16m AHD.
A risk analysis report prepared by a structural engineer certifying that the design criteria adopted for the building will withstand the impact of flood waters and debris up to the 1 in 500-year flood ARI event. Such report to be submitted to Council with the Construction Certificate.	A Structural Design Statement, prepared by TTW on 18 December 2024, confirms that the structure has been designed to withstand the flood forces associated with the PMF event. For further details, please refer to the Appendix E.
Bulk fill to within 300mm of finished surfaced level is to be sourced from on-site, from the preferred excavation area or from another area on the floodplain. Minor increases in the depth of imported fill will be considered where it can be demonstrated that this is necessary to complement the design of the footings of a future building. If bulk fill cannot be obtained on-site, from the preferred excavation area or from another area on the floodplain, Council may approve fill imported from another source providing a flood impact assessment has been prepared by a suitably qualified consultant which demonstrates that the fill will have no adverse effects upon flood levels upstream or on flooding behaviour on adjacent properties.	The cut and fill calculations indicate a net fill for the project (1,469 m3). The cut and fill plan is provided in Appendix F.

6.3 Floodplain Risk Management Plan 2014

The site is also located within the South Lismore Flood Isolated Evacuation zone in the Floodplain Risk Management Plan 2014 (Figure 43), in which there is the potential for floodwaters to pose a danger to personal safety, cause damage to light structures, and create difficulties for physically capable adults to reach safety by wading. The safety of users of the site is additionally at risk due to inadequate evacuation routes and limited time for evacuation of large numbers of people.

The categorisation of a large part of this area as Flood Isolated (Evacuation) Precinct is due to hydraulic characteristics and the risk associated with evacuation of a high number of people, potentially up to 1600, and the relatively early cutting of potential evacuation routes, with the only effective route being via Union Street and the Ballina Street Bridge (according to the Floodplain Risk Management Plan 2014). There are no specific controls associated with this zone, but this is an important consideration in preparing for the flood emergency response strategy for the school. This has been addressed in TTW's Flood Emergency Response Plan (FERP) for the site.

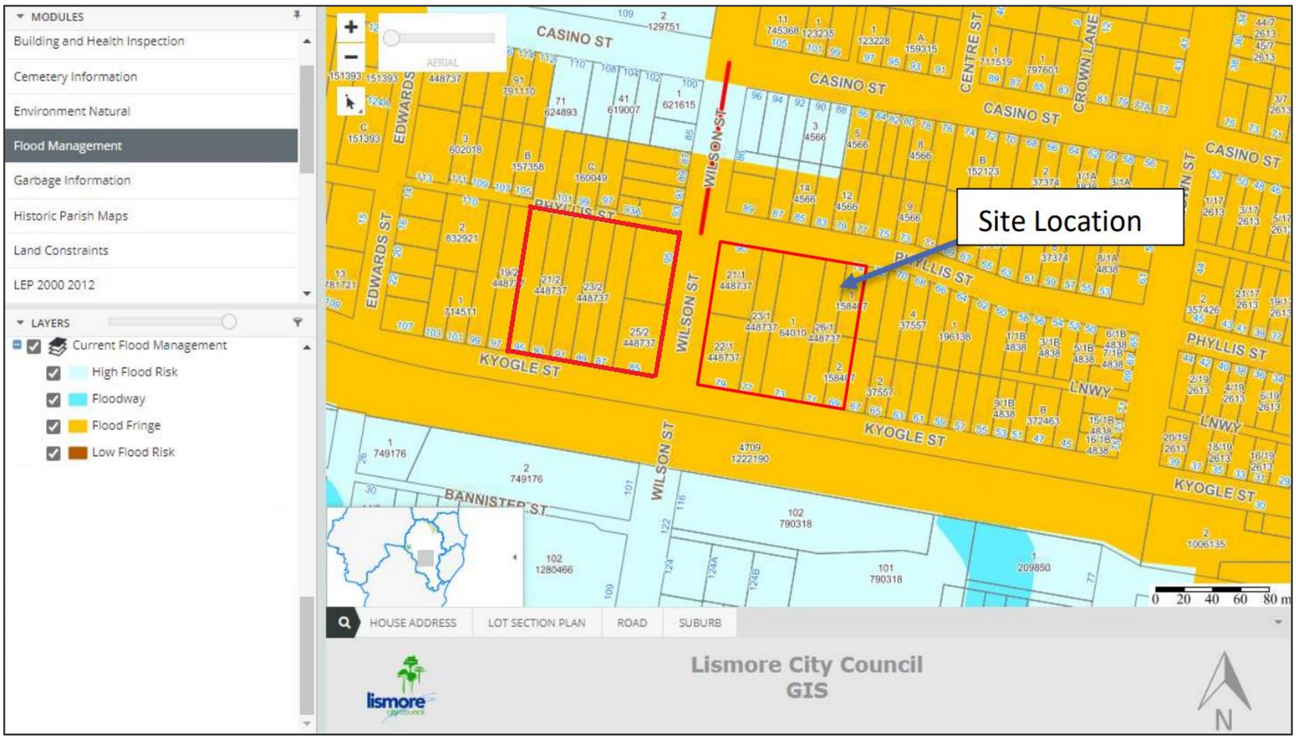


Figure 42: Flood risk categorisation in Lismore LEP (2012) based on the current 2012 DCP definitions

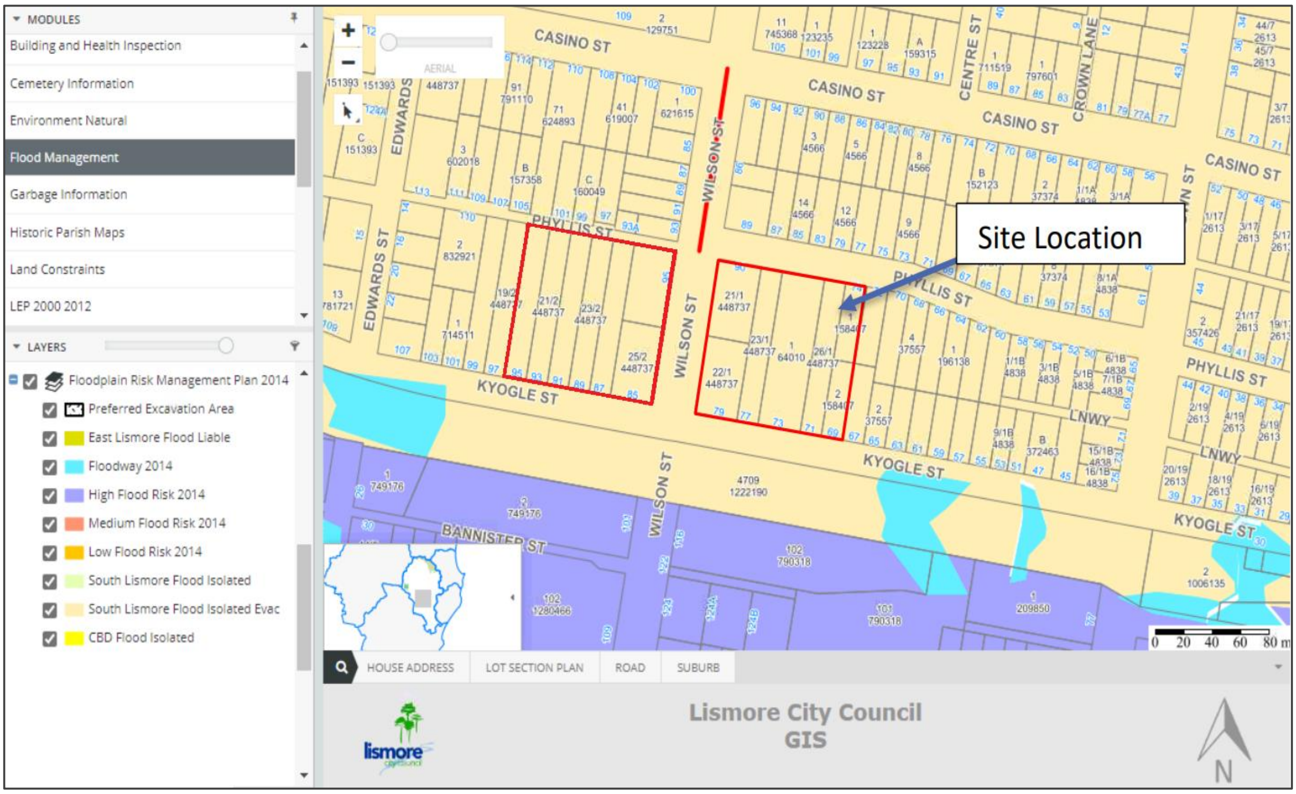


Figure 43: Flood risk categorisation based on the Floodplain Risk Management Plan 2014

6.4 Draft Development Control Plan (2023)

As aforementioned, there is a draft Revised Flood Prone Lands Development Control Plan published in 2023 that outlines the updated regulations for building on flood-prone land in the Lismore LGA. The draft DCP provided updated Flood Risk Precinct zones within Lismore, and updated guidance on the recommended FPL, now accounting for the potential impacts of climate change.

In the draft DCP, the site is categorised as within the High Flood Risk Precinct, and the South Lismore Development Restricted area, shown in Figure 44. Land within the High Flood Risk Precinct is characterised by high flood depths with significant risk to life and property. It includes areas that would experience H6 hazard in a 0.2% AEP event or a H5 hazard in the 1% or 5% AEP events.

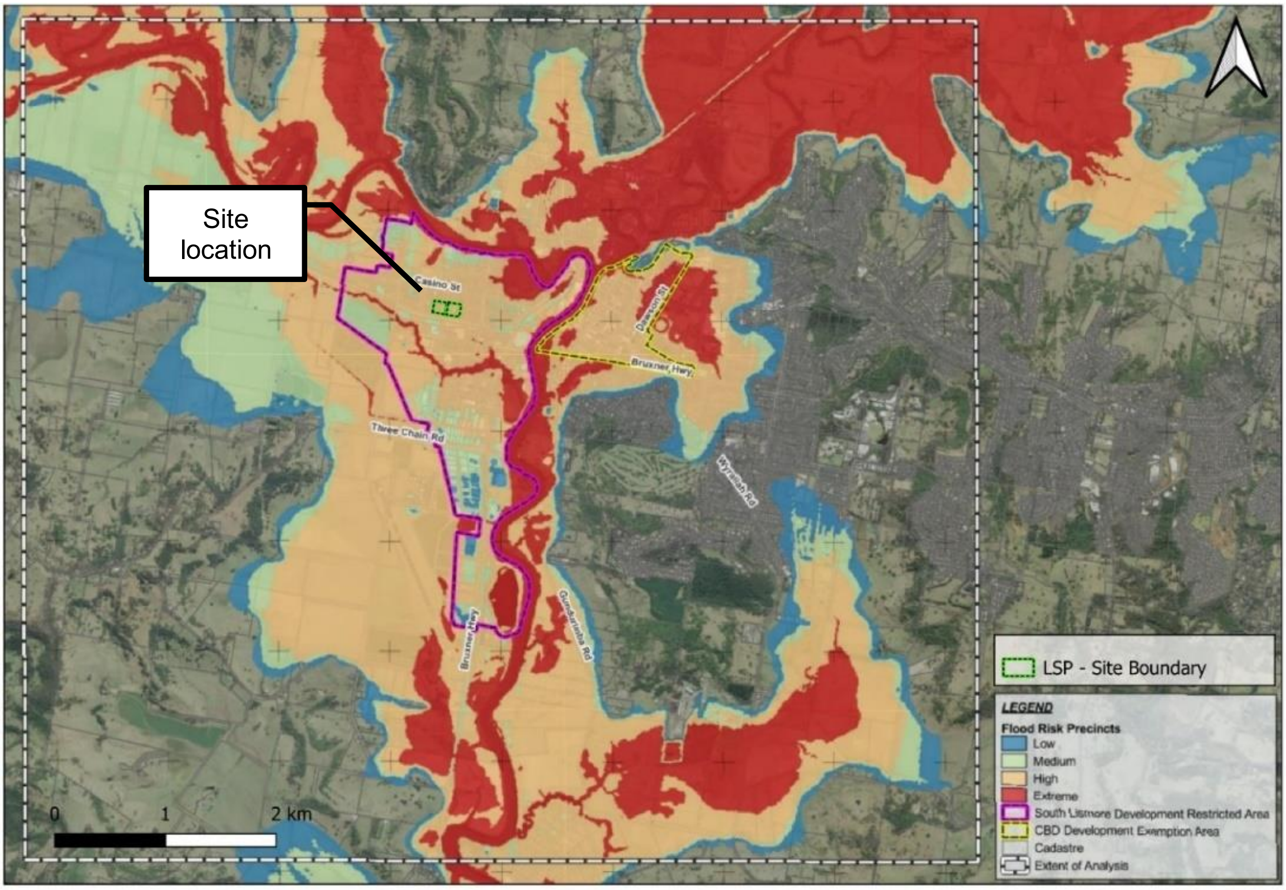


Figure 44: LSP Site in relation to Lismore Flood Risk Precincts (adapted from Lismore Draft DCP, 2023)

The planning controls related to a commercial development in the High-Risk Precinct and the South Lismore Restricted Development Precinct are set out in Table 8, taken from Section 4 of the draft DCP (2023). It should be noted that, in this DCP, educational establishments are reclassified as commercial developments. It should be noted that this draft has not yet been accepted by the council at the time of writing this report.

Table 8: Development controls for a commercial development within both the High Risk and South Lismore Restricted Development Precinct in the 2023 draft DCP

CATEGORY	DEVELOPMENT CONTROL	TTW COMMENTS
FLOOR LEVEL	• Non-habitable levels as close to FPL as practical. Where below the FPL, more than 25% of floor space must be higher l above the FPL.	In the draft DCP, the recommended FPL is the 1% AEP flood level + a climate change factor (that varies according to location) + 500mm freeboard. The climate change factor is based upon RCP 8.5, which represents a "worst-case" climate change scenario where rainfall intensity increases by 19.7% in 2090. Based on the climate afflux mapping provided in the draft DCP, the LSPS site is within the 0.5-0.6m climate afflux region. Based on the flood modelling results under post-development conditions, the FPL for the site is therefore 12.65m AHD + 0.6m climate change factor + 0.5m freeboard = 13.75 m AHD. This FPL is 0.6m higher than the FPL guidance in the current 2012 DCP. However, it is still 0.7m lower than the record-breaking flood of February 2022. The FPL, defined as the 2022 flood level plus 500 mm, was discussed and agreed upon in principle with SES, Lismore City Council, and DPHI in late 2023/early 2024. This level has been adopted as the FPL for this project.
FILL	• Fill required up to the 1:100 flood level. Bulk fill to within 300mm of finished surfaced level is to be sourced from on-site. No filling permissible in land identified as floodway.	The cut and fill calculations indicate a net fill for the project (1,181 m3). Based on Figure 43 the site located at flood fringe. The cut and fill plan is provided in Appendix F.
FLOOD AFFECTATION	• Flood impact and risk assessment (FIRA) required by a suitably qualified professional to certify the development will not increase flood affectation elsewhere. Such a report to be satisfactory to Council.	The FIRA (Section 5.4) confirms that changes in flood levels on neighbouring properties are less than 10 mm in 1% AEP Storm event. For the 1% AEP event, a minor afflux of approximately 12 mm is observed within a small portion of the site. During the PMF event, afflux levels between 12 and 14 mm are observed along Willson Street (west), Kyogle Street (south), and the adjacent property to the south of Kyogle Street. As the PMF flood depths exceed 2 metres, the resulting afflux is considered negligible.
BUILDING MATERIALS AND DESIGN	• All structures to have flood resilient materials below or at the FPL. Services such as air conditioning units, electrical switchboards, storage hot water units and water tanks to be placed above the FPL. • Fencing must be permeable to allow the passage of flood flows (minimum 90% void space) or be collapsible under flood flow.	These controls have been noted and discussed with the architects. A drawing with the flood-resilient requirements is provided in the site plan found in Appendix D. These requirements will be included during the detailed design phase.

	• Any enclosure below the flood planning level must have openings to allow automatic entry and exit of floodwater.	
STRUCTURAL SOUNDNESS	• Report required that includes certification by a suitably qualified professional that any structure can withstand the forces of floodwater, debris & buoyancy up to & including the 0.2%AEP (and PMF if on-site refuge is required). Such a report, to be provided at Construction Certificate stage, to be satisfactory to Council.	A Structural Design Statement, prepared by TTW on 18 December 2024, confirms that the structure has been designed to withstand the flood forces associated with the PMF event. For further details, please refer to the Appendix E.
EMERGENCY RESPONSE	• A site-specific evacuation plan prepared by a suitably qualified consultant must be submitted with any DA. • Development must have a road evacuation route to land above PMF.	A Flood Emergency Response Plan (FERP) has been prepared for this activity.
MANAGEMENT	• A business flood safe plan is to be provided addressing how safety and property damage (including fit outs and goods storage) is addressed, considering the full range of floods.	A business flood safe plan is prepared by TTW and provide with this FIRA.

6.5 Interim Development Control Plan

A new DCP (Revised Flood Prone Lands DCP - Post Exhibition [Clean]) has been provided to TTW for use in this study. This DCP is very similar to the draft DCP 2023, with only minor differences. Based on this DCP, schools are categorized as Commercial development. The site falls within the high flood risk precincts. Figure 45 shows the development controls applies to the commercial development within the high hazard precincts.

Flood risk precinct	Land use category	Floor level	Fill	Flood Affectation	Building materials and design	Structural soundness	Emergency response	Management
Extreme	Critical uses & facilities							
	Sensitive and hazardous							
	Residential							
	Subdivision							
	Commercial, industrial & community							
	Recreation & non-urban	4	3	1	1, 3, 4	1	1	2, 3
	Concessional development	1, 3, 5	3	2	1, 3	2	1	2, 3, 4
High	Critical uses & facilities							
	Sensitive and hazardous							
	Residential							
	Subdivision (except for residential)		1	2				1
	Commercial, industrial & community	4	1	1	1, 3, 4	1	1	2, 3
	Recreation & non-urban	4	1	1	1, 3, 4	1	1	2, 3
	Concessional development	1, 3, 5	1	2	1, 3	2	1	2, 3, 4
Medium	Critical uses & facilities							
	Sensitive and hazardous							
	Residential	1, 5	1	1	1, 3, 4	2	1	
	Subdivision		1	2				1
	Commercial, industrial & community	4	1	1	1, 3, 4	2	1	2, 3
	Recreation & non-urban	4	1	1	1, 3, 4	2	1	2, 3
	Concessional development	1, 3, 5	1	2	1, 3	2	1	2, 3, 4
Low	Critical uses & facilities							
	Sensitive and hazardous	2	1	1	2, 3, 4	3	1	2, 3
	Residential							
	Subdivision							
	Commercial, industrial & community							
	Recreation & non-urban							
	Concessional development	1, 3	1	2	1, 3	2	1	2, 3, 4

Figure 45- Control plans apply to the LSPS based on the Interim Development Plan

The minor changes are shown in Table 9 :

Table 9- Minor Changes to DCP

CATEGORY	CONTROL	DEVELOPMENT CONTROL	TTW COMMENTS
STRUCTURAL SOUNDNESS	1	Report required that includes certification by a suitably qualified professional that any structure can withstand the forces of floodwater, debris & buoyancy up to & including the 0.2%AEP (1:500 probability event), and additionally the PMF for commercial and industrial development, and where on-site refuge is required. Such a report, to be provided at Construction Certificate stage, to be satisfactory to Council.	A Structural Design Statement, prepared by TTW on 18 December 2024, confirms that the structure has been designed to withstand the flood forces associated with the PMF event. For further details, please refer to the Appendix E.
MANAGEMENT	2,3	An SES Emergency Business Continuity Plan is to be provided addressing how safety and property damage (including fit outs and goods storage) is addressed, considering the full range of floods. No storage of hazardous material is allowed below the flood planning level	A business flood safe plan is prepared by TTW. The project team has been informed that the storage of hazardous materials below the flood planning level is not allowed.

7.0 Mitigation Measures

Mitigation Measures identified as necessary are outlined in Table 10.

Table 10- Summary of flood mitigation measures

Mitigation Number/Name	Aspect/Section	Mitigation Measure	Reason for Mitigation Measure
Design Review Against Flood Impact Report	Detailed Design & Construction	- The design document should be reviewed during detailed design and construction to ensure compliance with flood impact assessment findings. - Any significant design changes should be evaluated for potential flood impacts.	- Prevents unintended flood risks. - Ensures consistency with flood assessment findings
Flood Emergency Response Plan (FERP)	Ref Approval	- Develop and implement a FERP to facilitate safe evacuation during severe flooding. - Conduct regular training and drills to ensure preparedness.	- Mitigates risks to students and staff. - Enhances emergency response efficiency.
Construction Flood Emergency Response Plan (FERP)	Construction	Develop and implement a Construction FERP to ensure safe evacuation during severe flooding in the construction phase	- Mitigate flooding risks to construction workers.
Using Flood-resistant material for structures located below or at the Flood Planning Level (FPL), and essential services, such as air conditioning units and electrical switchboards, will be positioned above the FPL.	Priorto construction	- Flood-resistant materials must be used for structures located at or below FPL. - Essential services (e.g., air conditioning units, electrical switchboards) must be positioned above the FPL. - Design teams and architects must confirm compliance during detailed design and construction.	To reduce the risk of flood damage
Regular Review & Update of FIRA	Ongoing	- The FIRA should be reviewed and updated every 5 to 10 years or after significant flood events. - Updates should incorporate the latest climate data, flood modelling.	- Ensures flood mitigation strategies remain effective. - Adapts to evolving climate risks and flooding patterns.

8.0 Conclusion and Next Stages

This report provides a Flood Impact and Risk Assessment (FIRA) for the proposed rebuild of Lismore South Public School in South Lismore and identifies the applicable development controls for the site. New site survey data, and the proposed civil design prepared by the TTW Civil team, were incorporated into Council's TUFLOW model to assess flood behaviour under existing and proposed site conditions. In addition, an updated modelling approach was adopted to improve the representation of elevated buildings at the site under both existing and proposed conditions, in a variety of design flood events ranging from the 10% AEP event to the PMF event. The following observations have been made:

- A flood impact assessment comparing existing and post-development flood levels demonstrates the proposed activity has no notable flood impact on surrounding properties in the 10% AEP, 1% AEP and PMF events. This is primarily attributed to the negligible flood storage filled by the proposed school (which is elevated on piers, with an FFL of 15.25 m AHD), in comparison to the large floodplain storage.
- The FPL defined as the 2022 flood level plus 500 mm, was discussed and agreed upon in principle with SES, Lismore City Council, and DPHI in late 2023/early 2024. This level (15.25 m AHD) has been adopted as the FPL for this project.
- The proposed activity of the LSPS site is regarded as a commercial development by Lismore City Council, and therefore it does not require protection up to the PMF event. Based on the current DCP (2012) the minimum Flood Planning Level (1% AEP + 500mm freeboard) for the site is 13.15m AHD. Based on the draft DCP (2023) the minimum Flood Planning Level (1% AEP + 0.6m climate change factor + 500mm freeboard) for the site is 13.75 m AHD. With a proposed FFL of 15.25 m AHD, the proposed buildings are set well above both DCPs minimum FPLs.
- The potential impact of climate change has been considered, with a 19.7% increase in rainfall intensity equating to a 600mm increase in flood levels at the site. This would result in a maximum level of 13.19m AHD, which is equivalent to the 0.2% AEP flood level and lower than the minimum Finished Floor Level of 15.25 m AHD for the proposed development.
- A hazard assessment has been completed in accordance with the flood hazard vulnerability curves set out in the Australian Disaster Resilience Handbook Collection (2017). The site is impacted by high hazard floodwaters in both the 1% AEP and PMF events (categorised as H4-H5 hazard level in the 1% AEP event, and H6 hazard level in the PMF). This will have implications for the evacuation of the site during rare flood events and has been considered in more detail in TTW's Flood Emergency Management Plan for the site.
- The proposed activity has been assessed, and it has been determined that the activity will not have a significant impact on the environment. Therefore, the development is not considered to pose a significant environmental impact.
- The implementation of building and material design controls—such as utilizing flood-resistant materials for structures below or at the FPL, positioning services like air conditioning units and electrical switchboards above the FPL, ensuring permeable fencing with a minimum 90% void space or collapsible fencing, and incorporating openings in enclosures below the flood planning level for the automatic entry and exit of floodwater—is to be integrated into the detailed design phase. (These aspects are not yet fully incorporated into the current design but will be considered during the detailed design).
- A qualified professional will ensure structures in the proposed development can withstand the effects of floodwater, debris, and buoyancy, covering events up to PMF. This evaluation will follow relevant guidelines and standards, and the resulting report will be delivered during the Construction Certificate stage.

Prepared by
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Associate (Flood)

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Appendix A
Part A - Risk Assessment

Appendix A
Part B- Meeting Minutes

Education
School Infrastructure

TSA

NORTHERN RIVERS FLOOD RECOVERY
RICHMOND RIVER HC & LISMORE SOUTH PS
COUNCIL, SES AND DPHI MEETING
MEETING MINUTES

Meeting Title:	Northern Rivers Flood Recovery – Richmond River HC & Lismore South PS Council and SES Meeting		
Date:	Monday, 26 February 2024	Time:	10:30am-11:35am
Location:	Microsoft Teams		

Attendees:	**Role:**	**Email:**
Mark Coyte (MCo)	Senior Project Director, SINSW	Mark.Coyte1@det.nsw.edu.au
Krystal Porteus (KP)	Project Officer, SINSW	Krystal.Porteus@det.nsw.edu.au
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Toong Chin (TC)	DPHI	Toong.Chin@environment.nsw.gov.au
Jason McCosker (JM)	Project Director, TSA	Jason.Mccosker@tsamgt.com
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Rodney Mallam (RM)	Planning Coordinator, Lismore Council	rodney.mallam@lismore.nsw.gov.au
Lucas Myers (LM)	Planning Coordinator, Lismore Council	
Peter Cinque (PC)	Senior Manager Emergency Risk Management, SES	peter.cinque@ses.nsw.gov.au
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Gillian Webber (GW)	SES	gillian.webber@ses.nsw.gov.au

Apologies:	Role:	Email:
Dean Birkett (DB)	Project Director, SINSW	Dean.Birkett@det.nsw.edu.au
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Martyn Charlett (MCh)		
Michael Trajkov (MT)	Senior Project Manager, TSA	Michael.Trajkov@tsamet.com
Olivia Britt (OB)	Structural Engineer, TTW	
David Caleo (DC)	Director, LCI	
Graham Snow (GSn)	Head of Planning and Environment, Lismore Council	graham.snow@lismore.nsw.gov.au

Minutes

Item	Description	Responsibility	Due Date
1.	**Acknowledgement of Country**		
1.1.	JM completed Acknowledgement of Country and acknowledged the Widjabul Wia-bal people of the Bundjalung Nation.		
2.	**Welcome & Introductions**	**Responsibility**	**Due Date**
2.1.	JM facilitated introductions and noted apologies.		
3.	**Code of Conduct / Confidential Information**		
3.1.	Due to the commercial in confidence aspects of the project, the code of conduct must be strictly followed by all parties involved.		
4.	**Meeting Purpose (Lismore South PS)**		
4.1	JM highlighted that the Project Team conducted Lismore South Public School (LSPS) due diligence since the last Council-SES meeting. The due diligence concluded in the viability of redeveloping on the existing LSPS site. MCo noted this is the Department of Education (DOE) preference. Due diligence results considered flood modelling, evacuation strategy, structural, and service integrity.		Note
4.2	The purpose of the meeting is to discuss the findings of the DOE due diligence prior to lodging to DPHI a request for SEARS to rebuild at LSPS. The objective of this meeting is to identify any other key issues for DOE consideration such as additional due diligence needs, including those related to flood safety and planning authority perspective.		Note
4.3	JM noted the authority process has been determined as a State Significant Development (SSD) as cost estimates are greater than the $50M CIV.		Note
5.	**Technical Due Diligence Overview**		
5.1	JM noted that the technical due diligence revealed substantial structural and service modifications were necessary to render the existing buildings operational and fit for purpose. In addition, raising the floor levels to the recommended height was not structurally sound and cost prohibitive. As a result, reusing the existing buildings is not supported.		Note
5.2	Further due diligence has been undertaken to support the school's reconstruction on the existing site. This included: 1. Flood modelling and evacuation strategy 2. Structural and Service assessment based on flood model and velocity of water.		Note

Item	Description		
	3. Planning advice. This due diligence has been completed, and the principal consultants summarised their findings.		
6.	**Flood Impact Assessment Results**		
6.1	PM Summarised the flood modelling findings also refer to the presentation in Appendix A: Site Flood Category: H5 • This is generally unsafe for vehicles and people regarding depth • Buildings will require special engineering design and construction • A flood evacuation strategy will be required. Planning Considerations and Floor Levels: • DCP categories define the area as industrial and community, which means there is no required protection at PMF event. • Draft DCP floor level is set at the one in 500-year flood level+ 500mm freeboard. • This floor level is 13.7 which is 0.7m below peak level in 2022 at the existing site. • The project intends to a flood planning level of 14.6m is recommended for habitable spaces. This is based on 2022 level and in considerations of other flood events (2%, 5%, 10%). • DOE are further considering designing the flood level at 14.9 as further risk mitigation. This equates to 0.5m above the 2022 flood level.		Note
6.2	JM confirmed the LSPS minimum habitable floor level will be at 14.9 which is based on the February 2022 flood level +500mm freeboard.		Note
6.3	PM confirmed that the 0.2% AEP flood level was less than the February 2022 level.		Note
6.4	TC stated in 1989, a 1% flood made its way into Lismore from Leycester Creek. It is recommended that flood modelling consider the scenario where the Leycester Creek catchment (only) well creates a flooding event.	TTW	11/03/24
6.5	MCo noted setting the building floor height under the above criteria is viable for DOE. However, planning floor levels to the PMF level is unviable. Meeting attendees noted and supported the above approach.		Note
7.	**Flood Emergency Response for the School**		
7.1	PM summarised the draft evacuation strategy that has considered SES initial comments, also refer to the presentation in Appendix A: Key findings: • During a PMF event, the site is impacted by flooding approximately 11-12 hours after the onset of the storm. • Forty-eight (48) hours following the first impact at the school, the site remains inundated with hazard levels of H5, therefore shelter in place is not a viable emergency response strategy for the school. Flood Response: • Based on previous floods the LSPS can be evacuated between 2- 4 hours.		Note

Item	Description		
	• In the February 2022 floods, there was over 12 hours advance notice, and PMF hydraulic modelling shows 11-12 hours between storm onset and school inundation. If all students and staff evacuate safely in 4 hours, the Lismore community can evacuate in 7-8 hours. • A preferred assembly point at the school will be identified (currently nominated to be the hall). In the event of an evacuation order, staff are to gather all students and staff at the assembly point and perform a headcount. • East along Elliot Rd, Wilson St, the Ballina St Bridge, and Ballina Rd is the planned emergency evacuation route. This route extends outside the PMF region to Southern Cross University (SCU), a Lismore City Local Flood Emergency Sub Plan (2018) flood evacuation centre endorsed by the NSW SES in 2023. The February 2022 flood evacuation centre was at SCU. • Bureau of Meteorology (BOM) specification report recommends target warning lead time of 12 hours to evacuate Lismore residents.		
7.2	EO noted: • A preference is for the school to be closed once there was a flood watch alert, advising this will allow parents and students to leave in a timely manner and there will be no requirement for emergency evacuation from the school. • By comparison, another school had encountered flood watch alerts on average twice a year which was reasonable. JM noted the project will investigate and consider the flood watch alert to optimise additional time.	TTW	11/03/24
7.3	EO noted when the community is evacuating, it is unlikely students will evacuate to the school hall and student are to evacuate to the nominated community location. PM confirmed this is clear within the report.		Note
7.4	KU advised the emergency response plan could further consider and detail how the school will be informed of flood warnings, noting this is relayed by SES. An example being the use of the "Hazards Near Me" app for notifications, stating these are provided based on pre trigger levels which creates more certainty for evacuation.	TTW	11/03/24
7.5	TC Noted: • the Lismore community act quickly when a flood watch is announced. • Historically the river rises at 0.5m/hr, therefore once the flood rises from 5m to 10m AHD, a 10 hour timeframe is understood at this stage.		Note
7.6	RM asked about evacuation, the proposed path over Ballina Rd to the University, and whether the school has buses to carry students to the community evacuation centre if parents cannot go. Whether the school has emergency evacuation buses is unclear. JM noted the project team will take this up with LSPS to understand their existing evacuation strategy and access to emergency buses to be detail in the response plan.	TSA	11/03/24

Item	Description		
	• Major plant such as hot water cylinder for hydraulic to be positioned above flood level where possible. • Usage of PVC for corrosion resistance and the drainage is to include expansion joints to prohibit damage from another flood. • it appears the electrical substation is sufficient however this is to be confirmed at the next design stage and will be upgraded if required.		
9.	**Preferred Masterplan**		
9.1	KG confirmed considerable consultation with the school has taken place to develop the design. KG presented the plans and blocking package, refer Appendix A.		Note
10.	**Planning and Authority Process**		
10.1	MK summarised the planning analysis and strategy, also refer to Appendix A: • The project will be via the SSDA pathway based on the CIV being above $50M. • The SEARs process is currently critical path and the team is proceeding with a project specific SEARs in lieu of industry specific. This will require a more detailed request for SEARs. • The agreed process with DPHI is to request industry specific SEARS, which is to be rejected and then we reapply for project specific SEARs. • Once SEARs has been provided the project team is to address all technical points and further engagement to develop the Environmental Impact Statement. Additionally, the LEP will be addressed. • Considerations for the requirements of the Draft DCP will also be addressed.		Note
10.2	AP advised that the Council did not recently endorse the Draft DCP via the last Council meeting. Therefore, there is no time frame for a new DCP. MK requested clarity on the classification of commercial establishments and whether this is likely to shift. AP stated this is a difficult position as it has been rejected by Council, however the reasoning for Council not supporting the Draft DCP was not connected to the planning matters considered at LSPS and thus unlikely to change. AP further noted the Engeny interim report is available for flood planning controls and recommendations made for DCP. RM noted uncertainty regarding Council debating establishment of DCP, noting this is not believed to be an issue and even if draft DCP is not adopted based on this presentation best practice is expected for this site.		Note
10.3	MK noted a full scoping report is to be included in SEARs request and proposed approach, advising any feedback in the submission is to be included.		Note
11.	**Open Discussion**		
11.1	MCo invited Council, SES, and DPHI to furnish any additional responses regarding the Project Team's due diligence and recommendations. It is critical to comprehend key issues or critical areas that require attention.		Note
11.2	Council: AP noted given this will be an SSD, the approach to rebuild at existing site which is above 2022 flood event which		Note

NSW Education School Infrastructure TSA

Item	Description		
	is to service the community is a great outcome for the council. The proposal is looking to rebuild the school in a better way will be supported by Council.		
11.3	Council: RM noted that the LEP will need to be addressed as apart of the SSD. MK believes that the proposal will address this and will be fully detailed in the authority submission.	Gyde	11/03/24
11.4	DPHI: TC stated it is common to assess risk versus consequence, noting this is a H5 risk and an assessment is normally conducted of consequence and potential outcomes. The Project Team to consider a risk assessment for the site.	TSA	11/03/24
11.5	SES: No further comment to those provided through the meeting.		Note
11.6	JM noted that there appear to be no obstacles to rebuilding the school on the current location, and all present are supportive. All significant meeting actions should be considered by the Project Team. Key Actions: • All surrounding catchments to be considered in the flood model. • The evacuation strategy to consider closing the school at flood watch with notifications to be clearly detailed. • Evacuation strategy for the school to be assessed and determine if buses are available for students that do not have parents to collect them. • Detailed risk analysis to be considered in the authority submission.		Note
12.	**Other Business**		
12.1.	JM noted that Richmond River High Campus is still looking for a preferred locality and is under due diligence on a number of sites. Once a preferred site is selected further engagement with this group will be requested.		Note

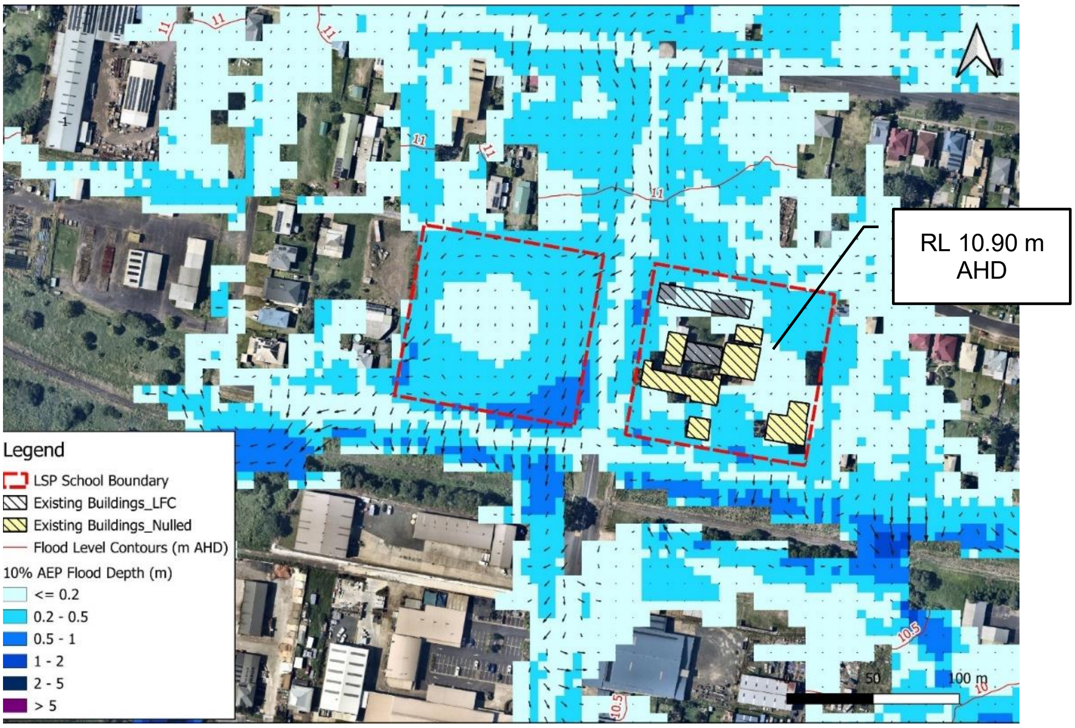
Appendices:

Appendix-A – NRFR – SES_Council Meeting Presentation - 240221

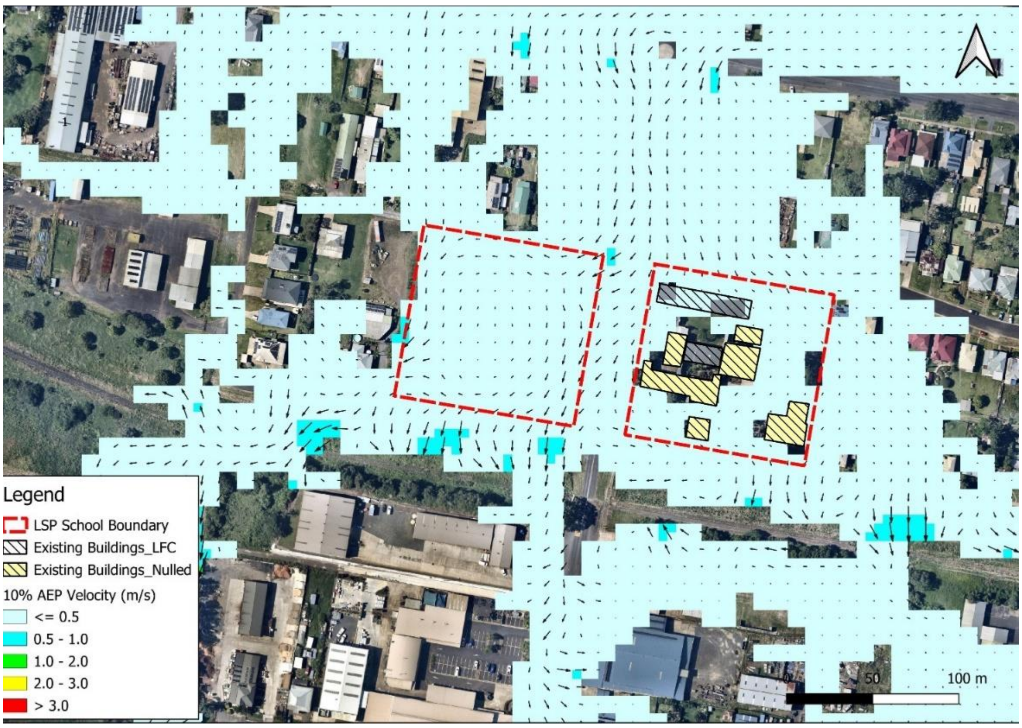
Appendix B

Additional Flood Maps – Existing Scenario

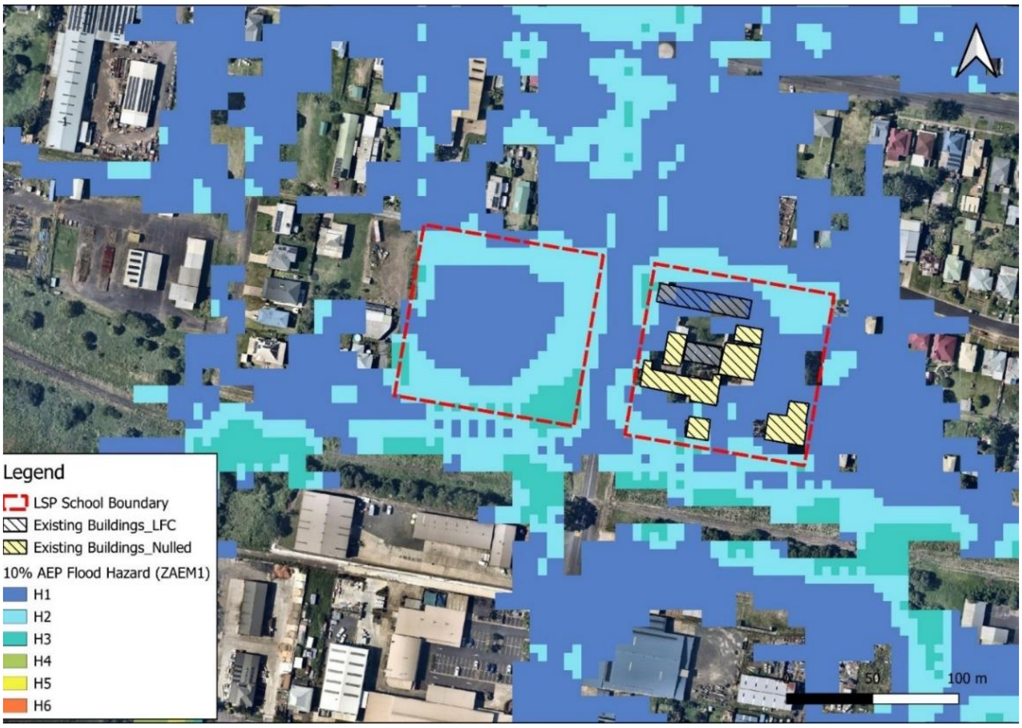
10% AEP Event



Appendix B 1: 10% AEP flood depths and levels at the LSPS site under existing site conditions

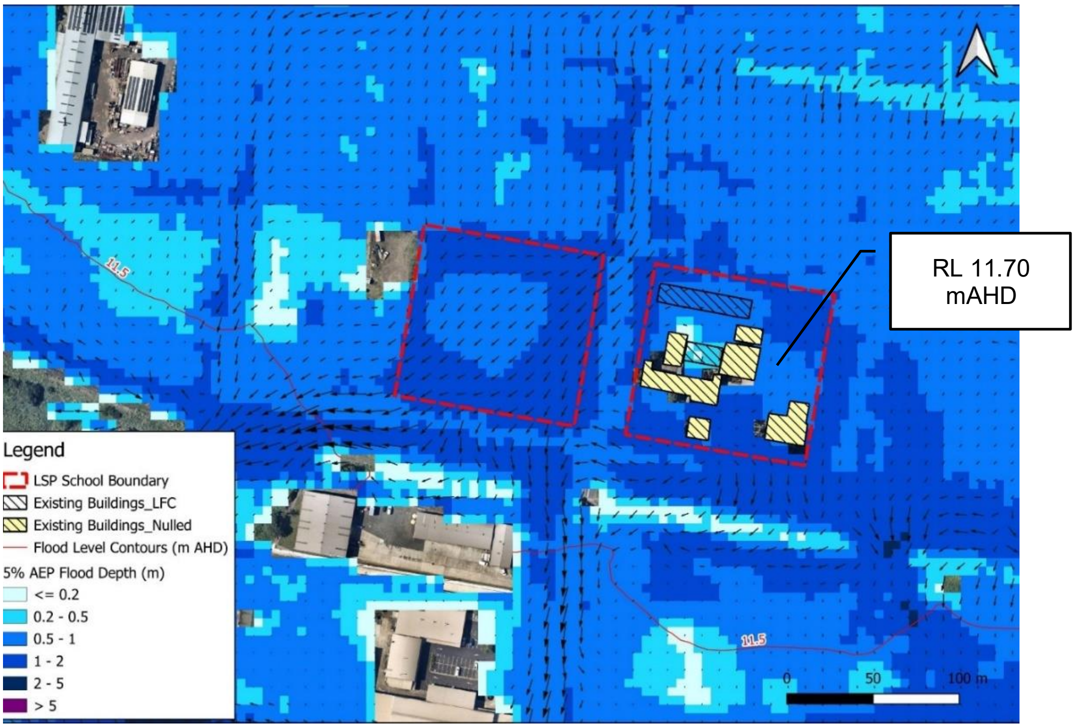


Appendix B 2: 10% AEP flood velocity at the LSPS site under existing site conditions

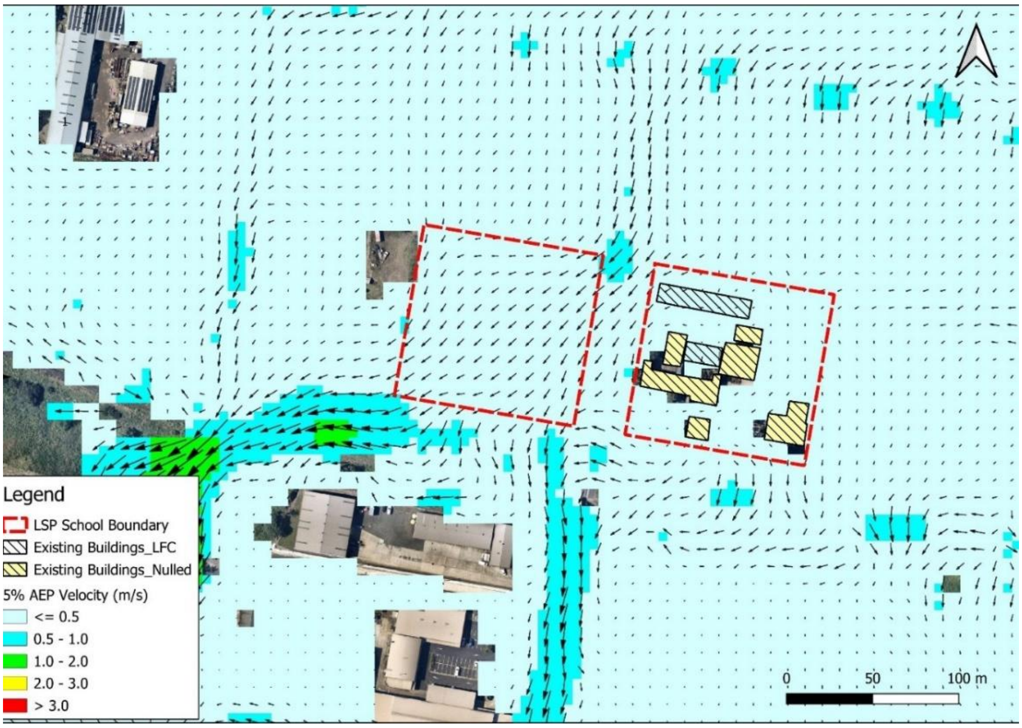


Appendix B 3: 10% AEP flood hazard categorisation at the LSPS site under existing site conditions

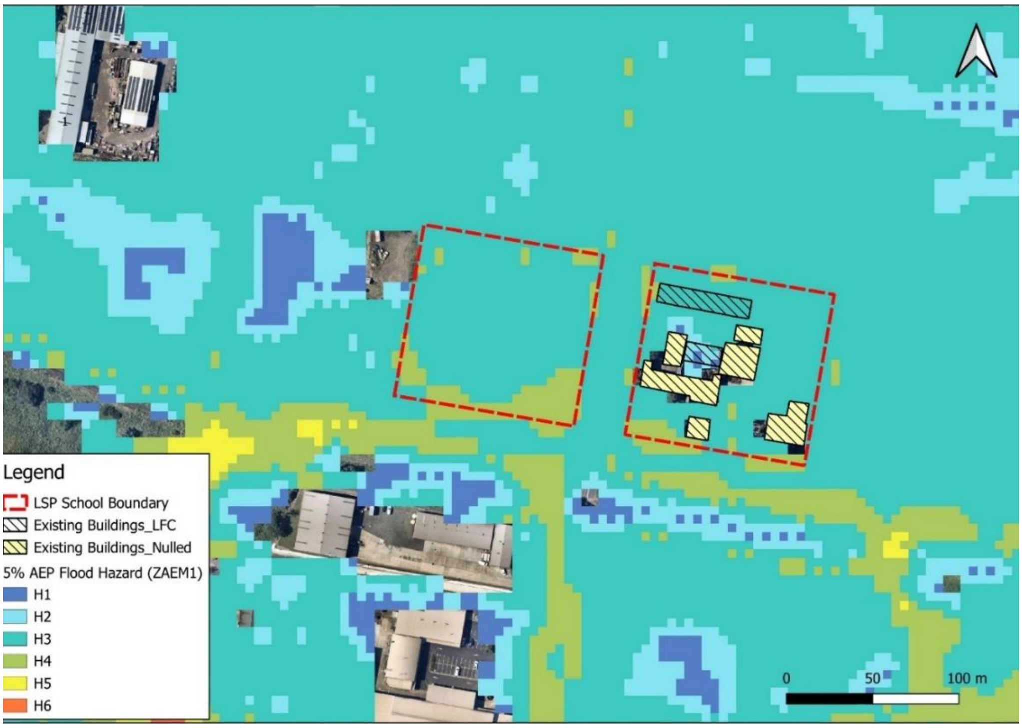
5% AEP Event



Appendix B 4: 5% AEP flood depths and levels at the LSPS site under existing site conditions

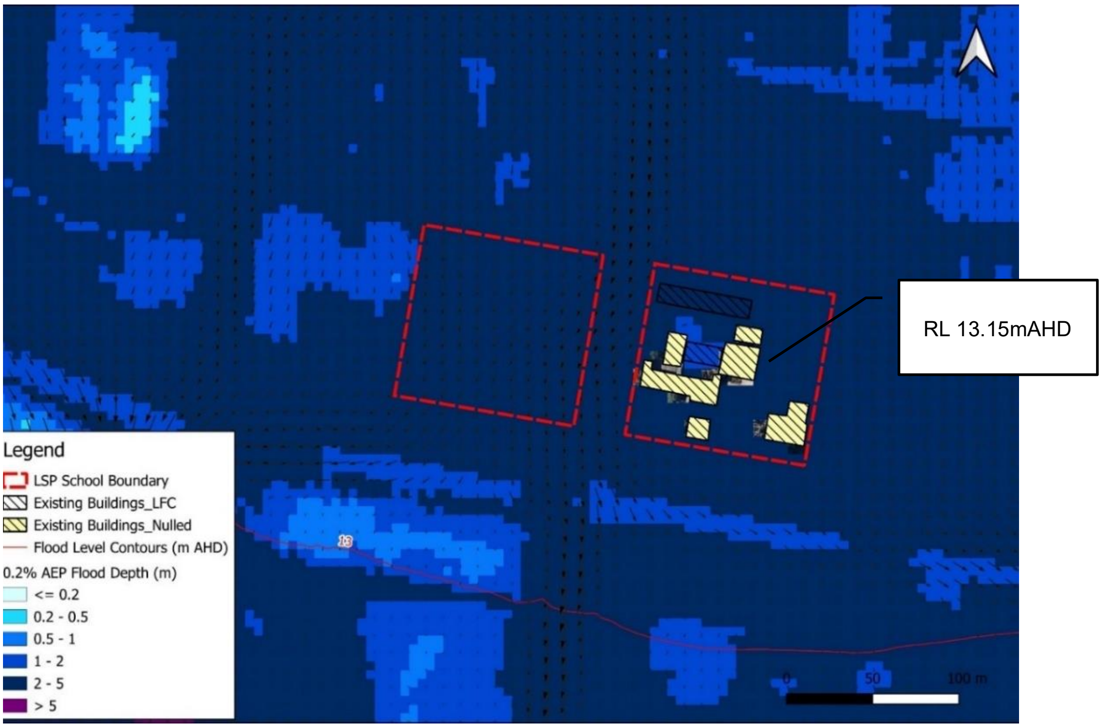


Appendix B 5: 5% AEP flood velocities at the LSPS site under existing site conditions

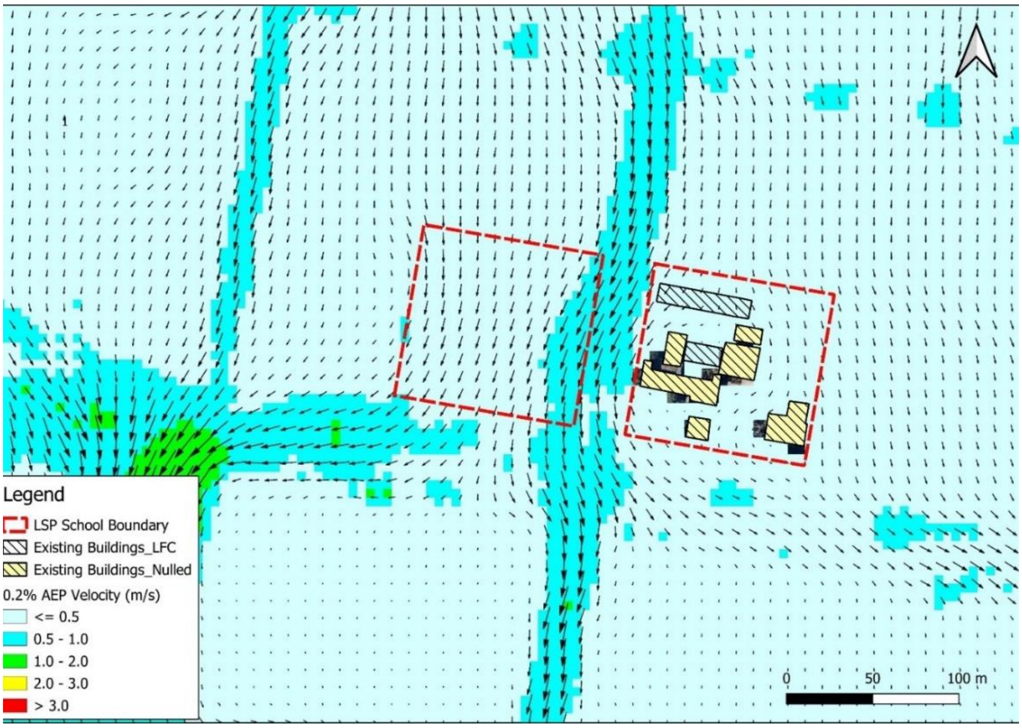


Appendix B 6: 5% AEP flood hazard categorisation at the LSPS site under existing site conditions

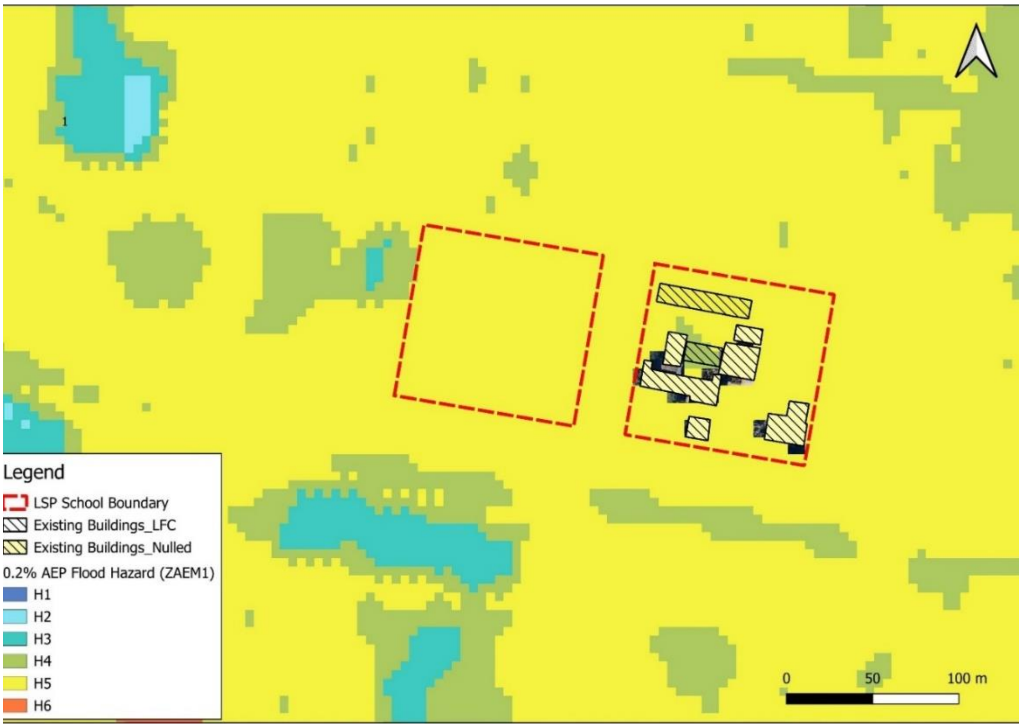
0.2% AEP Event



Appendix B 7: 0.2% AEP flood depths and levels at the LSPS site under existing site conditions



Appendix B 8: 0.2% AEP flood velocities at the LSPS site under existing site conditions

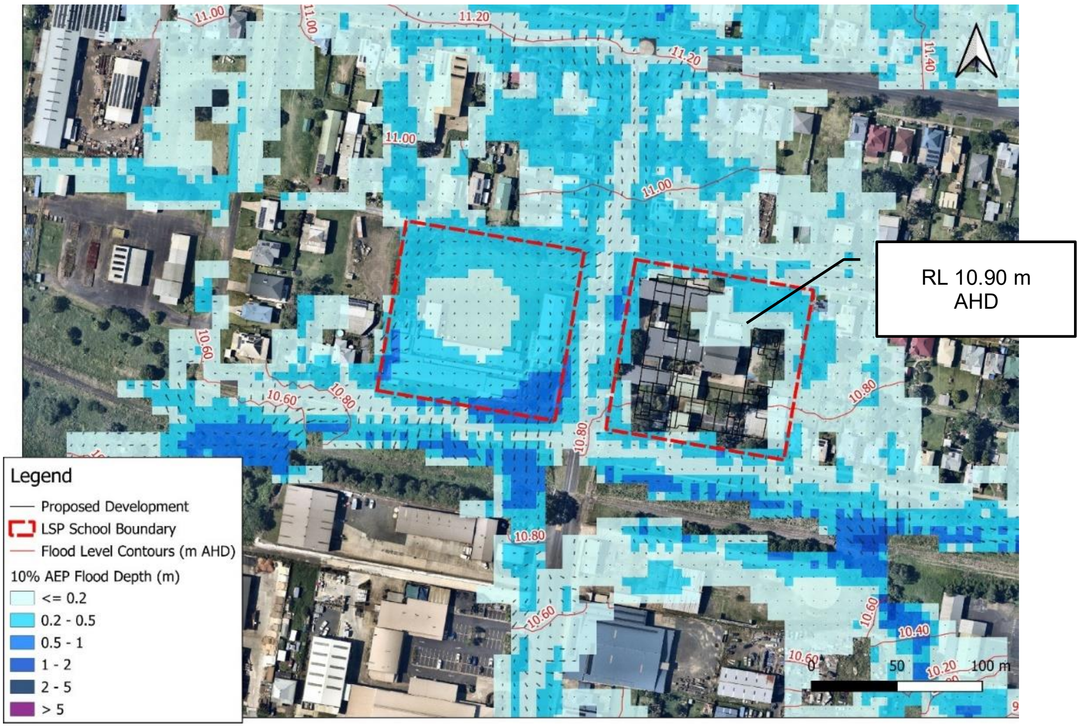


Appendix B 9: 0.2% AEP flood hazard categorisation at the LSPS site under existing site conditions

Appendix C

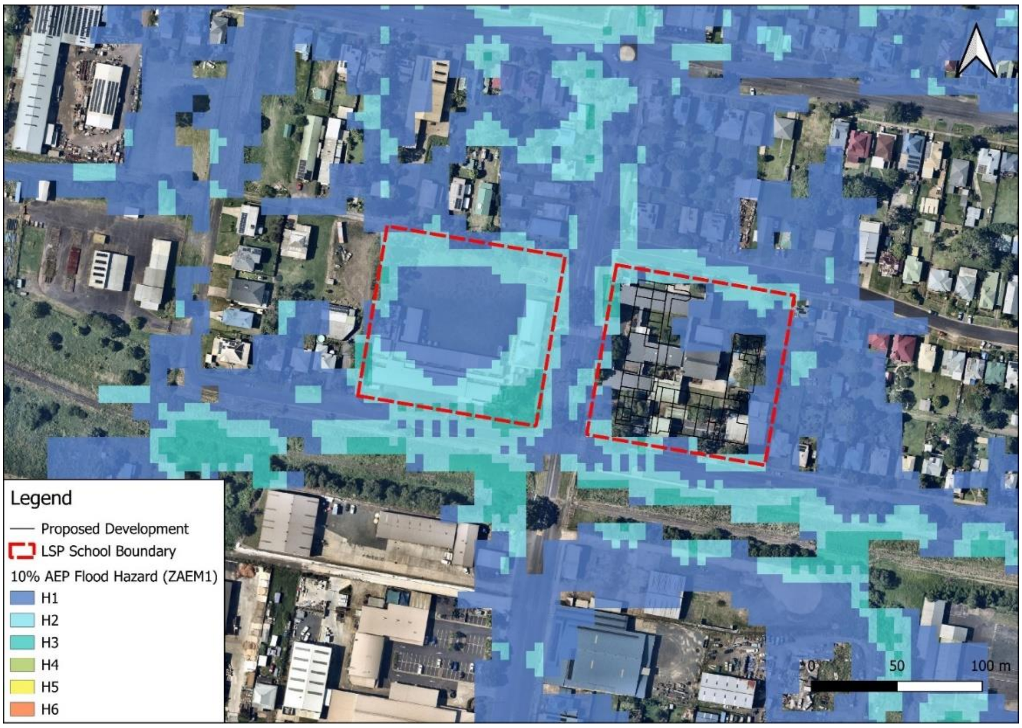
Additional Flood Maps – Post-Development Scenario

10% AEP Event



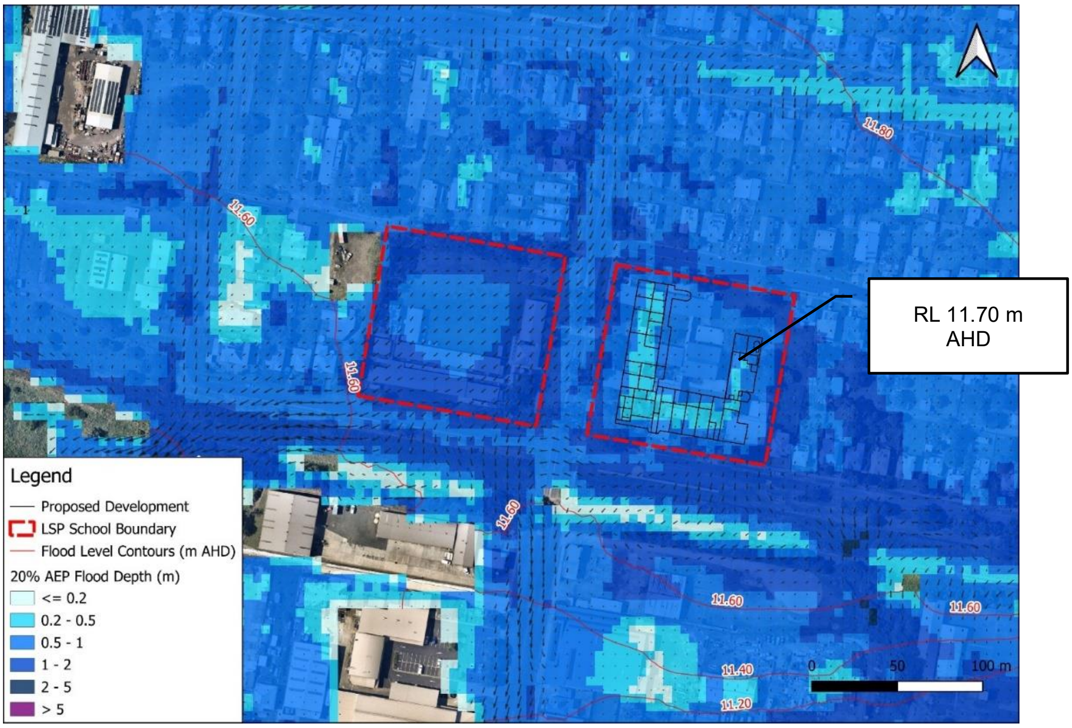
Appendix C 1: 10% AEP flood depths and levels at the LSPS site under post-development site conditions

Appendix C 2 :10% AEP flood velocities at the LSPS site under post-development site conditions

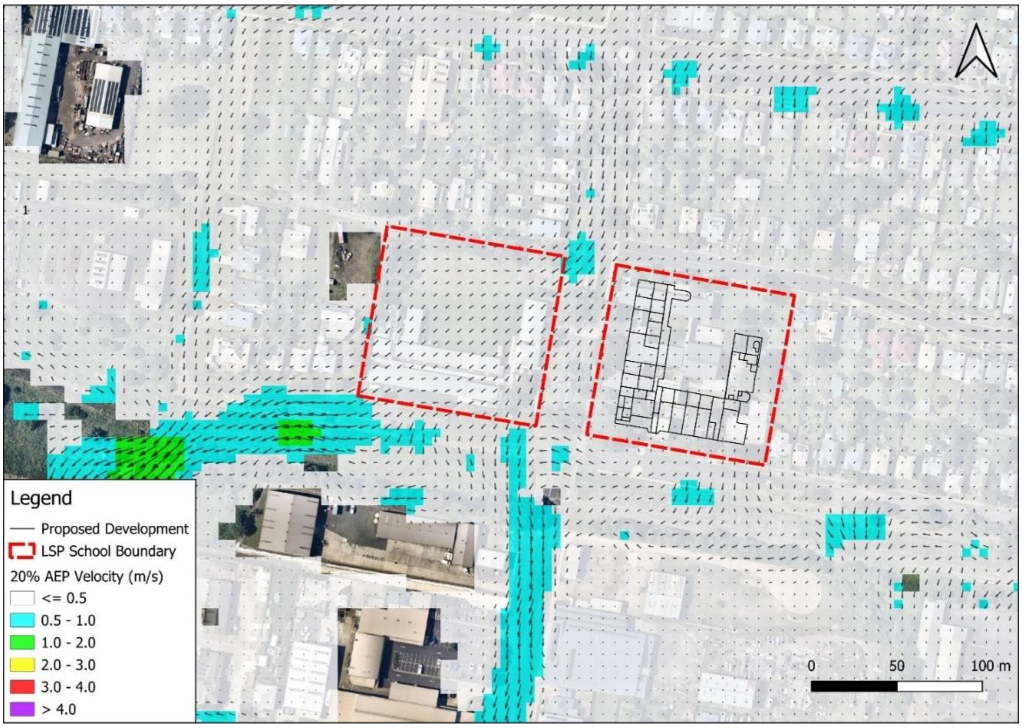


Appendix C 3 : 10% AEP flood hazard categorisation at the LSPS site under post-development site conditions

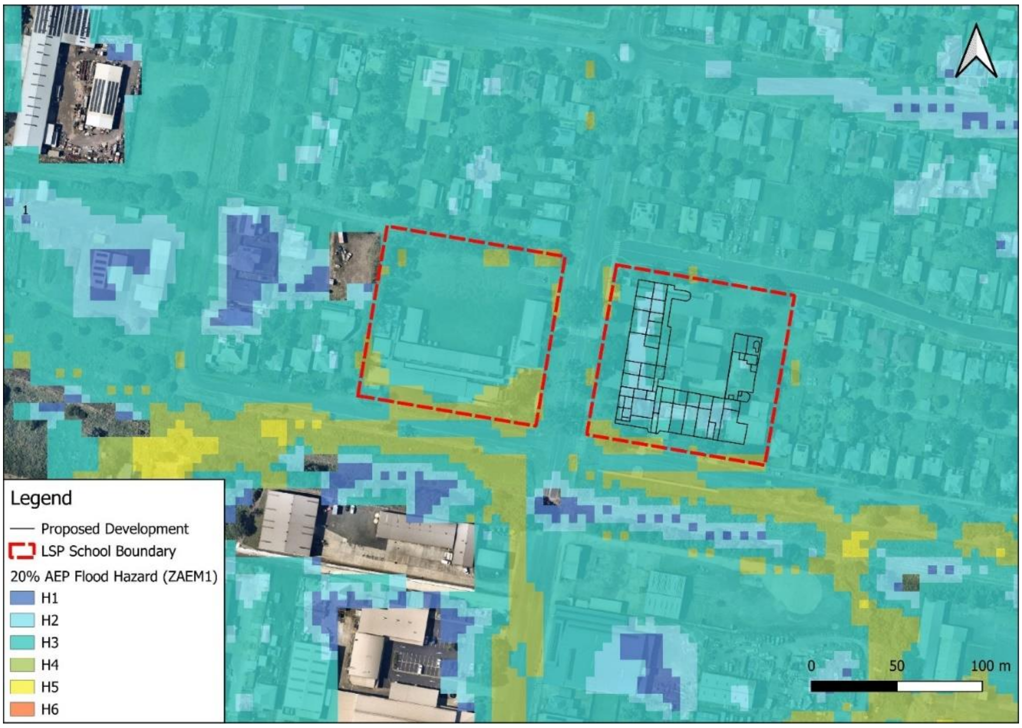
5% AEP Event



Appendix C 4 : 5% AEP flood depths and levels at the LSPS site under post-development site conditions

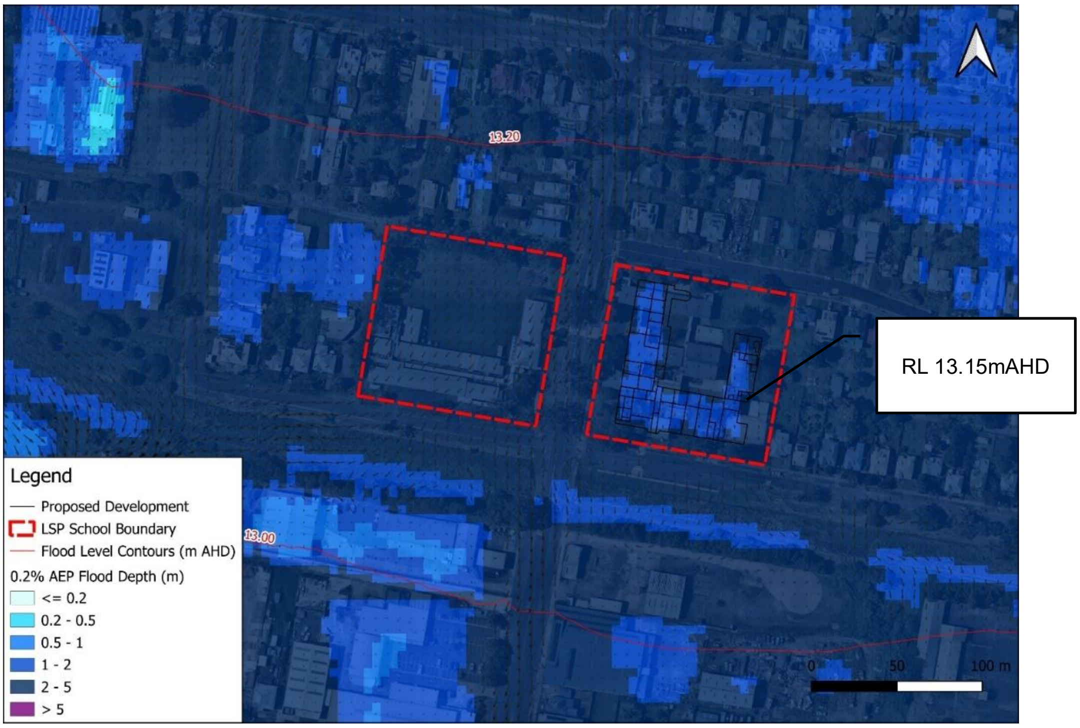


Appendix C 5 : 5% AEP flood velocities at the LSPS site under post-development site conditions

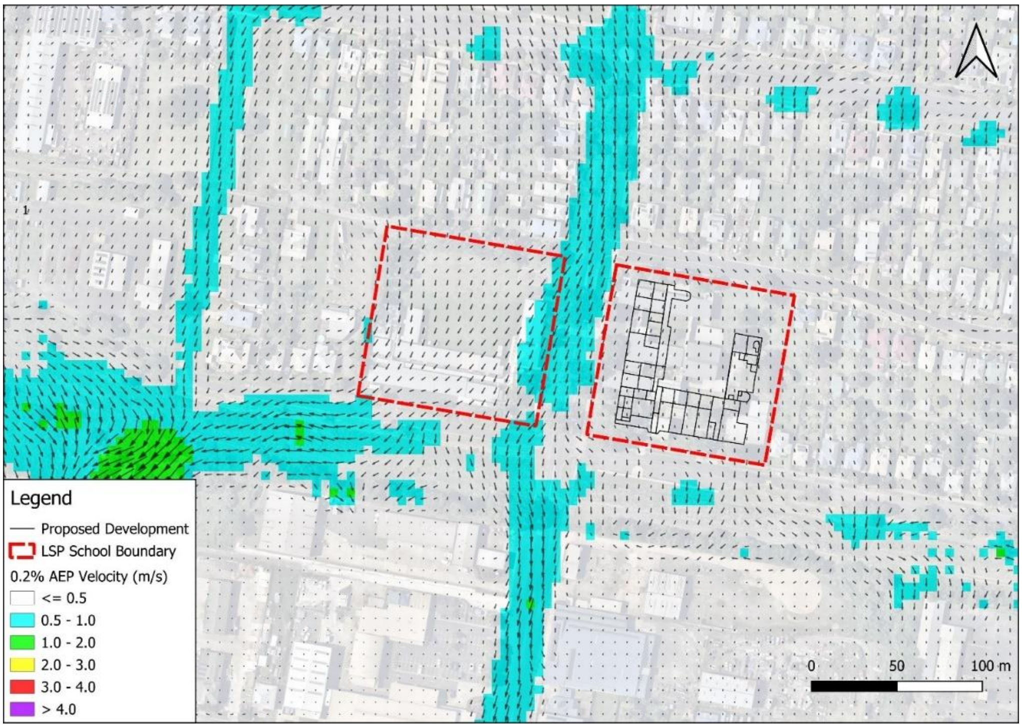


Appendix C 6: 5% AEP flood hazard categorisation at the LSPS site under post-development site conditions

0.2% AEP Event



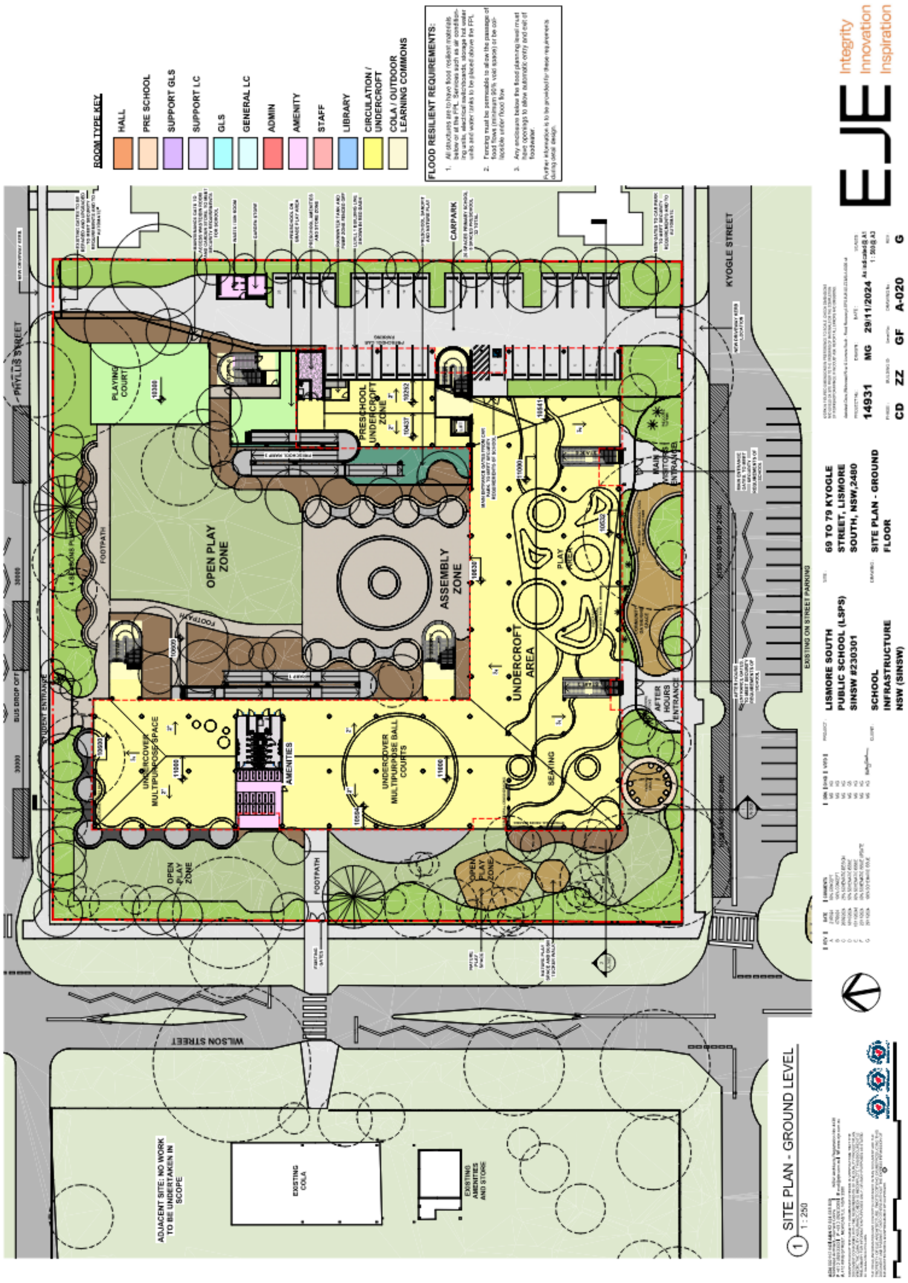
Appendix C 7: 0.2% AEP flood depths and levels at the LSPS site under post-development site conditions



Appendix C 8: 0.2% AEP flood velocities at the LSPS site under post-development site conditions

Appendix C 9: 0.2% AEP flood hazard categorisation at the LSPS site under post-development site conditions

Appendix D
Proposed Site Plan



Appendix E
Structural Design Statement

18 December 2024 231882

NSW Department of Education – School Infrastructure (SINSW)
Level 8, 259 George Street
SYDNEY NSW 2000

Attention: Tessa Sharp

Lismore South Public School - Flood Recovery Rebuild

Structural Design Statement – Schematic Design

Dear Tessa,

We certify that we have prepared the structural design of Lismore South Public School, as shown in the attached sketches, in accordance with the following Australian Standards:

- AS 3600:2018 Concrete Structures
- AS 3700:2018 Masonry Structures
- AS 4100:2020 Steel Structures
- Relevant parts of the Building Code of Australia BCA 2022.

And the structure shown would be sufficient to carry the relevant loads specified on our drawings, Section DG21 and DGN007 of the EFSG, and in:

- AS 1170.0:2002 Structural design actions – General principles
- AS 1170.1:2002 Structural design actions – Permanent, imposed and other actions
- AS 1170.2:2021 Structural design actions – Wind actions
- AS 1170.4:2007 Structural design actions – Earthquake actions in Australia
- AS 5100.2:2017 Bridge Design – Design Loads *(NB: sections relevant to flooding)*

We confirm that the structure has been designed for the flood forces associated with the PMF event.

Yours faithfully,
TTW (NSW) PTY LTD

GEOFF BILLS
Director
CPEng NER (2662753)

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Appendix F
Cut and Fill plan

BULK EARTHWORKS NOTES

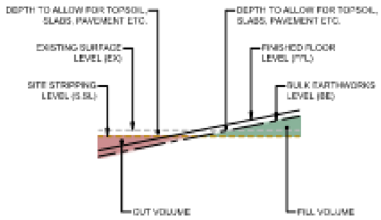
1. All bulk earthworks setout from grid lines U.N.O.
2. All batters at a slope of 2 (H) : 1 (V) U.N.O.
3. Excavated material may be used as structural fill provided:
   (i) it complies with the specification requirements for fill material,
   (ii) the placement moisture content complies with the Geotechnical Consultants requirements, and allows filling to be placed and prooffolled in accordance with the specification. Where necessary the Contractor must moisture condition the excavated material to meet these requirements.
4. Compact fill areas and subgrade to not less than:

Location	Standard dry density (AS 1289 5.1.1.)	Moisture (OMC)
Under building slabs on ground:	98%	±2%
Under roads and carparks:	98%	±2%
Landscaped areas:	95%	±2%

5. Before placing fill, proof roll exposed subgrade with a 12 tonne minimum roller to test subgrade and then remove soft spots(areas with more than 3mm movement under roller). Soft spots to be replaced with granular fill U.N.O.
6. Contractor shall place safety barriers around excavations in accordance with relevant safety regulations.
7. For interpretation of bulk earthworks foot print line shown on the bulk earthworks drawings refer to the bulk earthworks construction legend.
8. Bulk earthwork drawings are not to be used for detailed excavation.
9. Refer to Geotechnical Report prepared by "JK GEOTECHNICS Pty Ltd" 36310LTrpt Draft SECTION 4.7 DATED 13/12/2024.
10. Detailed earthworks such as piling, pile caps, ground beams, lift pits, service trenching & landscape mounding etc is excluded.

BULK EARTHWORKS					
LOCATION	AREA (m²)	CUT (m³)	FILL (m³)	NET (m³)	AV. DEPTH (mm)
	10,585	-706	-1,887	1,181	

	BUILD - UPS (mm)
STRUCTURAL SLAB	850
GROUND FLOOR	100
CONCRETE FOOTPATH	250
ROADWAY (CARPARKING)	280
PLAYING COURT	150
LANDSCAPING	300



EARTHWORKS TYPICAL SECTION

DEPTH RANGE COLOUR TABLE				
Lower_value		Upper_value	Unit	Colour
-5.0	to	-2.50	m	
-2.50	to	-2.25	m	
-2.25	to	-2.00	m	
-2.00	to	-1.75	m	
-1.75	to	-1.50	m	
-1.50	to	-1.25	m	
-1.25	to	-1.00	m	
-1.00	to	-.75	m	
-.75	to	-.50	m	
-.50	to	-.25	m	
-.25	to	0.00	m	
0.00	to	0.25	m	
0.25	to	.50	m	
.50	to	.75	m	
.75	to	1.00	m	
1.00	to	1.25	m	
1.25	to	1.50	m	
1.50	to	1.75	m	
1.75	to	2.00	m	

ASSUMPTIONS

1. Existing topsoil assumed 150mm stripped.
2. Bulk quantities represent difference between existing levels and proposed levels.
3. Set down for Structural slab is 850mm. (Stairs, Lift, Bathroom and Pump room)
4. Set down for Building Ground is 100mm.
5. Set down for concrete footpath pavement assumed to be 250mm, Asphalt roadway carparking area assumed to be 280mm, and landscape areas assumed to be 300mm based on 3% CBR. Further investigation is required by Geotechnical Engineer.
6. Pavement buildup in undercroft area is only documented to subgrade level. A 300mm piling rig working platform is to be set up in hardstand area and 2m beyond it's extents as per Geotechnical advice from JK Geotechnics Geotechnical investigation 36310Rrpt draft section 4.7.
7. Pavement buildups only address above the subgrade level.Subgrade improvement to approximately cbr 10% is required as per Geotechnical advice from JK Geotechnics Geotechnical investigation 36310Rrpt draft section 4.7 dated 12/11/2024.