Flood Statement

Greenway Park Public School Upgrade and New Public Pre School

Prepared for Department of Education / 24 March 2025

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Rev	Date	Prepared	Approved	Remarks
1	03/03/2025	RC	TM	DRAFT For REF
2	24/03/2025	RC	TM	For REF

1.0 Introduction

This Flood Statement has been prepared to accompany a Review of Environmental Factors (REF) prepared for the Department of Education (DoE) relating to upgrades to Greenway Park Public School (the development) under Part 5 of the Environmental Planning and Assessment Act 1979 (EP&A Act) and State Environmental Planning Policy (Transport and Infrastructure) 2021 (SEPP TI).

This document has been prepared in accordance with the Guidelines for Division 5.1 assessments – Consideration of environmental factors for health services facilities and schools, October 2024 (the Guidelines) by the Department of Planning, Housing and Infrastructure.

This report examines and takes into account the relevant environmental factors in the Guidelines and Section 170, Section 171 and Section 171A of the Environmental Planning and Assessment Regulations 2021 (EP&A Regulation) as outlined in Table 1.

Table 1: Summary of Relevant Section of the Part 5 Guidelines and EP&A Regulation

Regulation / Guideline Section	Requirement	Response	Report Section
Guidelines for Division 5.1 (DPHI) Section 3.0	When considering the likely impact of an activity on the environment, the proponent and determining authority must take into account any risk to the safety of the environment	As the site is situated outside of the extent of flood prone land, the proposed activity will have no impact on flood behaviour in the area, nor will it adversely impact the risk to safety.	Section 4.0, 5.0
Guidelines for Division 5.1(DPHI) Section 4.0	The proponent will gather and record relevant information on potential environmental impacts including any episodic risks.	As above	Section 4.0, 5.0, 6.0, 7.0
Section 171.2 (a) and (b) and (j) EP&A Regulations	The determining authority must take into account the environmental impact on the community and the transformation of the locality, risk to the safety of the environment	As above	Section 6.0, 7.0

This report outlines the existing effects of flooding and overland flow paths on this site. The details of this report are based on current available information and correspondence undertaken at the time of writing. This investigation forms part of a broader educational infrastructure improvement program based on the Election Commitment upgrade program.

1.1 Document Review

The following plans/reports identified in Table 2 have been reviewed to inform the assessment contained within this report:

Table 2: Plans and reports reviewed

Discipline	Document Name	Revision	Date
Bewsher	Cabramatta Creek Floodplain Management Study and Plan	N/A	Oct. 2004
Bewsher	Cabramatta Creek Flood Study and Basin Strategy Review	N/A	Sept. 2011
Department of Planning and Environment (DPE)	Considering Flooding in Land Use Planning Guideline	N/A	July 2021

Department of Planning and Environment (DPE)	Flood Risk Management Manual	N/A	June 2023
Department of Planning and Environment (DPE)	Flood Impact and Risk Assessment – Flood Risk Management Guide LU01	N/A	Feb. 2022
Department of Planning and Environment (DPE)	NSW Planning Portal Spatial Viewer	N/A	2025
Department of Planning, Housing and Infrastructure (DPHI)	Planning Circular PS 24-001, Update on addressing flood risk in planning decisions	N/A	Mar. 2024
Liverpool City Council	Liverpool City Development Control Plan (DCP)	Revision 39 (revised September 2024)	2008
Liverpool City Council	Liverpool City Local Environmental Plan (LEP)	Revised September 2024	2008
School Infrastructure New South Wales (SINSW)	Guidelines for School Site Selection and Master Planning		2023

1.2 Proposed Development Description

The proposed activity for the Greenway Park Public School upgrade includes:

Demolition/Earthworks

- Demolish part of boundary fence on Chapman Street for new vehicular crossover;
- Demolish parts of boundary fence on Chapman Street for new gates;
- Demolish shade structure and associated concrete slab and footpath;
- Demolish footpaths;
- Removal of two trees;
- Trenching for underground services; and
- Earthworks associated with new buildings and landscaping.

Construction

- Construction and operation of single storey classroom building with associated covered walkways;
- Construction and operation of a new preschool building, including covered walkways, new carpark (12 spaces and one (1) accessible space) and vehicular crossover to Chapman Street;
- Installation of artwork on Block H and Block J façades, as well as a preschool retaining wall;
- Laying of services within trenches;
- New pedestrian entry points;
- Fencing and gates;
- Underground OSD tanks;
- Rainwater tanks;
- Shed for preschool;
- Outdoor play equipment for the preschool;

- New fire hydrant booster & associated building services connections;
- Retaining walls associated with the preschool;
- Signage;
- Landscaping; and
- Associated earthworks.
- A proposed site plan with the proposed works is shown in Figure 1.

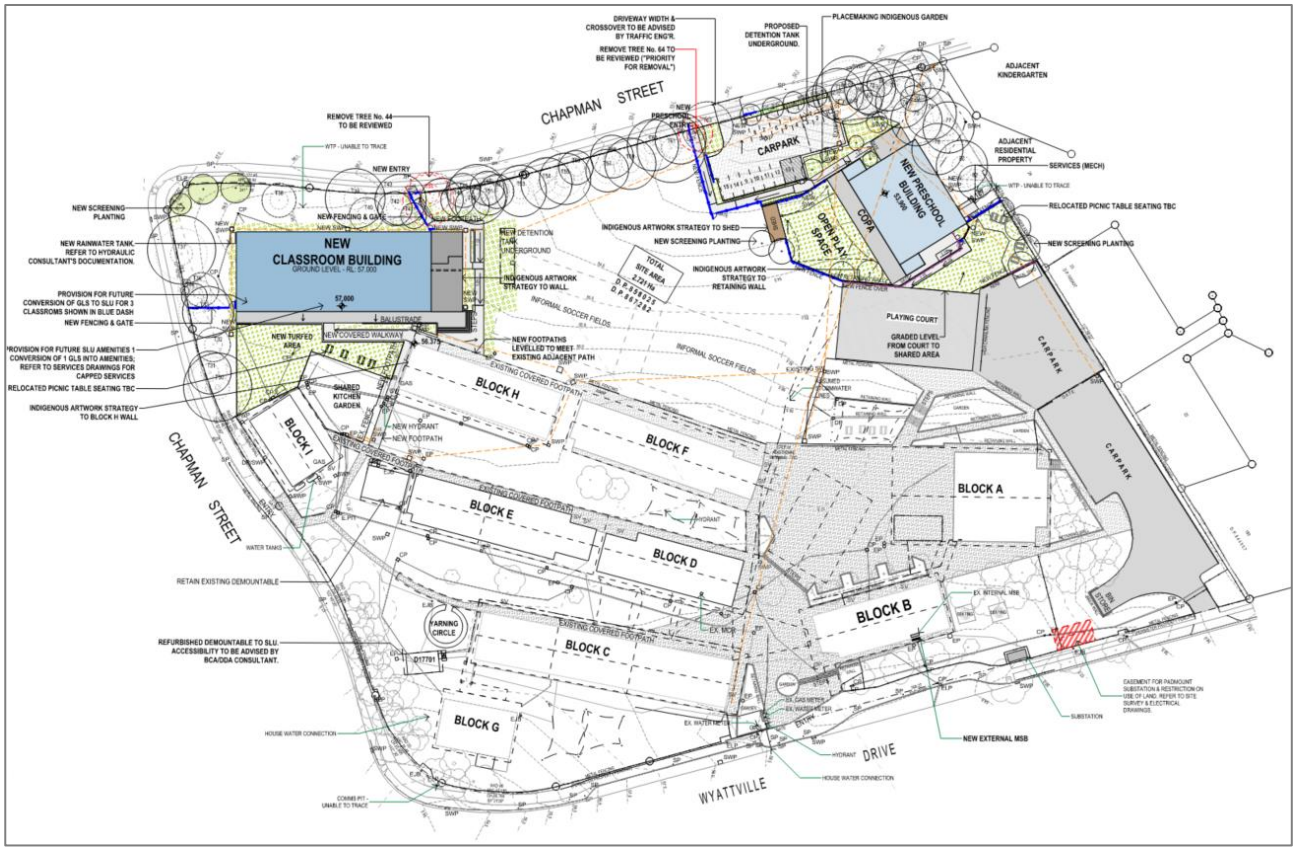

Figure 1: Proposed site plan for the proposed activity at the site (Source: Fulton Trotter Architects, 24th January 2025).

1.3 Works under separate planning pathway (not part of this REF)

To enable the proposed activity to proceed, the existing seven (7) portable classrooms, associated walkways, a shade structure and associated concrete slab will be removed from site and five (5) new portable classrooms and associated walkways will be installed adjacent to Block F under a separate planning pathway. A tree removal permit for the removal of three (3) trees will also be sought separately. These works do not form part of this REF application and have not been assessed in this report.

1.4 Activity Site

The activity site is located on Wyattville Drive, West Hoxton and is legally described as:

- - Lot 11 DP 858025; and
- - Lot 20 DP 867282

Greenway Park Public School is located on the southeastern side of Chapman Street and the northeastern side of Wyattville Drive. The surrounding context of the site is predominantly low density residential as well as a childcare centre to the north.

Figure 2 is an aerial photograph of the site.

Figure 2: Aerial photograph of site

2.0 Site Characteristics

2.1 Site Location

The site is located at Wyattville Drive in West Hoxton, a suburb within the City of Liverpool local government area (LGA).

The location and layout of the existing site is shown in Figure 3. The site is approximately rectangular with school buildings to the south and open space and playing fields to the north. The site area is approximately 3ha. The site is zoned R2 Low Density Residential on Liverpool City Council's LEP. The site is surrounded by residential areas.

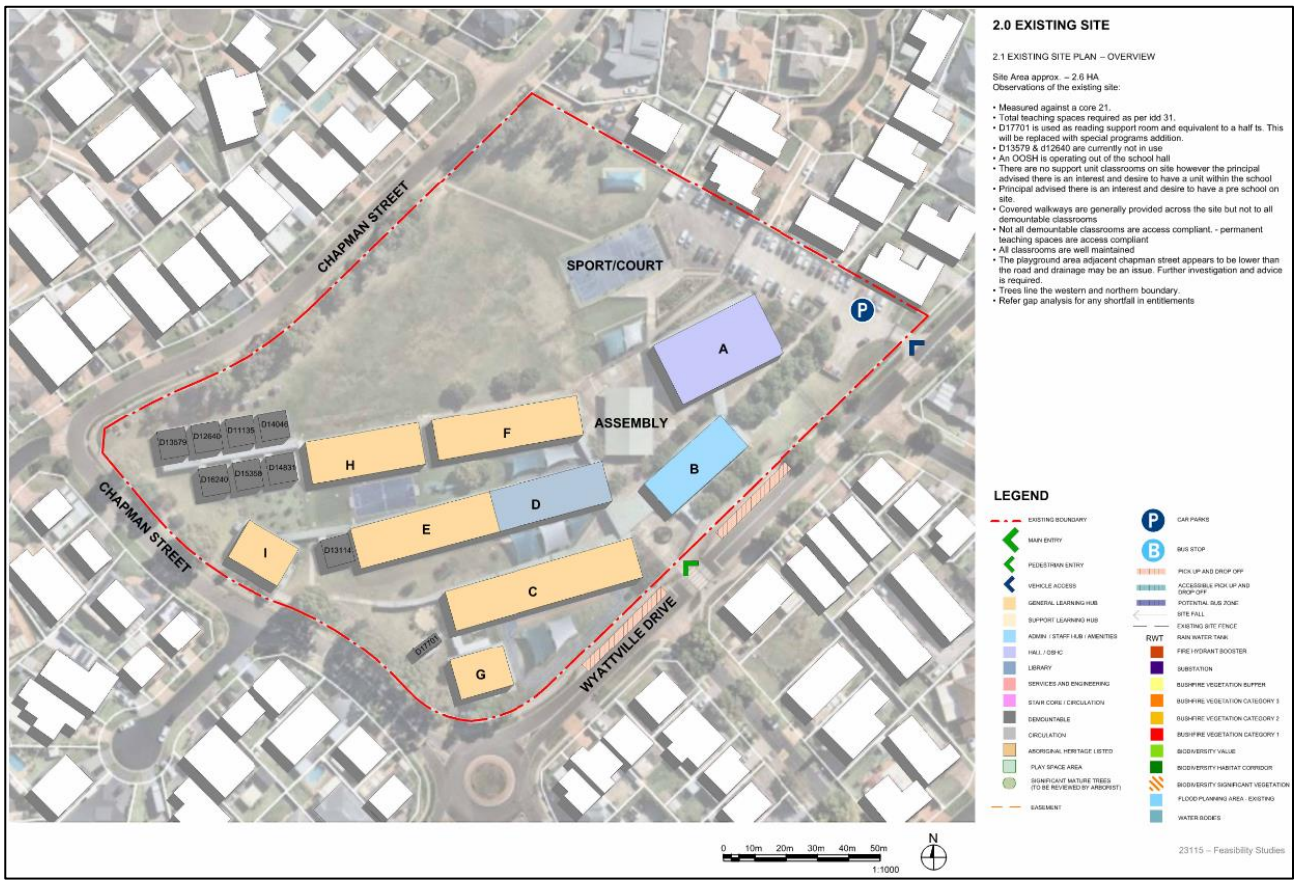

Figure 3: Plan layout of the existing site

2.2 Surrounding Hydrological Features

The third-order Beard Creek lies approximately 0.3km north of the site, and the first-order Bayhorse Creek to the south (see Figure 4). Both watercourses are tributaries of the Cabramatta Creek 1.5km to the east.

Cabramatta Creek is a major tributary of the Georges River, in Sydney's south-west. It has a catchment area of 74km^2, which is mostly located within the Liverpool City Council Local Government Area. The catchment is highly urbanised, with significant residential, commercial, and industrial development. This has led to increased stormwater runoff and environmental pressures on the creek system.

Figure 4: Creek systems affecting the Site (Cabramatta Creek Floodplain Management Study and Plan, October 2004)

2.3 Site Topography

To assess the topography of wider area, the latest available elevation data (2019) was obtained from the NSW Spatial Services, Elevation Information System (ELVIS), with a spatial resolution of 1 metre. As presented in the Digital Elevation Model (DEM) in Figure 5, the site is located on the crest between the Beard Creek catchment and the Bayhorse Creek catchment. This is ridge is also shown in the elevation profile in Figure 6. As the two main drainage features, flows are directed to these creek systems.

The site predominantly slopes from the southern boundary to the north. Ground level peaks at the southeastern boundary of the site at approximately 59.3m AHD, with a drop to approximately 52.1m AHD at the northern corner (with an approximate gradient of 5%), at the location of the proposed pre-school (see Figure 1). A cross-sectional profile of this slope is presented in Figure 7. There is an east-to-west ridgeline running through the site at the south, with a north-south split.

The contours indicate an overland flow channel along the northwestern boundary of the site at Chapman Road.

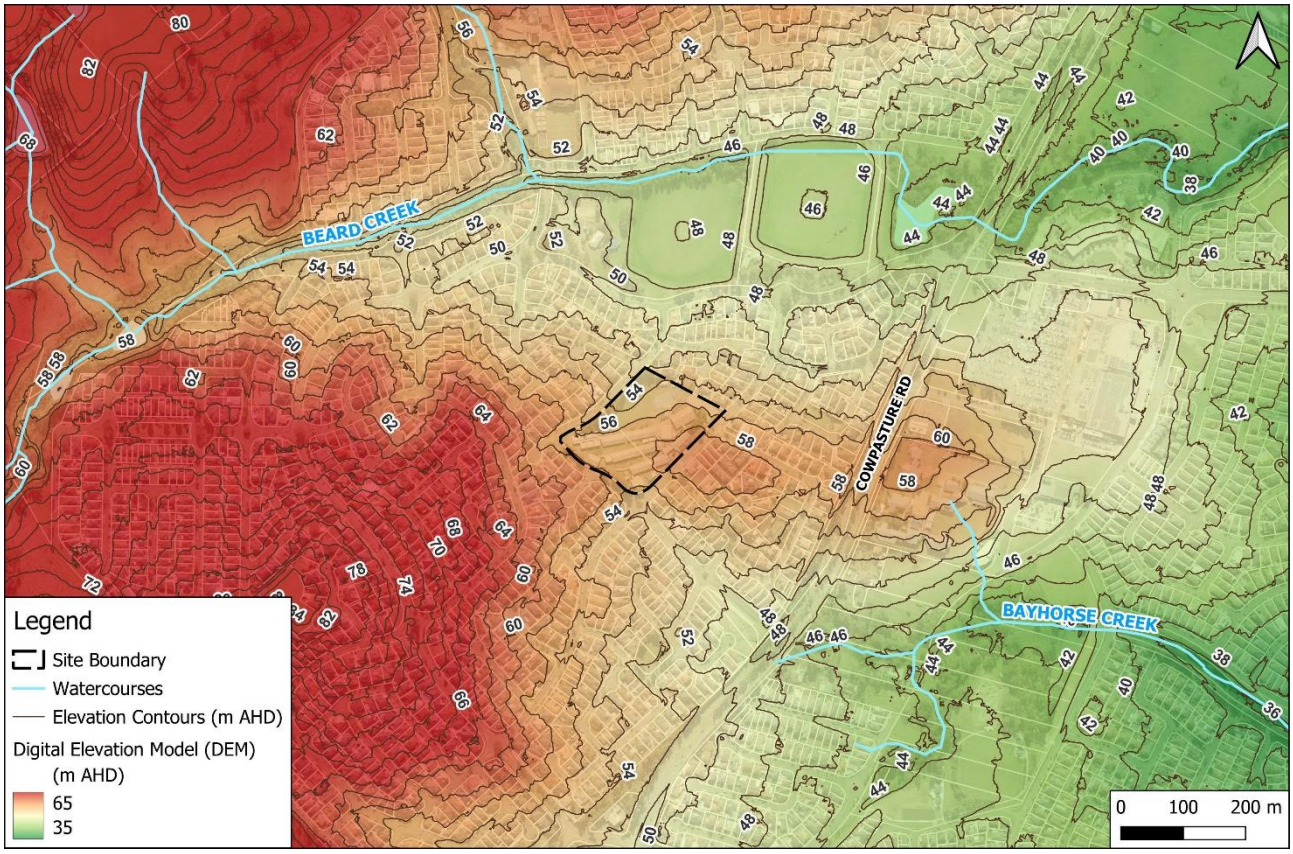

Figure 5: Topography of the site and its surrounding area based on 2019 LiDAR data (Source: ELVIS).

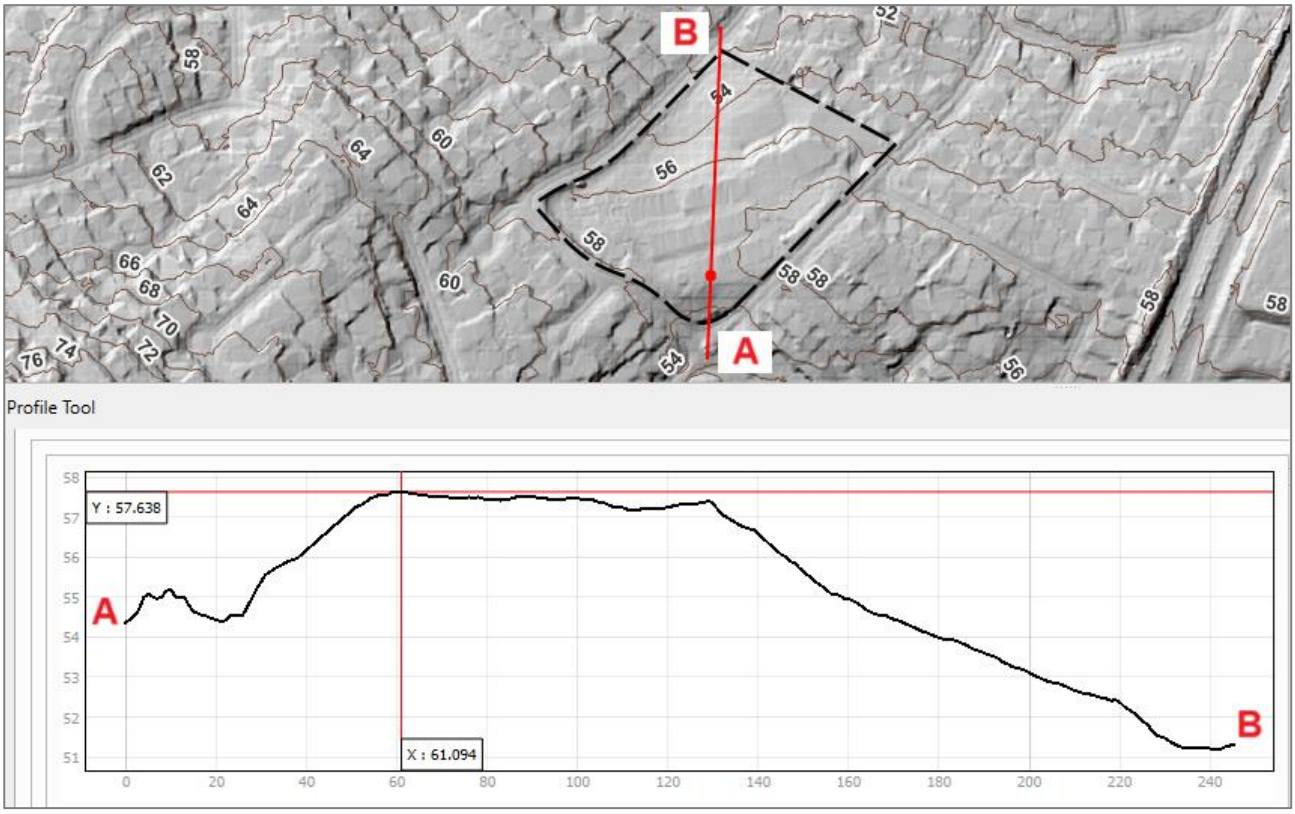

Figure 6: Elevation profile showing the ridge line in the southern portion of the site

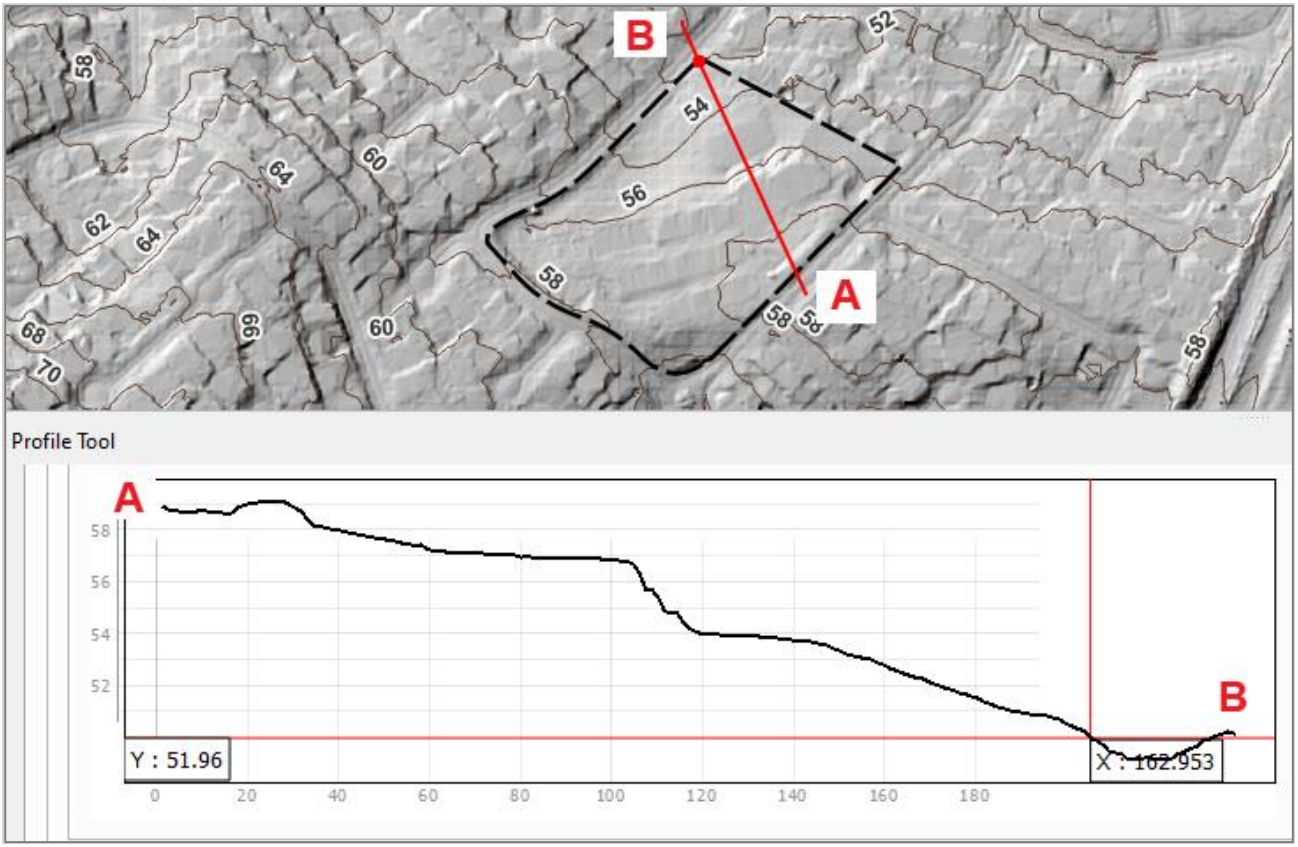

Figure 7: Elevation profile through the site from southwest to northeastern corner.

3.0 Flood Planning Requirements

3.1 Requirements of the Development Control Plan

The current Development Control Plan (DCP) in place for Liverpool is the Liverpool Development Control Plan. The DCP applies to all land in Liverpool LGA. This was published in 2008 and was last updated in September 2024.

Part 1 Section 9 of the Liverpool DCP provides a risk-based approach to planning and development in the flood prone lands. The New South Wales State Government flood prone land policy is to reduce the impact of flooding and flood liability on individual owners and occupiers of flood prone property, and to reduce private and public losses resulting from floods, utilising ecologically positive methods wherever possible.

The objectives of the DCP in relation to flooding are:

- to minimise the potential impact of development and other activity upon the aesthetic, recreational and ecological value of the waterway corridors;
- to ensure essential services and land uses are planned in recognition of all potential floods;
- to reduce the risk to human life and damage to property caused by flooding through controlling development on land affected by potential floods;
- to ensure that the economic and social costs which may arise from damage to property due to flooding is minimised and is not greater than that which can be reasonably managed by the property owner and general community;
- to limit developments with high sensitivity to flood risk (e.g. critical public utilities) to land with minimal risk from flooding;
- to prevent intensification of inappropriate use of land within high flood risk areas or floodways;
- to permit development with a lower sensitivity to the flood hazard to be located within the floodplain, subject to appropriate design and siting controls;
- to ensure that development should not detrimentally increase the potential flood affectation on other development or properties either individually or in combination with the cumulative impact of development that is likely to occur in the same floodplain; and
- to ensure that development does not prejudice the economic viability of any Voluntary Acquisition Scheme.

The flood controls which apply to a site is dependent on the floodplain the site is located within, the land use category of the site, and the flood risk precinct that the site falls within.

The site is located within the ‘Cambramatta Creek and all other floodplains (Hinchinbrook Creek, Maxwells Creek, Brickmakers Creek, upper parts of Anzac Creek, and other tributaries’ zone, and therefore flood controls from ‘Table 3’ and ‘Table 5’ of the DCP are applicable to the site. ‘Table 6’ of the DCP provides an explanation of the development controls laid out for each category.

The relevant tables of the DCP are shown below in Figure 8 (‘Table 3’ in the DCP) and Figure 9 (‘Table 5’ in the DCP), while ‘Table 6’ of the DCP is reproduced below in Table 3.

According to the DCP, the land use category of a school is ‘Sensitive Uses and Facilities’.

Figure 8: Flood Planning Controls for Fluvial Flooding (Table 3 of the Liverpool DCP, Part 1 Section 9)

Flood Risk Category	Land Use Risk Category	Planning Controls							
		Floor Level	Building Components	Structural Soundness	Flood Effects	Car Parking & Driveway Access	Evacuation	Management & Design	Fencing
Low Flood Risk	Critical Uses & Facilities								
	Sensitive Uses & Facilities	13	4	4	2, 4, 5	2, 3, 6, 7, 8	3, 6, 8	4, 5	
	Subdivision				2, 4, 5			1, 6	
	Residential (++)	2, 6	3	3		2, 3, 7	3, 6		
	Commercial & Industrial	2, 11, 15	3	3	2, 4, 5	2, 3, 6, 7, 8	(3 or 4), 6	2, 3, 5	
	Tourist Related Development	2, 6, 15	3	3	2, 4, 5	2, 3, 6, 7, 8	3, 6	2, 3, 5	
	Recreation & Non-Urban	2, 7	3	3	2, 4, 5	1, 5, 7, 8	6, 8	2, 3, 5	
	Concessional Development	14, 15	3	3	2, 4, 5	1, 7, 8, 9	3, 6	2, 3, 5	
Medium Flood Risk	Critical Uses & Facilities								
	Sensitive Uses & Facilities								
	Subdivision				1, 4, 5			1, 6	1, 2, 3
	Residential	2, 6, 15	3	1	2, 4, 5	2, 3, 6, 7, 8	3, 6		1, 2, 3
	Commercial & Industrial	11, 15	3	1	2, 4, 5	2, 3, 6, 7, 8	4, 6	2, 3, 5	1, 2, 3
	Tourist Related Development	2, 6, 15	3	1	2, 4, 5	2, 3, 6, 7, 8	3, 6	2, 3, 5	1, 2, 3
	Recreation & Non-Urban	2, 7	3	1	2, 4, 5	1, 5, 7, 8	6, 8	2, 3, 5	1, 2, 3
	Concessional Development	14, 15	3	1	2, 4, 5	1, 7, 8, 9	3, 8	2, 3, 5	1, 2, 3
High Flood Risk	Critical Uses & Facilities								
	Sensitive Uses & Facilities								
	Subdivision								
	Residential								
	Commercial & Industrial								
	Tourist Related Development								
	Recreation & Non-Urban	2, 7	3	1	1, 4, 5	1, 5, 7, 8	6, 8	2, 3, 5	1, 2, 3
	Concessional Development	14, 15	3	1	1, 4, 5	1, 7, 8, 9	3, 6	2, 3, 5	1, 2, 3

Key:

	Not Relevant
	Unsuitable Land Use
1, 2, 3	Control reference number relevant to the particular planning consideration. (see Table 6)
(++)	Attached dwellings, Dwelling houses, dual occupancies, multi unit dwelling housing, residential flat buildings (not including development for the purpose of group homes or seniors housing), Secondary dwellings and Semi-detached dwellings are exempt from these controls.

Figure 9: Flood Planning Controls for Overland Flow of the Liverpool DCP, Part 1 Section 9).

Flood Risk Category	Land Use Risk Category	Planning Controls							
		Floor Level	Building Components	Structural Soundness	Flood Effects	Car Parking & Driveway Access	Evacuation	Management & Design	Fencing
Local Overland Flood Risk	Critical Uses & Facilities	13	4	5	3	4, 7, 8	7	3, 5	2, 4
	Sensitive Uses & Facilities	13	4	5	3	4, 7, 8	7	3, 5	2, 4
	Subdivision				3		5	1	2, 4
	Residential	3, 5	1	6	3	4, 7, 8	5		2, 4
	Commercial & Industrial	10	1	6	3	4, 7, 8	5	3, 5	2, 4
	Tourist Related Development	3, 5	1	6	3	4, 7, 8	5	3, 5	2, 4
	Recreation & Non-Urban	3, 5	1	6	3	4, 7, 8	5	3, 5	2, 4
	Concessional Development	14	1	6	3	4, 7, 8	5	3, 5	2, 4

Key:

	Not Relevant
1, 2, 3	Control reference number relevant to the particular planning consideration.

Table 3: Explanation of Development Controls (Table 6 of the Liverpool DCP, Part 1 Section 9).

Reference Number	Controls
Floor Level	
1	All floor levels to be as high as practical but not less than the 20% AEP flood level.
2	Non habitable floor levels to be as high as practical but no less than the 5% AEP flood level.
3	Non-habitable floor levels to be not less than the 1% AEP flood.
4	The level of Non-habitable and general Industrial floor areas to be as high as practical but not less than the 2% AEP flood. Where this is impractical for single lot developments within an existing developed area, the floor shall be as high as practical but no less than the 5% AEP flood
5	Habitable floor levels to be equal to or greater than the 1% AEP flood level plus 300mm freeboard.
6	Habitable floor levels to be equal to or greater than the 1% AEP flood level plus 500mm freeboard.
7	Habitable floor levels to be no lower than the 1% AEP flood plus 500mm freeboard unless justified by site specific assessment.
8	Habitable and general commercial floor levels to be as high as practical but no lower than the 1% AEP flood plus 500mm freeboard unless justified by site specific assessment.
9	The level of habitable floor areas to be equal to or greater than the 1% AEP flood level plus 500mm freeboard. If this level is impractical a lower floor level may be considered provided the floor level is as high as possible but no less than the 5% AEP flood level.
10	All floor levels to be equal to or greater than the 1% AEP flood level plus 300mm freeboard. Freeboard may be reduced if justified by site specific assessment.
11	All floor levels to be no lower than the 1% AEP flood plus 500mm freeboard. Freeboard may be reduced if justified by site specific assessment.
12	All floor levels to be equal to or greater than the PMF level. If this level is impractical a lower floor level may be considered provided the floor level is as high as possible but no less than the 1% AEP flood level plus 500mm freeboard.

13	Floor levels to be no lower than the PMF level unless justified by a site specific assessment.
14	Floor levels to be equal to or greater than the minimum requirements normally applicable to this type of development. Where this is not practical due to compatibility with the height of adjacent buildings, or compatibility with the floor level of existing buildings, or the need for access for persons with disabilities, a lower floor level may be considered. In these circumstances, the floor level is to be as high as practical, and, when undertaking alterations or additions no lower than the existing floor level.
15	A restriction is to be placed on the title of the land, pursuant to S.88B of the Conveyancing Act, where the lowest habitable floor area is elevated more than 1.5m above finished ground level, confirming that the undercroft area is not to be enclosed.
Building Components & Method	
1	All structures to have flood compatible building components below the 1% AEP flood level plus 300mm freeboard.
2	All structures to have flood compatible building components below the 1% AEP flood level plus 500mm freeboard.
3	All structures to have flood compatible building components below the 1% AEP flood level plus 500mm freeboard or a PMF if required to satisfy evacuation criteria (see below).
4	All structures to have flood compatible building components below the PMF level.
Structural Soundness	
1	Applicant to demonstrate that the structure can withstand the forces of floodwater, debris and buoyancy up to and including a 1% AEP flood plus 500mm freeboard or a PMF if required to satisfy evacuation criteria (see below). An engineer's report may be required.
2	Engineer's report to certify that the structure can withstand the forces of floodwater, debris and buoyancy up to and including a 1% AEP flood plus 500mm freeboard.
3	Applicant to demonstrate that the structure can withstand the forces of floodwater, debris and buoyancy up to and including a 1% AEP flood plus 500mm freeboard.
4	Applicant to demonstrate that any structure can withstand the forces of floodwater, debris and buoyancy up to and including a PMF. An engineer's report may be required.
5	Applicant to demonstrate that any structure can withstand the forces of floodwater, debris and buoyancy up to and including a PMF.
6	Applicant to demonstrate that the structure can withstand the forces of floodwater, debris and buoyancy up to and including a 1% AEP flood plus 300mm freeboard.
Flood Effects	
1	Engineers report required to certify that the development will not increase flood effects elsewhere, having regard to: (I) loss of flood storage; (ii) changes in flood levels, flows and velocities caused by alterations to flood flows; and (iii) the cumulative impact of multiple similar developments in the floodplain.
2	The flood impact of the development to be considered to ensure that the development will not increase flood effects elsewhere, having regard to: (i) loss of flood storage; (ii) changes in flood levels and velocities caused by alterations to the flood conveyance; and (iii) the cumulative impact of multiple potential developments in the floodplain. An engineer's report may be required.
3	The flood impact of the development to be considered to ensure that the development will not increase flood affectation elsewhere having regard to changes in flood levels and velocities caused by alteration of conveyance of flood waters. An engineer's report may be required if Council considers a significant affectation is likely. The unmitigated obstruction, concentration or diversion of overland flow paths to adjacent property shall not be permitted.
4	A floodway or boundary of significant flow may have been identified in this catchment. This area is the major conveyance area for floodwaters through the floodplain and any structures placed within it are likely to have a significant impact on flood behaviour. Within this area no structures other than concessional development, open type structures or small non habitable structures (not more than 30sqm) to support agricultural uses will normally be permitted. Development outside the Boundary of Significant flow may still increase flood effects elsewhere and therefore be unacceptable
5	Any filling within the 1% AEP flood will normally be considered unacceptable unless compensatory excavation is provided to ensure that there is no net loss of floodplain storage volume below the 1% AEP flood.

Car Parking and Driveway Access	
1	The minimum surface level of open car parking spaces, carports or garages, shall be as high as practical.
2	The minimum surface level of a car parking space, which is not enclosed (e.g. open car parking space or carport) shall be as high as practical, but no lower than the 5% AEP flood level or the level of the crest of the road at the highest point were the site can be accessed. In the case of garages, the minimum surface level shall be as high as practical, but no lower than the 5% AEP flood.
3	Garages capable of accommodating more than 3 vehicles on land zoned for urban purposes, or basement car parking, must be protected from inundation by floods equal to or greater than the 1% AEP flood plus 0.1m freeboard.
4	Basement car parking shall be protected from inundation by the 1% AEP flood.
5	The driveway providing access between the road and car parking space shall be as high as practical and generally rising in the egress direction.
6	The level of the driveway providing access between the road and car parking space shall be no lower than 0.3mbelow the 1% AEP flood or such that depth of inundation during a 1% AEP flood is not greater than either the depth at the road or the depth at the car parking space. A lesser standard may be accepted for single detached dwelling houses where it can be demonstrated that risk to human life would not be compromised.
7	Basement car parking or car parking areas accommodating more than 3 vehicles (other than on Rural zoned land) with a floor level below the 5% AEP flood or more than 0.8m below the 1% AEP flood level; shall have adequate warning systems, signage and exits.
8	Barriers to be provided to prevent floating vehicles leaving a site during a 1% AEP flood.
9	Driveway and car parking space levels shall be no lower than the minimum requirements normally applicable to this type of development. Where this is not practical, a lower level may be considered. In these circumstances, the level is to be as high as practical and, when undertaking alterations or additions no lower than the existing level.
Evacuation	
1	Reliable access for pedestrians required during a 1% AEP flood
2	Reliable access for pedestrians or vehicles is required from the building, commencing at a minimum level equal to the lowest habitable floor level to an area of refuge above the PMF level, or a minimum of 20% of the habitable floor area is above the PMF.
3	Reliable access for pedestrians or vehicles is required from the building to an area of refuge above the PMF level, or a minimum of 20% of the habitable floor area is above the PMF
4	Reliable access for pedestrians or vehicles required during a 1% AEP flood to a publicly accessible location above the PMF.
5	The evacuation requirements of the development during flooding shall be considered.
6	The development is to be consistent with any relevant flood evacuation strategy or similar plan.
7	The evacuation requirements of the development are to be considered up to the PMF level.
8	The evacuation requirements of the development are to be considered. An engineer's report will be required if circumstances are possible where the evacuation of persons might not be achieved within the effective warning time.
9	Adequate flood warning is available to allow safe and orderly evacuation without increased reliance upon the SES or other authorised emergency services personnel.
Management and Design	
1	Applicant to demonstrate that potential development as a consequence of a subdivision proposal can be undertaken in accordance with this DCP.
2	Site Emergency Response Flood Plan required where floor levels are below the design floor level, (except for single dwelling-houses).
3	Applicant to demonstrate that area is available to store goods above the 1% AEP flood level plus 500mmfreeboard.
4	Applicant to demonstrate that area is available to store goods above the PMF level
5	No storage of materials below the design floor level which may cause pollution or be potentially hazardous during any flood.

6	Finished land levels in new release areas shall be not less than the 1% AEP flood unless justified by site specific assessment. A surveyor's certificate will be required upon completion certifying that the final levels are not less than the required level.
Fencing	
1	Fencing within a High Flood Risk area, Boundary of Significant Flow or floodway will not be permitted except for permeable open type fences.
2	Fencing is to be constructed in a manner that does not obstruct the flow of floodwaters so as to have an adverse impact on flooding.
3	Fencing shall be constructed to withstand the forces of floodwaters or collapse in a controlled manner so as not to obstruct the flow of water, become unsafe during times of flood or become moving debris.
4	Fencing shall be constructed to withstand the forces of floodwaters.

The following sections will analyse the existing flood information for the site and the local catchment area to determine which controls, if any, apply to the site and whether the activity is compliant.

4.0 Existing Flood Information

4.1 Cabramatta Creek Floodplain Management Study and Plan (Bewsher, 2004)

The Cabramatta Creek Floodplain Management Study (Bewsher Consulting, 2004) was the last major study undertaken on the Cabramatta Creek catchment. The study investigated flood behaviour in the catchment and recommended a range of floodplain management measures to manage the flood risk. A flood model was developed as part of the study, which provided information on flood behaviour for 1989 (previous) and 1996 (existing) catchment conditions, as well as 'future' and 'ultimate' catchment conditions. Design flood levels and flood inundation mapping from the study were adopted by both Liverpool and Fairfield Councils during 2004. These flood levels have been used to specify minimum floor level controls and other building controls throughout the catchment since 2004, before this flood study was updated in 2011.

4.2 Cabramatta Creek Flood Study and Basin Strategy Review (Bewsher, 2011)

Bewsher was commissioned by Liverpool City Council in 2011 to study flood behaviour in the Cabramatta Catchment. Building upon the 2004 study, this review assesses the flood behaviour under previous (1989) catchment conditions, as well as assessing the existing (2008) conditions. A third model was developed representing future (2026) catchment conditions during Part 2 of the Study, including full development of the new release areas (including West Hoxton) and construction of the remaining basins from the basin strategy. The outcomes of this study are documented in Cabramatta Creek Flood Study and Basin Strategy Review Report (Bewsher, 2011) which has been formally adopted by Liverpool City Council.

The existing RAFTS hydrologic model of catchment runoff from the 2004 was updated and the flows input to a new TUFLOW hydraulic model to estimate flood levels, velocities and extents.

The results for the 2008 and 2026 flood levels and extent are the same at the site location, with only small increases in flood extent to the east of Cowpasture Rd. Figure 10 depicts the design 100-year (1% Annual Exceedance Probability (AEP)) flood extent and levels for the future (2026) conditions, which is the more conservative flood extent.

North of the site, flood levels adjacent to Beard Creek reach approximately 48-49m AHD in the 1% AEP event, with the lowest point of the site still elevated well above this level, with a proposed Finished Floor Level (FFL) of 53.90m AHD for the new pre-school building in the north, and 57.00m AHD for the new classroom building to the west (see Figure 1).

While mapping of the Probable Maximum Flood (PMF) was not included as part of this assessment, the study produced a flood risk precinct map, shown in Figure 11, which is indicative of flood affectation in the PMF. Land within the 'low flood risk precinct' is defined as all land within the PMF that does not fall into the higher risk categories. The site is located outside of all flood risk precincts and is therefore shown to be unimpacted by mainstream flooding.

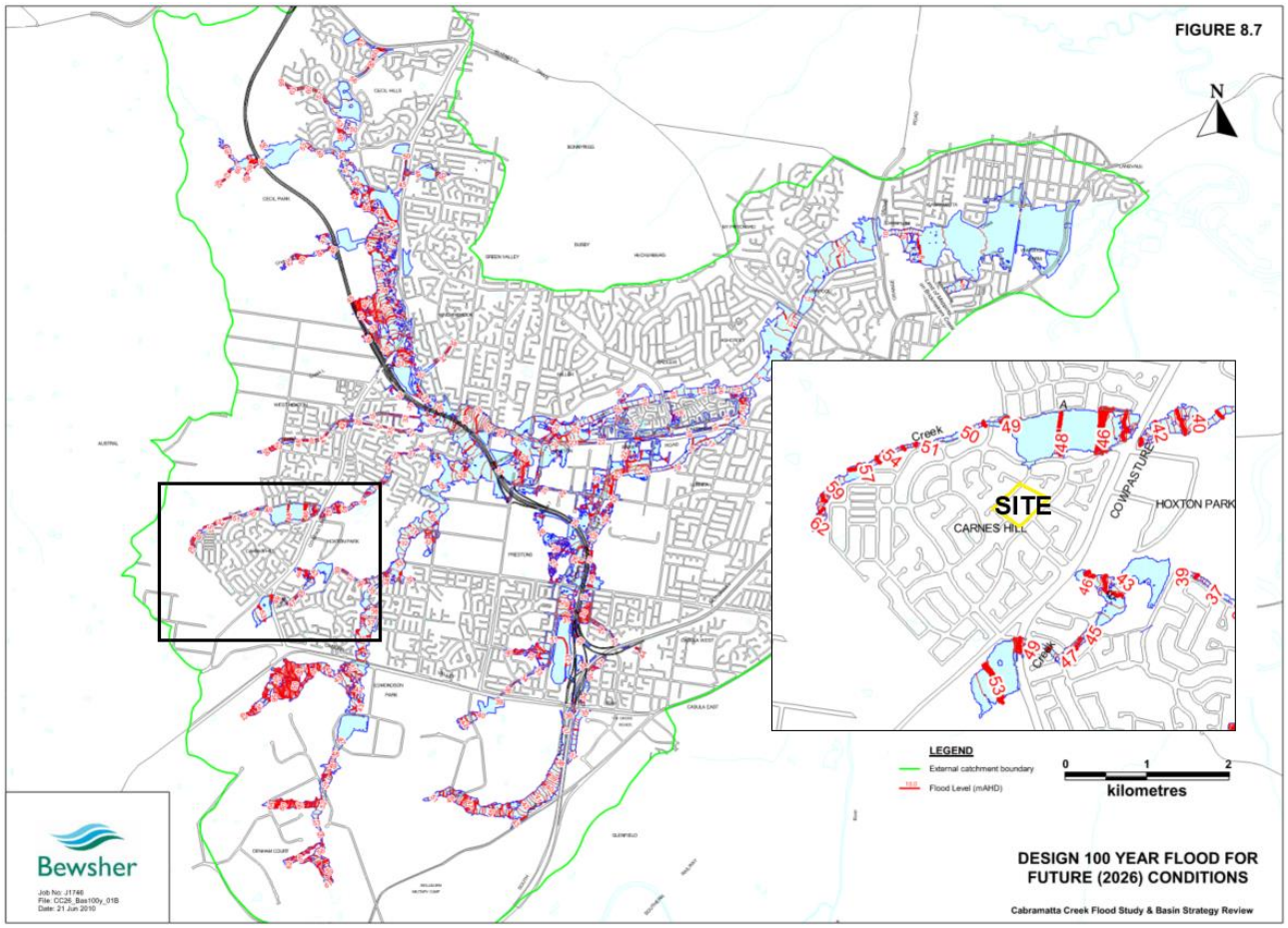

Figure 10: Flood levels and extent in the design 100-year (1% AEP) flood event, under future 2026 conditions (Source: Bewsher, 2011).

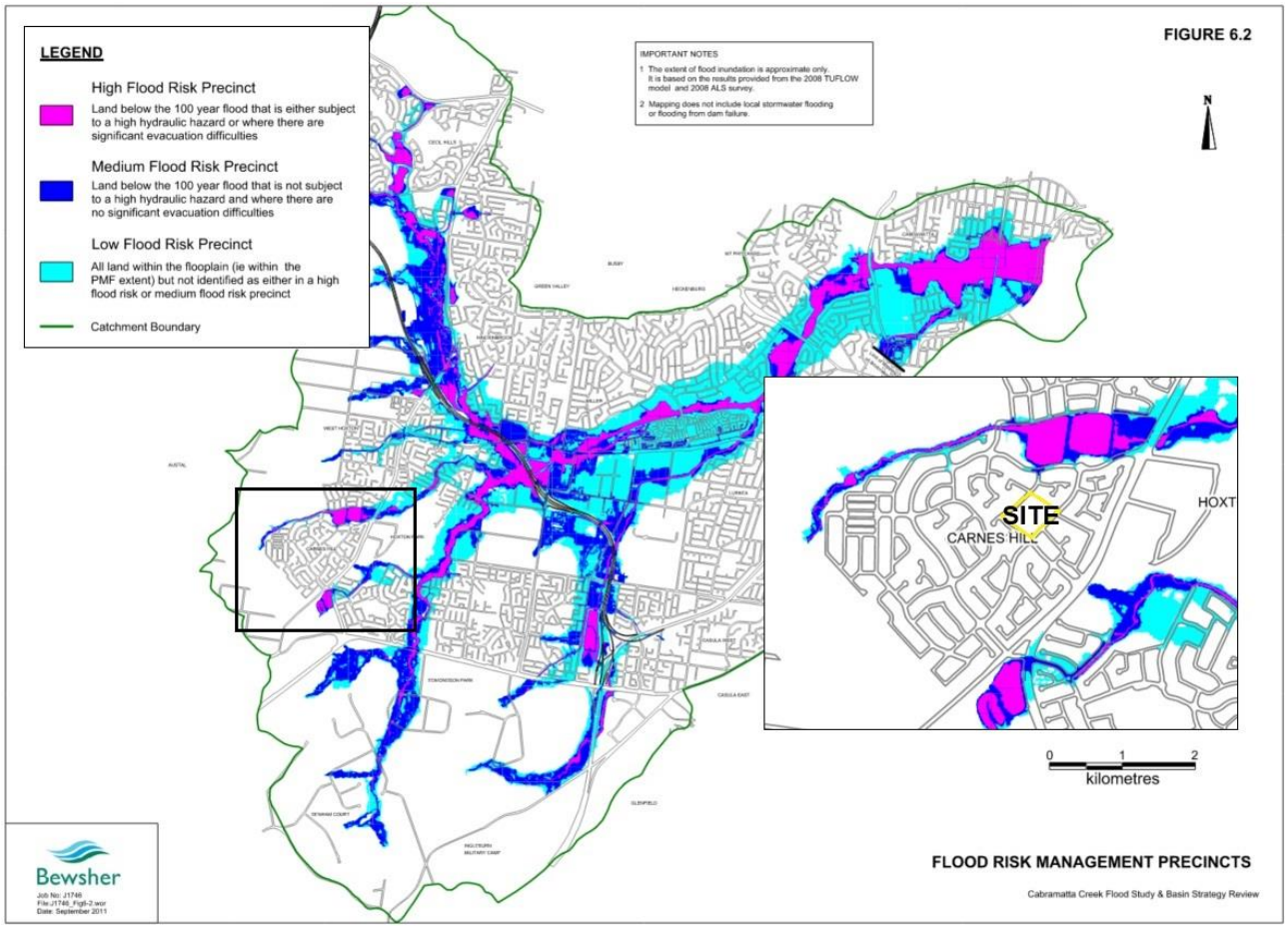

Figure 11: Flood risk management precincts contained within the Cabramatta Creek Flood Study and Basin Strategy Review (Source: Bewsher, 2011).

4.3 Liverpool City Council ePlanning Portal

The Liverpool City Council's ePlanning Portal similarly shows the flood risk category (Low, Medium and High flood risk) and indicative flood extents for the 1%, 5% and PMF flood events, depicted in Figure 12. The Flood Planning Area (1% AEP flood plus 0.5m freeboard) is also shown. According to Liverpool City Council's Flood Planning Map, the site is located outside the flood zone of each of these.

Council's flood maps show that the school lies outside the PMF flood extent and the Flood Planning Area (FPA 1% AEP + 500mm) and, as such, should not be affected by fluvial flooding.

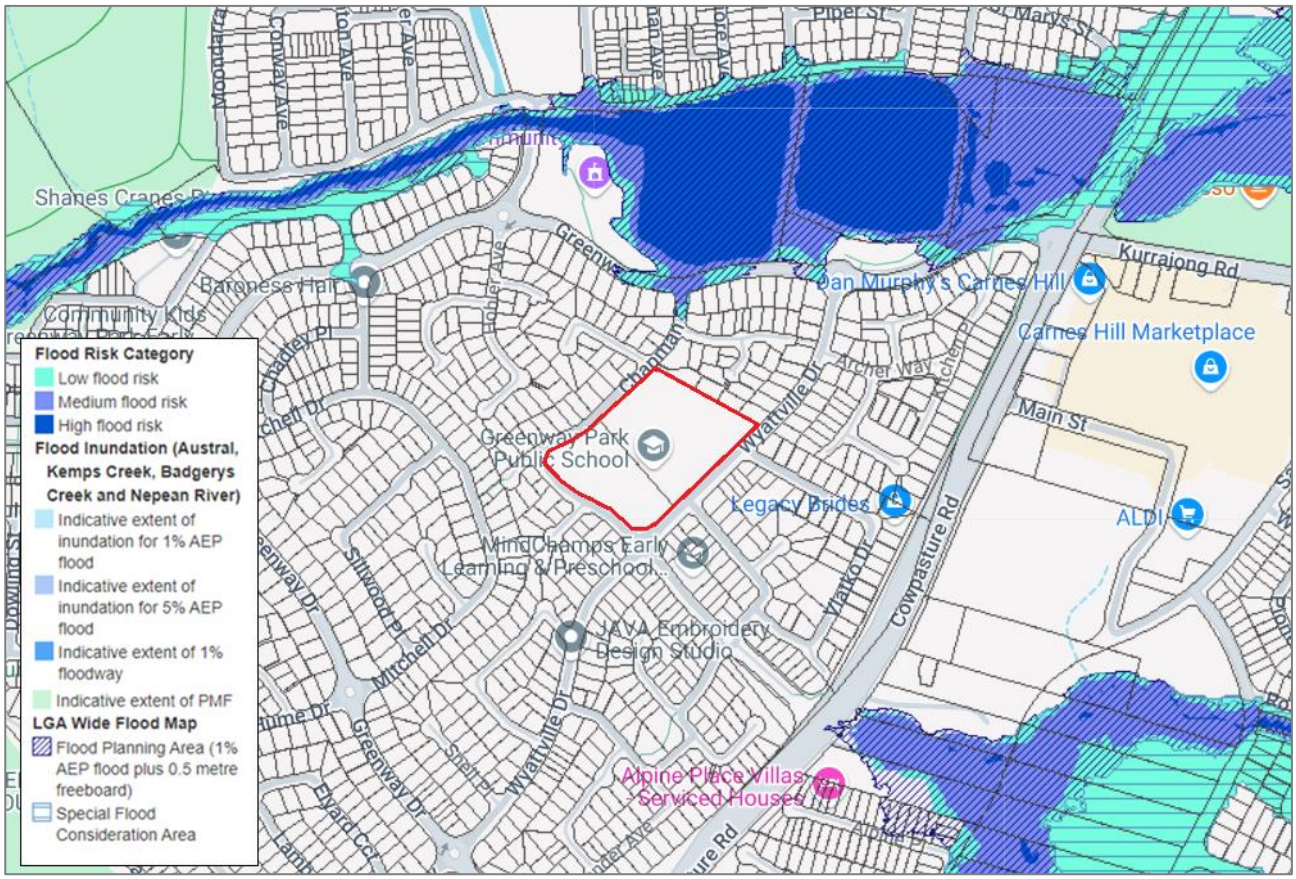

Figure 12: Liverpool City Council ePlanning Flood Map

5.0 Stormwater and Overland Flow

The local catchment contributing to runoff flows within the site boundary is shown in blue hatching in Figure 13, with the total contributing area estimated as 9.6 hectares. The local catchment area was estimated with reference to the DEM and contours obtained from ELVIS (2019).

Though it is anticipated that overland flow will be largely accommodated within the roads and drainage system, some overland flow onsite is expected to be conveyed in a northerly direction towards the site . Flow that does enter the site is likely to be split due to the ridge running through the site, with some flow directed towards Wyattville Drive.

Given that the proposed activity is situated within the north, the project civil design team should consider this in their internal stormwater management and ensure overland flows are effectively diverted away from proposed buildings, e.g. via design considerations including site grading.

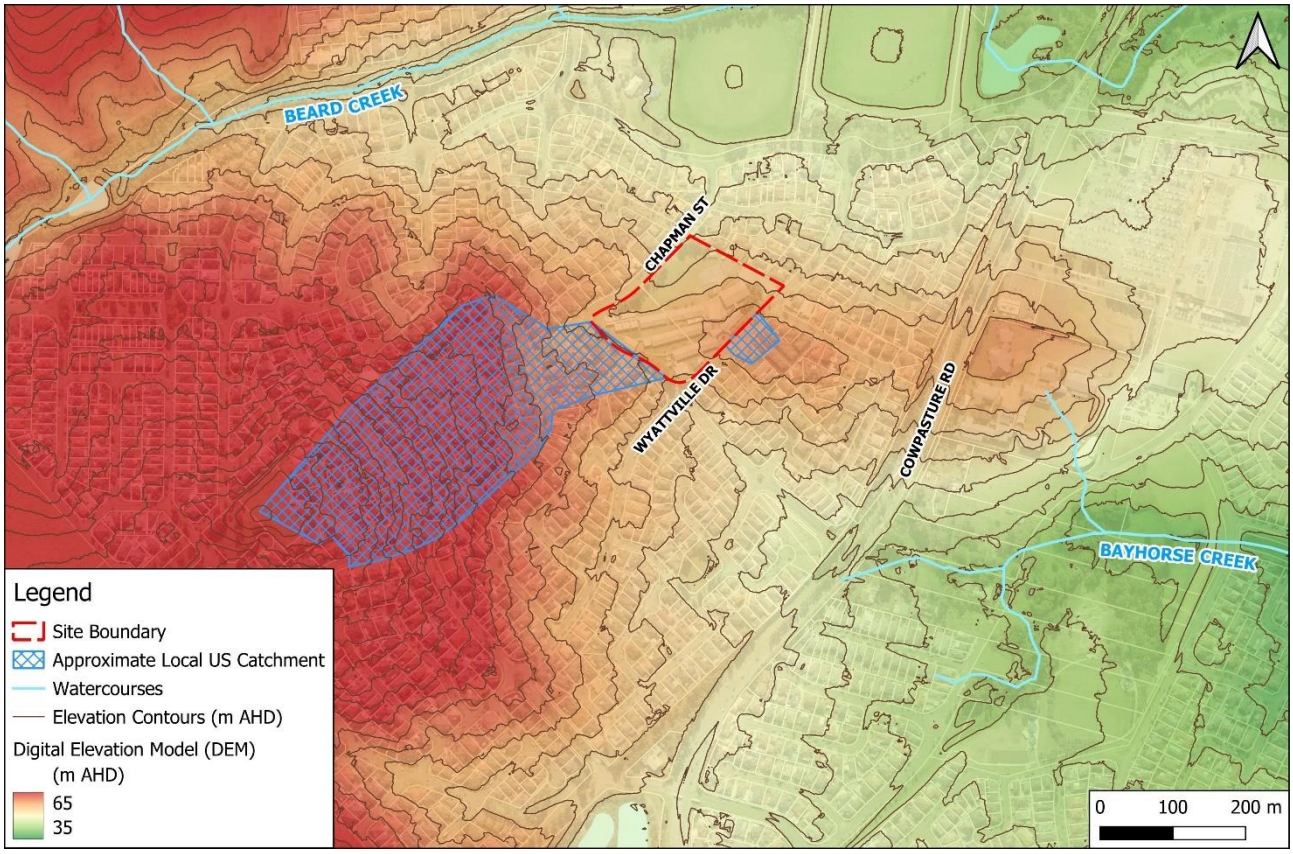

Figure 13: Local catchment contributing to overland flow within the site boundary

Preliminary calculations can be used to estimate overland flow across the catchment using the Rational Method. The overland flow travel time was calculated using the Friend equation:

$$t_o = \frac{107\ x\ n\ x\ L^{0.333}}{S^{0.2}}$$

Where:

t_o = overland flow travel time (mins)
L = flow path length (m)
n = Manning's n roughness
S = slope of surface (%)

The overland flow travel time was calculated at approximately 10 minutes. As an urban area, 5 extra minutes has been allowed for inlet time. This then informed the rainfall-runoff equation to calculate flow for the 1% AEP 15-min duration storm. The fraction impervious was adopted as 0.7, based on a desktop review which is reflective of urban residential area. The rainfall-runoff equation is as follows:

$$Q = CiA$$

Where:

C = the runoff coefficient (in this case, estimated as 0.88);
i = the rainfall intensity (in this case, 151 mm/hr for the 1% 15-min storm, taken from the BOM website);
A = the area of the contributing catchment (9.6 hectares)

$$Q = 0.88\ x\ 151\ x\ 9.6/360$$

$$Q = 3.5\ m^3/s$$

The 18% AEP (5-year Annual Recurrence Interval) has been adopted as the capacity for the surrounding in-ground stormwater network as this would be the minimum design criteria expected to be adopted for the design of the minor system. The 18% AEP flows are estimated at 1.6 m^3/s using the same assumptions as above) Based on this, the residual 1% AEP overland flow is estimated to be 1.9 m^3/s.

Conservative calculations using the Izzard Equation (assuming a 2.5% crossfall and 7m total road width, and a flow depth of 150mm at the top of kerb) indicates that the section of Chapman Street at the southern frontage of the site has a road flow capacity of approximately 1.43 m^3/s. The remaining 0.47 m^3/s of 1% AEP flows can be contained within the road corridor above the kerb levels and within the footpath area. The total road corridor width was estimated at 14.5m based on cadastral boundaries, with an assumed 2% slope from the top of kerb to the edge of the road corridor. Based on this, the total road flow capacity (up to the edge of the road corridor with full flow width of 14.5m) is calculated at approximately 4.0 m^3/s.

The total road flow capacity is enough to contain 1% AEP flows, and the site is therefore unimpacted by external overland flooding in the 1% AEP.

According to the BOM IFD rainfall depths, the 1% AEP 15-minute storm total rainfall depth at the site is 37.8mm. The 15-minute storm total rainfall depth at the site is estimated to be 180mm, using the Generalised Short Duration Method. To estimate the PMF flow that contribute to the section of Chapman Street south of the site, the ratio of the rainfall depth derived for the PMF and 1% AEP events have been used, which equates to approximately 4.76 (i.e. 180/37.8). The PMF flow (i.e. for the 15-minute storm) in the area is calculated to be approximately:

$$\text{PMF Q} = 4.76\ x\ 3.5 m^3/s$$

$$\text{PMF Q} = \mathbf{16.7\ m^3/s}$$

Similarly, assuming an underground stormwater capacity of 18% AEP flows, this equates to 15.1 m^3/s of overland flow in the PMF event. With a total road corridor capacity of 4.0 m3/s, this leaves approximately 11.1 m^3/s of residual PMF flows potentially impacting the site.

This is acknowledged as a conservative calculation. It is estimated that less than 50% of this flow would enter the site. A desktop analysis indicates that the sag point on Mitchell Drive may be breached at the connection through Cook Place at the western corner of the site. In this case, most flows would travel down Chapman Street at the site's northwestern frontage, bypassing the site. Overland flow would also be prevented from entering the school site due to physical impediments from the extensive housing development to the southwest, and due to road grading diverting flows along major conveyance channels. Flow that does enter the site is also likely to be split due to the ridge running through the site, with some flows diverted west towards Wyattville Drive, and the remainder directed to the north.

Based on the above it is estimated that the flow entering the site equates to sheet flow of less than 150mm depth in the PMF event.

As aforementioned, there is a predominant slope towards the north of the site. Given part of the proposed works is situated in this area, the project civil design team should consider this in their internal stormwater management and ensure overland flows are effectively diverted away from proposed buildings, e.g. via design considerations including site grading. Based on the above estimations, the proposal will need to cater for runoff and have adequately sized inground drainage and overland flow provisions. It is recommended that good practice levels design is adopted with falls away from building thresholds and FFL of the school at least 300mm above surrounding ground levels.

6.0 Compliance with DCP Controls

As denoted in Section 3.0, the Liverpool DCP outlines the various flood controls that apply to land within the floodplain. Schools are categorised as 'Sensitive Uses and Facilities' and are therefore subject to more stringent controls.

Flood risk precinct mapping available on the Liverpool City Council ePlanning Portal indicates that the site is located outside of the flood risk precincts, including the 'low risk' zone, which is indicative of the fluvial PMF level. As a result, the site is not subject to any of the controls outlined in Table 3 of the DCP (Figure 8).

Analysis in Section 5.0 indicates that while the road corridor accommodates flows in the 1% AEP event, the site may be subject to sheet flow in the PMF event. The relevant local overland flooding controls which apply to the site are outlined below (obtained from Figure 9 and Table 3 in Section 3.0)

- Floor levels to be no lower than the PMF level unless justified by a site-specific assessment.
- All structures to have flood compatible building components below the PMF level.
- Applicant to demonstrate that any structure can withstand the forces of floodwater, debris and buoyancy up to and including a PMF.
- The flood impact of the development to be considered to ensure that the development will not increase flood affectation elsewhere having regard to changes in flood levels and velocities caused by alteration of conveyance of flood waters. An engineer's report may be required if Council considers a significant affectation is likely. The unmitigated obstruction, concentration or diversion of overland flow paths to adjacent property shall not be permitted.
- The evacuation requirements of the development are to be considered up to the PMF level.
- Applicant to demonstrate that area is available to store goods above the 1% AEP flood level plus 500mm freeboard. No storage of materials below the design floor level which may cause pollution or be potentially hazardous during any flood.

While the site may be impacted by sheet flows in the PMF event, this can be managed by raising the floor level of the proposed works by at least 300mm above the surrounding ground levels.

The proposed works, summarised in Section 1.2, will not have any impact on off-site flood affectation, and will not impact upon wider emergency response plans. As shown in Figure 12, access and egress from the site in the PMF event is possible via the immediate access roads to the south of the school (Chapman Street), though Greenway Drive to the north is impacted by the creek flooding. Individual staff and student travel may be disrupted further afield.

7.0 Conclusion

This Flood Statement has been prepared to accompany a Review of Environmental Factors (REF) prepared for the Department of Education (DoE) relating to upgrades to Greenway Park Public School and new preschool. This report provides an analysis of the flood characteristics at the site location in addition to the nature and type of development to supplement the REF submission for the school.

Flood risk precinct mapping available on the Liverpool City Council ePlanning Portal indicates that the site is located outside of the flood risk precincts, including the 'low risk' zone, which is indicative of the fluvial PMF level. As a result, the site is not subject to any of the controls outlined in Table 3 of the DCP.

Analysis indicates that the site may be subject to sheet flow in the Probable Maximum Flood event. There is a predominant slope towards the north of the site. Given part of the proposed works is situated in this area, the project civil design team should consider this in their internal stormwater management and ensure overland flows are effectively diverted away from proposed buildings, e.g. via design considerations including site grading. The proposal will need to cater for runoff and have adequately sized inground drainage and overland flow provisions. It is recommended that good practice levels design is adopted with a continuous fall away from building thresholds, with FFL of the school at least 300mm above surrounding ground levels.

The proposed works will not have any impact on off-site flood affectation and will not impact upon wider emergency response plans.

Mitigation Measures

Mitigation measures identified as necessary are outlined in Table 4.

Table 4: Mitigation Measures

Mitigation Number/Name	When is Mitigation Measure to be complied with	Mitigation Measure	Reason for Mitigation Measure
1	Design	Continuous fall away from buildings, with at least 300mm above surrounding ground levels	The school should be constructed with a continuous fall away from building thresholds, with Finished Floor Levels set at least 300mm above the surrounding ground level in order to protect school buildings from overland flow flooding in the PMF event.
2	Design	Sufficient drainage and grading	Sufficient drainage provisions should be provided around each proposed building within the site to manage inground and overland stormwater flows away from the buildings.

Evaluation of Environmental Impacts

Based on the identification of potential issues, and an assessment of the nature and extent of the impacts of the proposed activity, it is determined that:

- As the site is located outside the fluvial PMF extent, the proposed development will not redistribute flows or reduce flood storage. As such, the development will have no impact on flood behaviour, flood risk to the

existing community, nor will it expose its users to onsite flood risks that require management or mitigation. In addition, it will not have any adverse offsite impacts, nor will it impact hydrology, drainage lines, downstream assets or watercourses.

- The extent and nature of potential impacts are low and will not have significant impact on the locality, community and/or the environment.
- Potential impacts can be appropriately mitigated or managed to ensure that there is minimal impact on the locality, community and/or the environment.

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