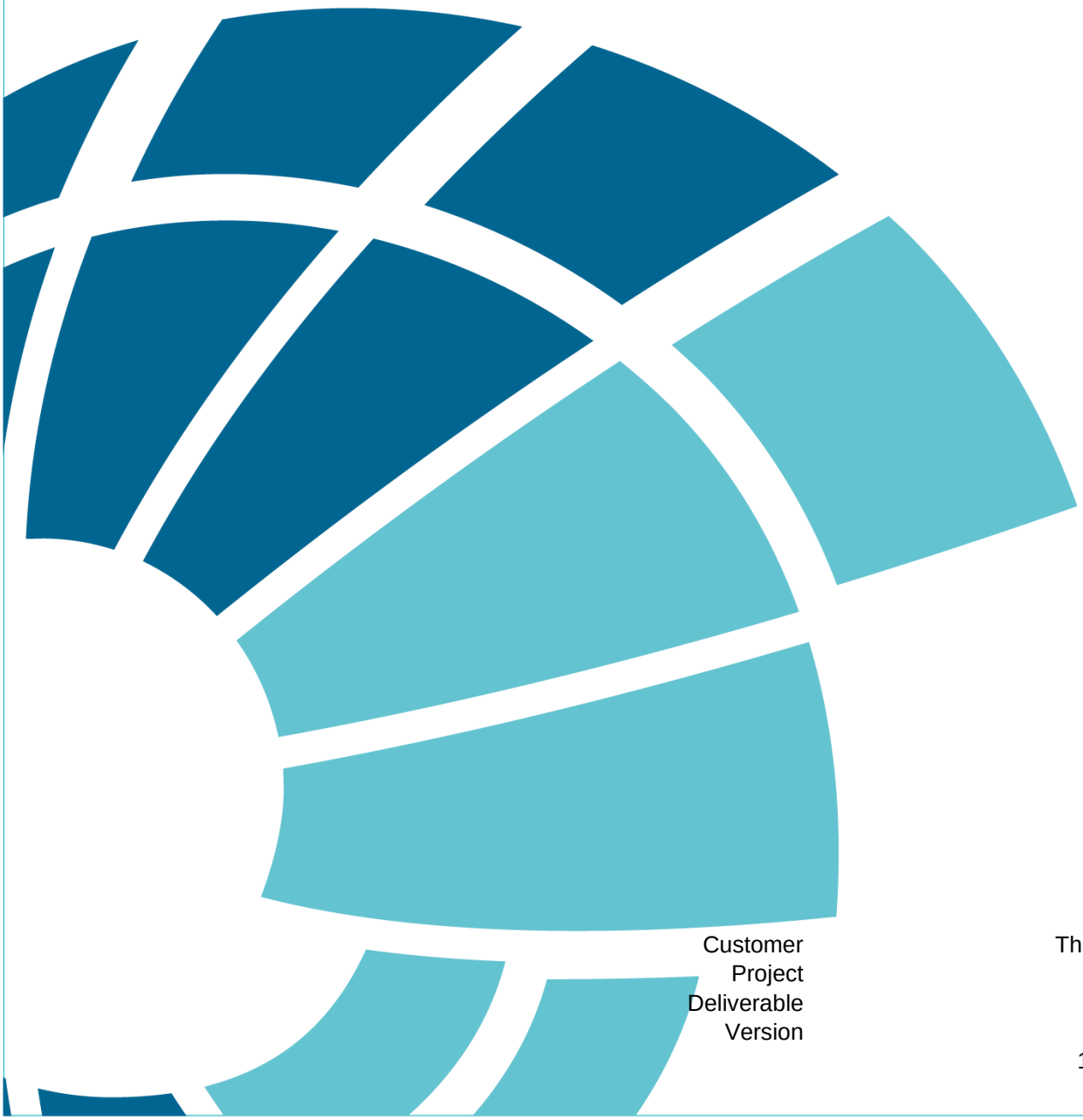
Flood Impact Assessment - Hunter River High School



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1 Introduction

This report has been prepared in relation to the proposed development of Hunter River High School located at 36 Elkin Avenue, Heatherbrae.

The school is located within Port Stephens Local Government Area (LGA) in the Hunter Region of NSW.

Hunter River High School (hereafter referred to as “HRHS”) covers an approximate area of 9.2 ha and is bounded by Adelaide Street and the Pacific Highway to the south-east, residential properties to the north-east and south-west, and open grassed land to the north-west. It is located about 800m east of the Hunter River and 500m south-west of the junction of Grahams Town Drain and Windeyers Creek. The locality of HRHS and its terrain is shown in Figure 1.1, which varies between 1.4 and 7.0 mAHD across the Site. Notably, there is a steep rise in ground elevations in the northwest corner of the site where ground levels rise from around 2.5mAHD to 6.7mAHD.

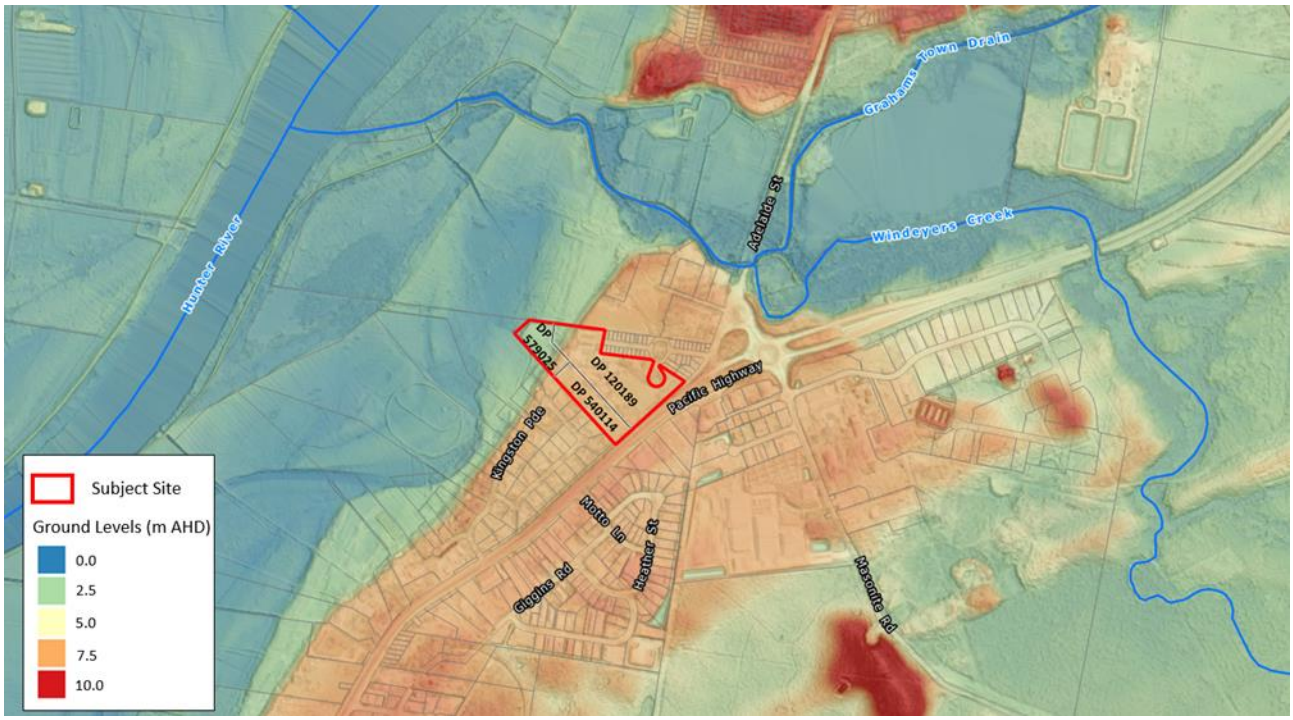

Figure 1.1 Hunter River High School Locality and Existing Terrain

This report has been prepared to support:

- A development application for the construction of a Construction of gymnasium (Block Y), consisting of a basketball court, equipment storage, canteen kitchen, staff room, first aid room and change room amenities, construction of hardstand civic space north of the gymnasium, construction of full-size rugby field, the construction of new carpark consisting of sixty-five (65) parking spaces (including 6 accessible parking spaces) and the construction and connection of a reticulated sewer pipe.
- A Part 5 Activity Approval, development permitted without consent, for the construction of a new administration building, student learning hub and provision of essential services.

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- A Part 5 Activity Approval, development permitted without consent, for the construction of a new linking road and kiss and drop bay between Adelaide Street and Elkin Avenue.

The proposed Site Plan is enclosed in Annex A to this report.

The Subject Site is formally described as the following three lots:

- Lot DP 540114
- Lot DP 579025
- Lot DP 120189

Port Stephens Council flood information certificates for the three mentioned lots (reference: Certificate numbers 83-2022-1025-1,83-2022-1026-1,83-2022-1027-1 dated 18 July 2022 and enclosed in Annex B to this report) indicate that majority of the Site is located in the category of “Minimal Risk Flood Prone Land”. However, the North-West corner of Lot 1 DP 120189 and most of Lot 1 DP 579025 are within a “High Hazard Floodway Area”. Therefore, BMT has been engaged by The APP Group to investigate the existing flood risk in relation to Council’s planning policies and to assess the suitability of development for the Site. This may also require the need to identify flood mitigation measures. This report documents the methodology and findings of this assessment and addresses Port Stephens Council 2022 Development Control Plan (DCP) and Port Stephens 2013 Local Environmental Plan (LEP).

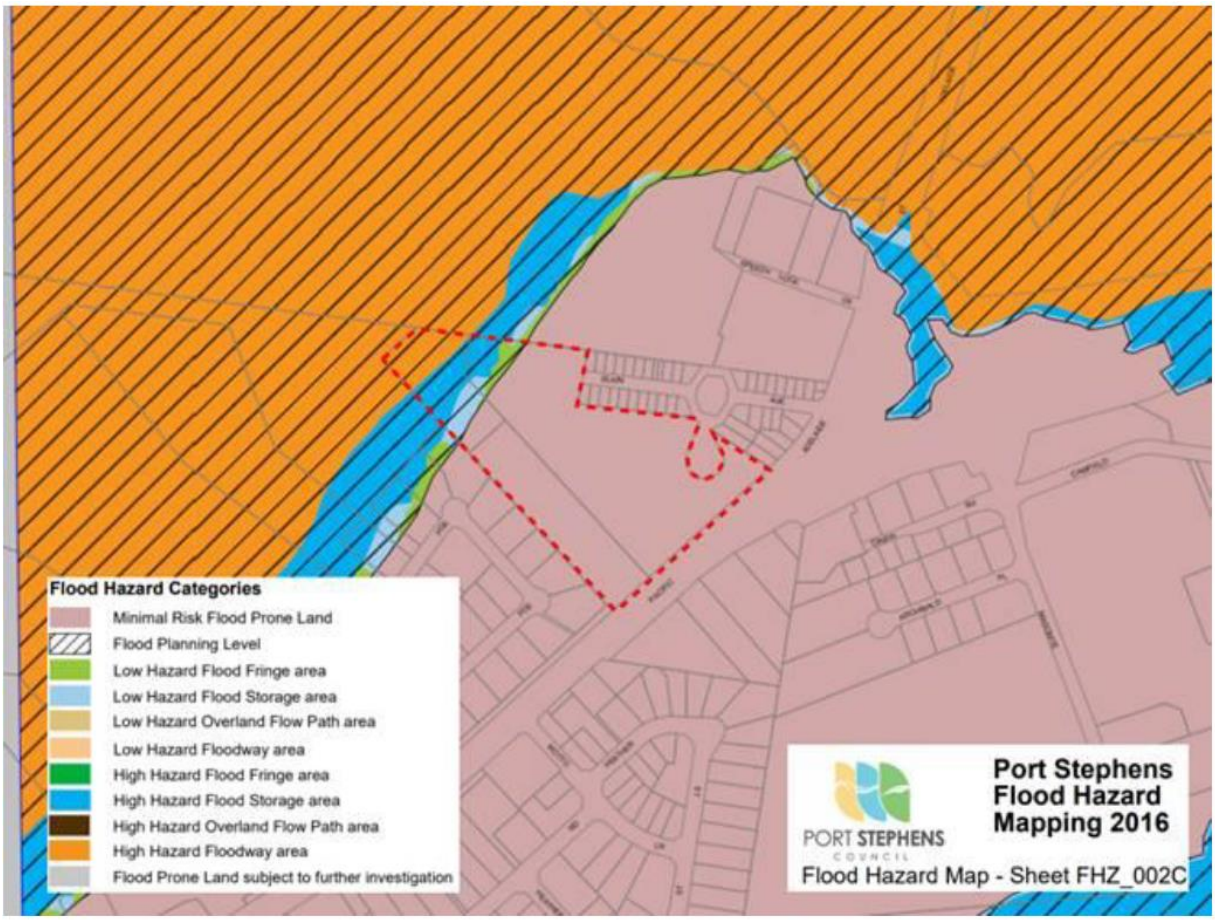

Figure 1.2 Port Stephens Council Flood Hazard Mapping

2 Available Flood Studies and Modelling

HRSH lies within the Hunter River catchment. Regional (mainstream) Hunter River flooding within this part of the Hunter River catchment has previously been defined by the following Port Stephens Council ("Council") studies:

- 'Williamtown Salt Ash Flood Study' (BMT WBM, 2005)
- 'Williamtown Salt Ash Flood Study Review' (BMT WBM, 2012)
- 'Updated Williams River Flood Study' (BMT WBM, 2016)
- 'Williamtown Salt Ash Floodplain Risk Management Study and Plan' (BMT WBM, 2017)

The 'Williamtown Salt Ash Floodplain Risk Management Study and Plan' (BMT WBM, 2017) (referred to hereafter as the "Williamtown FRMS&P") was prepared for Port Stephens Council to define the flood behaviour and was based on the Australian Rainfall and Runoff 1987 (AR&R 87) guideline. The study area covers a surface of approximately 400 km² that comprises the townships of Williamtown, Salt Ash, part of Raymond Terrace and the floodplain areas separating these towns. The entire project area was represented by a hydraulic two-dimensional model (refer to Figure 2.1 for overview of the model area).

The Williamtown model does not include local catchment and overland flow flooding in the surrounding area of the HRHS. However, basing on a review of the catchment area draining to Site, surrounding topography and land-use, it is not expected that there is an overland flow flood risk within the HRHS Site (for further discussion, refer to Section 3.4.2).

Therefore, the regional Williamtown model was considered suitable to be used as basis for this assessment.

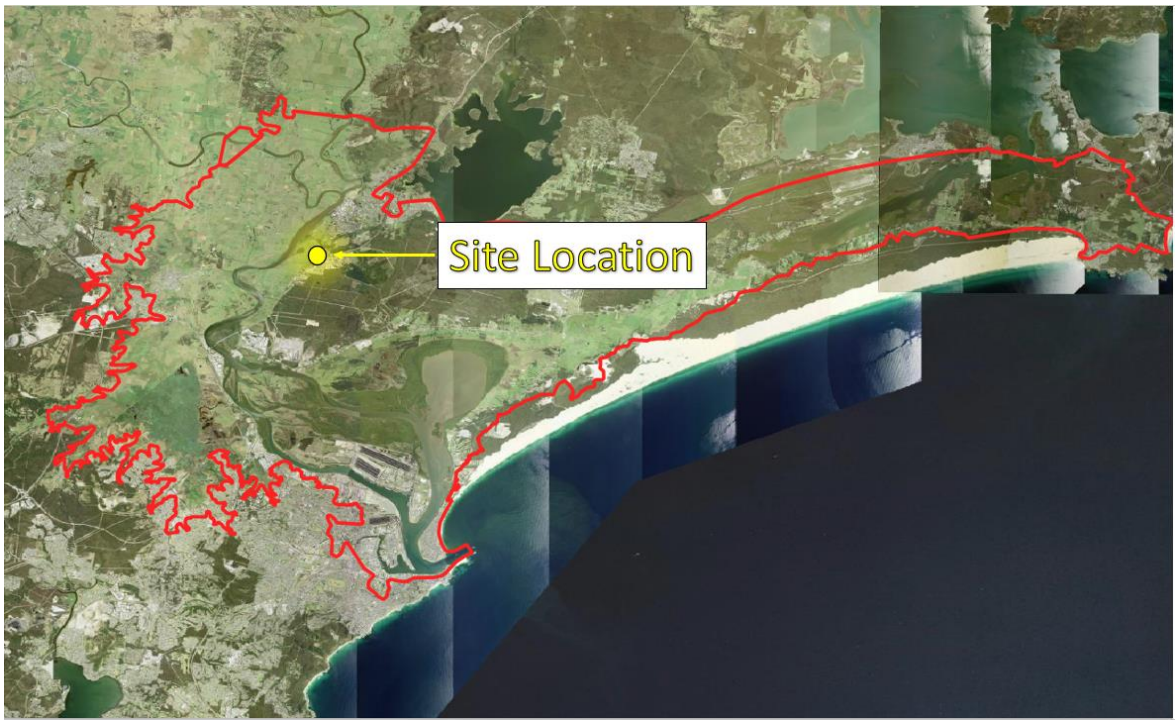

Figure 2.1 Williamtown /Salt Ash Flood Study Area

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3 Flood Modelling

3.1 Existing Scenario Model

The Williamtown Salt Ash Floodplain TUFLOW model was updated to represent local, contemporary floodplain conditions on-Site more reliably. This included the following updates:

- Ground surface elevations within the model were updated based on detailed Site survey data provided to BMT by Stantec on 31 October 2022 (reference: 220310A_02.dwg). This DEM is shown in Figure 3.1.
- The land use layers used to define the Manning's n roughness values within the Site were refined to better represent the existing surface conditions on-Site .
- Following the same approach used for the entire model, existing buildings within the Site are represented as areas of high roughness (Manning value = 2.0) to provide high obstruction to the flow while accounting for the flood storage capacity within each building. The outline of the existing buildings were refined on the basis of the survey data provided.

The updated version of the model is referred to as the "Existing Scenario TUFLOW model".

3.2 Post -development Scenario Model

On April 2023, The APP Group supplied BMT with the proposed Site plan (reference: 2023-04-11-14276-GRHS FINAL ISSUE FOR COORDINATION_EJE_combined.pdf.pdf), as enclosed in Annex A.

Stantec also supplied BMT with the design terrain data associated with the proposed development (reference: HRHS-STNC-XX-XX-M3-C-065101.dwg).

The following specific modifications were made to the Existing Scenario TUFLOW model to form the "Post-development Scenario TUFLOW model" for this assessment:

- Ground surface elevations within the model were updated based on a Digital Elevation Model (DEM) developed from the design terrain This DEM is shown in Figure 3.1.
- Land use layers used to define hydraulic roughness were updated to reflect proposed land uses and associated surface roughness types.
- Areas of high roughness associated with existing buildings were replaced by the outline of the new proposed buildings to which the same Manning's n value was applied.

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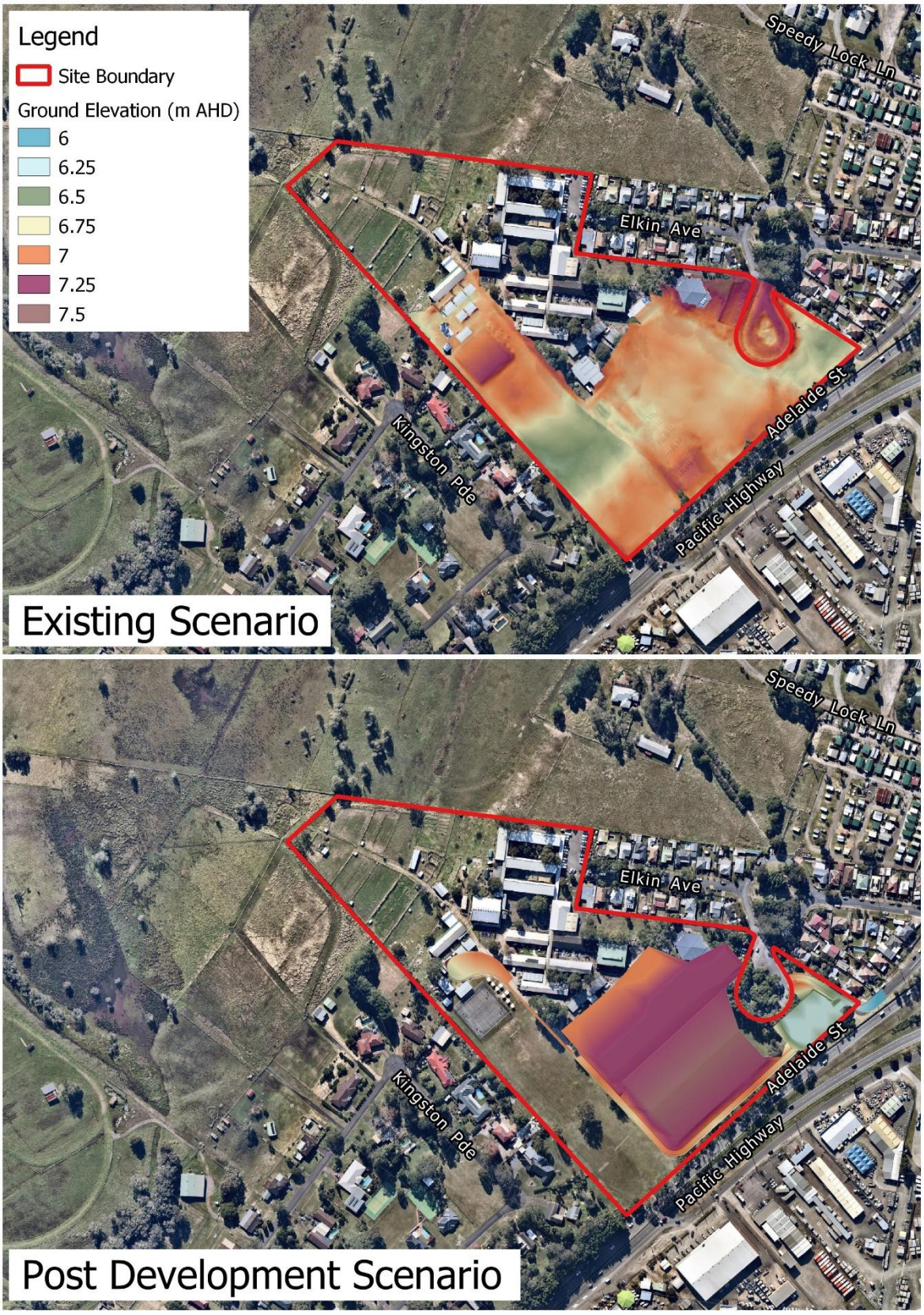

Figure 3.1 Existing and Post Development DEM

3.3 Model Simulations

Existing and post-development flood conditions were determined by using the Existing and Post-development Scenario TUFLOW models to simulate the 1% Annual Exceedance Probability (AEP) and Probable Maximum Flood (PMF) design events for the 48 hours critical duration.

Furthermore, following 2022 Port Stephen Council DCP indications, in order to assess the potential impact of future climate conditions on the existing flood behaviour, the 1%AEP flood event was also simulated under future (year 2100) design conditions (1% AEP Flood -2100 Planning Conditions): this included a projected sea level rise by 900mm relative to the 1990 mean sea level and increased design rainfall intensities by 20%.

The results of these simulations were used as the basis for flood and impact mapping.

3.4 Modelling Results

3.4.1 Flood Mapping

The results of the TUFLOW modelling for the modelled events were used to prepare flood depth, velocity and hazard mapping in the vicinity of the Site. This mapping is provided in Annex C and includes:

- Figure C-01 Peak Flood Depth – Existing Scenario - 1% AEP Flood
- Figure C-02 Peak Flood Depth – Post-development Scenario - 1% AEP Flood
- Figure C-03 Peak Flood Velocity – Existing Scenario - 1% AEP Flood
- Figure C-04 Peak Flood Velocity – Post-development Scenario - 1% AEP Flood
- Figure C-05 Flood Hazard – Existing Scenario - 1% AEP Flood
- Figure C-06 Flood Hazard – Post-development Scenario - 1% AEP Flood
- Figure C-07 Change in Peak Flood Level - 1% AEP Flood
- Figure C-08 Peak Flood Function – Existing Scenario - 1% AEP Flood
- Figure C-09 Peak Flood Function – Post-development Scenario - 1% AEP Flood
- Figure C-10 Peak Flood Depth – Existing Scenario - 1% AEP Flood 2100 Planning Conditions
- Figure C-11 Peak Flood Depth – Post-development Scenario - 1% AEP Flood 2100 Planning Conditions
- Figure C-12 Peak Flood Velocity – Existing Scenario - 1% AEP Flood 2100 Planning Conditions
- Figure C-13 Peak Flood Velocity – Post-development Scenario - 1% AEP Flood 2100 Planning Conditions
- Figure C-14 Flood Hazard – Existing Scenario - 1% AEP Flood 2100 Planning Conditions
- Figure C-15 Flood Hazard – Post-development Scenario - 1% AEP Flood 2100 Planning Conditions
- Figure C-16 Change in Peak Flood Level - 1% AEP Flood 2100 Planning Conditions

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- Figure C-17 Peak Flood Function – Existing Scenario - 1% AEP Flood 2100 Planning Conditions
- Figure C-18 Peak Flood Function – Post-development Scenario - 1% AEP Flood 2100 Planning Conditions
- Figure C-19 Peak Flood Depth – Existing Scenario – PMF
- Figure C-20 Peak Flood Depth – Post-development Scenario - PMF
- Figure C-21 Peak Flood Velocity – Existing Scenario - PMF
- Figure C-22 Peak Flood Velocity – Post-development Scenario - PMF
- Figure C-23 Flood Hazard – Existing Scenario - PMF
- Figure C-24 Flood Hazard – Post-development Scenario - PMF
- Figure C-25 Change in Peak Flood Level - PMF
- Figure C-26 Peak Flood Function – Existing Scenario - PMF
- Figure C-27 Peak Flood Function – Post-development Scenario – PMF

Port Stephens Council 2022 DCP, utilizes the Australian NSW Floodplain Management Manual (NSWG,2005) flood hazard categorization to identify flood conditions that are likely to present a risk to people, vehicles, and buildings. Flood Hazard is based on a combination of flood depths, velocity and depth-velocity product thresholds as show in Figure 3.2.

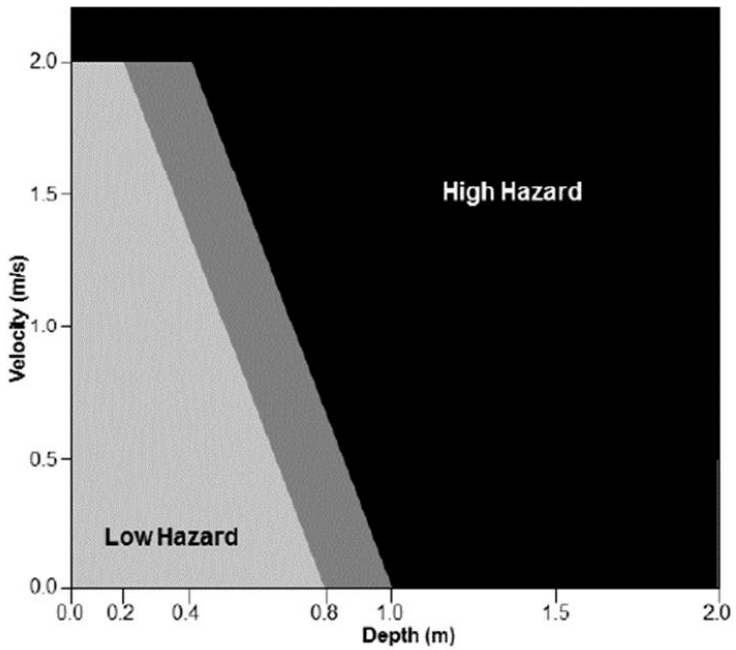

Figure 3.2 NSWG,2005 Flood Hazard Categorization

Flood function mapping was also prepared based on the flood function criteria defined within the Williamtown Salt Ash Floodplain Risk Management Study and Plan (BMT,2017).

3.4.2 Existing Flood Conditions

The dominant source of Site flooding is the Hunter River. In the 1% AEP event this can flood the low-lying areas located in the north-west corner of the Subject Site with depths up to 3.5m (1%AEP peak flood level is 4.7mAHD). In the 1% AEP Flood - 2100 Planning Conditions, the water level reaches the peak value of 5.2mAHD but the flood extent at the Site is similar to that for the 1%AEP scenario. In the PMF event the entire site is flooded and the peak water level is 8.51mAHD with depths ranging between 1.4m to 7.0m.

Windeyers Creek is a small tributary of the Hunter River located around 400m north of the site and has a catchment area of approximately 20km^2. Flow generated by Windeyers Creek would not be expected to affect the site as to do so its runoff would effectively have to fill the Hunter River floodplain. Windeyers Creek has the potential to be subject to backwater inundation from the Hunter River. This flood mechanism is accounted for in the modelling undertaken for this assessment although was shown to not affect the Site due to the Site being separated from Windeyers Creek by higher ground (as shown in Figure 1.1) .

Due to the elevated location of the Site and the physical barrier to flow represented by the Pacific highway running along the south Site boundary, size of local catchment is minimal and it is certainly not expected to result in any flood risk.

Therefore, the only source of flooding that is relevant for this assessment is the Hunter River.

3.4.3 Post development Flood Conditions

The proposed works lie outside the flood extent of both the 1%AEP and 1%AEP - 2100 Planning Conditions events as shown in Figure 3.3. Therefore, there are no flood impacts for these events. In the larger PMF event, the site is inundated but no flood impacts result.

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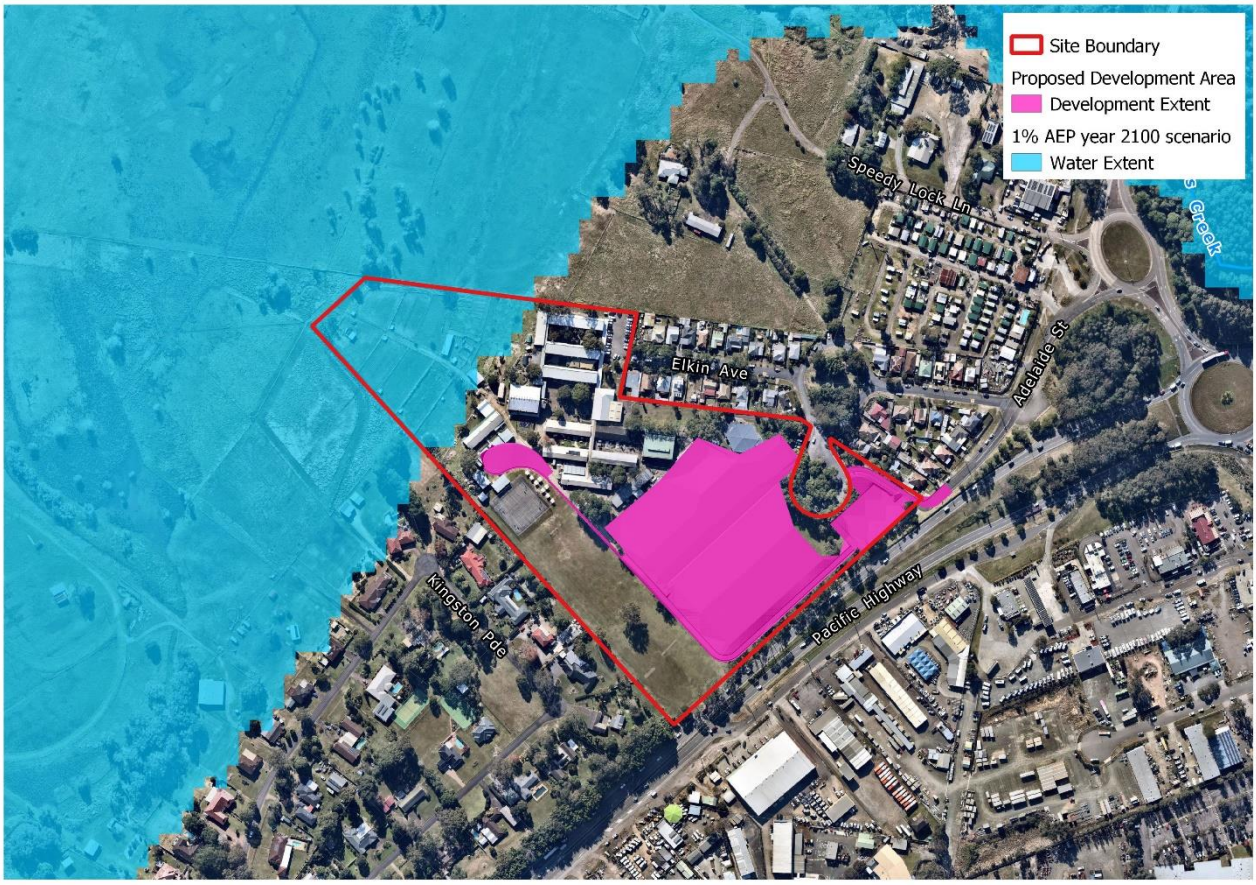

Figure 3.3 Proposed development area and 1%AEP (year 2100) flood extent

Peak flood level and velocity impact mapping are provided in Annex C. This provides a visual representation of the differences between flood conditions for existing and post-development conditions. These impact maps were created by subtracting results for the Existing Scenario from the results for the Post-development Scenario and show the location and magnitude of changes in flood level and velocity associated with the proposed development.

No changes in flood levels are predicted to result from the proposed development in any events up to and including the PMF.

The flood hazard is also unaltered as compared to the Existing Flood Conditions.

Overall, in regard to flood impact, the proposed development has no impact on flood behaviour and does not result in flood impacts to other private properties or public roads. It will not result in increased requirement for government spending on flood mitigation measures.

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4 Assessment of Council DCP Requirement

Table 4.1 sets out the compliance of the proposed development with 2022 Port Stephens Council Development Control Plan.

Table 4.1 Response to Port Stephens Council DCP Requirements

Requirement	Response
Site Selection	
B5.1 If multiple flood hazard categories are specified for a site on a flood certificate, the proposed development must be located on the land with the lowest flood risk	Flood Certificates received from Council on 18 July 2022, show the following hazard categories for the three lots that make park of the Subject Site: Lot DP 540114: entirely classified as “Minimum risk flood prone land” Lot DP 579025: mostly classified as “High hazard floodway area” with some portions at the south-east end classified as “Low hazard flood storage area” and “Low hazard flood fringe areas” Lot DP 120189: mostly classified as “Minimum risk flood prone land” with small portions at the north-west corner classified as “Low hazard flood storage areas”. Proposed upgrade works encompass all the three mentioned lots but only occupies areas classified as “Minimum risk flood prone land”
Finished Floor Level (FFL)	
B5.2 Development must meet the minimum FFL as specified in Figure BJ.	Flood Certificates received from Council on 18 July 2022, show the adoptable minimum floor level being equal to 5.7mAHD. Such level is resulting from the 1%AEP flood level, 50 years from now, with 500mm allowance for freeboard. Table 4.2 shows the adopted FFL for the proposed buildings which is consistently higher than the nominated minimum floor level. As noted by Council representative in the pre-DA meeting, control B5.2 of Port Stephens DCP requires the FFL for a vulnerable development to be at the PMF level which, in this instance, is equal to 8.5mAHD. However, for the new Hunter River high School buildings, a reduced FPL is proposed. Justifications to support a reduced FPL level are presented in the response to Council pre-DA comments in Annex D to this report.

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Requirement	Response
Flood Compatible design	
B5.3 Development for a building (and/or an associated driveway or access) must be of a flood compatible design and construction and shall meet the relevant requirements in the Construction of Buildings in Flood Hazard Areas (Australian Building Codes Board). Council may also require structural certification for development proposed on land which becomes a floodway in the PMF.	Proposed buildings must be constructed using flood compatible materials and according to flood compatible design. The Site is classified as “floodway” during PMF. The structural integrity of the Existing Buildings designated for sheltering-in-place (buildings G,H,I,J and K) shall be confirmed considering depths of water up to 2m and velocities up to 0.6m/s.
B5.4 Fencing on flood prone land should be stable in events up to the current day 1% AEP flood event and not obstruct the flow of floodwater.	Fencing is not part of the proposed works.
B5.5 All incoming main power service equipment, including all metering equipment, and all electrical fixtures, such as power points, light fittings, switches, heating, ventilation and other service facilities must be located above the FPL, or where possible above the PMF. Where the above cannot be achieved, the following features shall be used: • Electrical cabling is not to be installed within walls, or chased into walls; and • Any circuit containing switches, power points or any other electrical fitting that are located below the FPL, shall connect to the power supply through an individual Residual Current Device (RCD), located in the meter box.	All electrical services to be located above PMF level of 8.51mAHD.
B5.6 The storage of hazardous or potentially hazardous materials, potentially polluting material or material that could be washed from site and cause harm downstream must be stored above the FPL with appropriate bunding.	No hazardous or polluting material is expected to be stored on Site. Gas cylinders to be located above the FPL of 5.7mAHD and appropriately anchored.
B5.7 Items that may wash away during flood events (e.g. rainwater tanks, hot water tanks, gas cylinders, shipping containers) must be elevated above the 1% AEP flood event level in the year 2100 (without freeboard) or anchored to resist buoyancy and impact forces.	All movable items to be stored away from the 1%AEP year 2100 flood extent, as shown on maps in Annex C.
Flood impact and risk assessment	
B5.8 A flood impact and risk assessment is required for: • Any fill on land identified as floodway. • Any fill located in a flood storage area, unless:	No fill is proposed in areas identified as floodways and/or flood storage in the 1%AEP year 2100 scenario. A flood impact and risk assessment has been conducted following Council’s request.

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Requirement	Response
- The net volume of fill does not exceed the lesser of 20% or 2000m³ of the flood volume of the lot in the 1% AEP flood event in the year 2100 (this includes consideration of previous fill volumes); and - It is demonstrated that the fill does not adversely affect local drainage patterns of all events up to the 1% AEP flood event in the year 2100. Note: Fill in flood storage areas greater than the abovementioned volume can be offset by flood storage. Offsetting can be achieved through consolidation of lots and/or assigning an 'easement to flood land' on the compensatory lot/s. Compensatory lots must be located within the zone of influence of the proposed fill (as demonstrated by the flood impact and risk assessment) or adjacent to the proposed fill and be of the same hazard category of the subject site. • Any fill for the purposes of a livestock flood refuge mound, unless the livestock flood refuge mound is located in an identified flood fringe area: - The volume/size and location of the livestock flood refuge mound meets the criteria in Figure BK; and - The size of the mound must have regard to the agricultural capacity of the land. The design and size of the mound shall be determined by reference to the NSW Department of Primary Industries – Agriculture. 2009, 'Primefacts: Livestock flood refuge mounds'; and • Where the proposed development could change flood behaviour, affect existing flood risk, or expose people to flood risks that require management or; • If Council determines a flood impact and risk assessment is necessary for any other reason.	
B5.9 For residential accommodation, subdivision, commercial premises, industrial premises, garages, open car parking spaces and carports, a reduced planning horizon of 50 years from the date of determination will be accepted where the design facilitates ongoing flood adaptation (ie the future raising of the building).	N/A for vulnerable development
B5.10 Where proposed alterations and additions to existing residential accommodation	N/A.

Requirement	Response
is less than 40% of the gross floor area of the existing residential accommodation, and does not involve a net increase in the number of bedrooms, Council will consider a FFL lower than the flood planning level (FPL), but not lower than the existing floor level. Any additional flood risk must include mitigation measures to reduce the overall flood risk of the development.	
B5.11 Access from the building envelope to the public road is to have a minimum finished access level of: • The flood immunity of the connecting public road; or • The current day 1% AEP flood event level for the site.	Dual access to the Site is proposed via Adelaide Street and Elkin Avenue. Both accesses are flood free in the 1%AEP event.
5.12 Earthworks for driveways and access must satisfy the objectives of B3.D of the DCP and LEP. Note: Impacts on local drainage and localised flooding should be considered and addressed. Driveways should be designed and constructed in accordance with Councils standard design drawings.	Due to the elevated location of the Site and the physical barrier to flow represented by the Pacific Highway running along the south boundary of the Subject Site, it is expected that local flow would be minimal. Proposed driveway and access roads works do not involve considerable cut and fill volumes and do not have the potential to impact localised flood behaviour. Proposed roadworks are not within 40m of the top bank of a riparian corridor and do not represent a potential hazard to the environment.
5.13 Subdivision that creates the ability to erect additional dwellings is to indicate building envelopes above the FPL and comply with the requirements of B5.11, B5.12 and B5.14 of this Part.	No Subdivision is proposed at the Site.
5.14 If evacuation egress from residential accommodation, a commercial premises, an industrial premises, fill or development vulnerable to emergency response and critical infrastructure to flood free areas cannot be achieved via a route that is flood free in the current day 1% AEP flood event or is a low hazard flood area, an onsite flood refuge must be provided meeting the following criteria: • Is located above the PMF level; • Is intrinsically accessible to all people on the site, plainly evident and self-directing; • Is accessible in sufficient time for all occupants with fail safe access and no reliance on elevators; • Has unobstructed external access for emergency boats during flooding; • Caters for the number of persons that could reasonably be expected on-site at any one time (approx. 2m² per person);	Site egress locations are not flooded in the 1%AEP event or in the 1%AEP event in the 2100 Climate Change Scenario. However, in the 1%AEP, all evacuation routes from the Site are cut by flood water at several points. The north route via Adelaide Street is first cut off by floodwater at Windeyers creek. The Pacific Highway that runs in the south-west to north-east direction is interrupted both at north at Windeyers creek Bridge and at south by the Hunter River flooding at the Hunter Region Botanic Gardens. At south, Masonite Road is also not viable. Should floodwater rise above the1%AEP level (in the PMF event for instance), the Site would be flooded. From a Flood Emergency Planning perspective, the Site is classified as Low Flood Island (LFI). A Flood Emergency Response Plan has been drafted for the Site showing compliance to Council's requirements (reference: R.A12187.001.02_HRHS_FERP).

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Requirement	Response
• Provides adequate shelter from the storm and has natural lighting and ventilation; and • Contains sufficient clean water, a first aid kit, portable radio with spare batteries and a torch with spare batteries. Note: If a flood refuge is required, the DA must be accompanied by structural certification.	
B.15 A site based overland flow report must be submitted for development located within a designated overland flow path. The purpose of this report is to demonstrate that the development: • Will not result in material increase in flood level or flood hazard upstream, downstream or surrounding properties; and • Will provide acceptable management of flood risk with appropriate development levels to ensure the safety of people.	The Site is not located in a designated flow path. Refer to Section 3.4.2 of this report for discussion about local drainage.
Development on land identified as floodway	
B5.16 Development other than farm buildings and/or fill is not supported on land identified as either low hazard floodway or high hazard floodway.	No development is proposed on floodway areas identified in the 1%AEP event and 1%AEP event with rainfall and ocean levels calculated at the year 2100 horizon.
B5.17 Fencing in a floodway should not include non-permeable materials or fencing types that could restrict or redirect flood waters.	No fencing in floodway is proposed
Application of performance-based solutions	
B5.18 The proposed land use is consistent with Figure BI, which shows suitable land uses by flood hazard category (as identified on a flood certificate) and the proposed development incorporates adequate measures to manage risk to human life from flooding, including: • Evacuation access from an area affected by flooding to an area free of risk from flooding, taking into account any potential access restrictions; • Warning times and procedures to make people aware of the need to evacuate; • Consideration of the current and potential future occupants; and • Consistency with the most recent Council adopted flood study or floodplain risk management study that has been undertaken for the site.	Development is suitable with the flood hazard category designated for the Site (“Minimal Risk Flood Prone Lands”, as show in flood information certificates in Annex B to this report). A Site-specific Flood Emergency Response Plan (reference: R.A12187.001.02_HRHS_FERP) has been drafted to demonstrate compliance to Emergency Requirements.
B5.19 The proposed development will not increase the potential individual or cumulative flood impacts on other development or properties that are likely to occur in the same floodplain. In	A Flood Impact Assessment has been carried on for the Site. The assessment considered current days 1%AEP event, future conditions (year 2100) 1%AEP event and PMF. Results show that no changes in flood levels are predicted to result from

Requirement	Response
determining any potential increase in flood impacts, Council will consider: • Future (in the year 2100) flood levels and/or velocities including, but not limited to the 5% AEP flood event, 1% AEP flood event and probable maximum flood (PMF) events; • Loss of flood storage in the immediate floodplain; and • Consistency with the most recent, Council adopted flood study or floodplain risk management study that has been undertaken for the site.	the proposed development in any events up to and including the PMF. The proposed development has no impact on flood behaviour and does not result in flood impacts to other private properties or public roads.
B5.20 The proposed development must be compatible with the flood hazard category of the land (as identified on a flood certificate) or include mitigation measures or offsets to reduce the flood risk. In determining compatibility, Council will consider: • Whether there is other land on the site with lower flood risks where the development could be located; • Depth of flood inundation on the site and the adjacent land; • Flow velocity on the site as well as upstream and downstream from the site; • Suitability of design so that the development does not become isolated by high hazard floodwaters; and • Consistency with the most recent, Council adopted flood study or floodplain risk management study that has been undertaken for the site.	The development is compatible with the flood hazard category of the land (“Minimal Risk Flood Prone Lands”, as show in flood information certificates in Annex B to this report”). No development works is proposed for the portions of Lots with different (more severe) flood hazard categorisation.

Table 4.2 Design Flood Levels

Building	1% AEP year 2100 Flood Level (m AHD)	Flood Planning Level (m AHD)	Design Ground Floor Level (m AHD)
Block X – Admin Building	NF	5.7	7.3
Block Y – Gymnasium	NF	5.7	7.3
Block Z – Learning Hub	NF	5.7	7.3

NF = Building not flood affected in the 1%AEP event.

5 Conclusion

On behalf of The APP Group, BMT has prepared this flood risk and impact assessment for the proposed upgrade works within Hunter River High School. This included modelling of existing and post-development flood conditions within and in the vicinity of the Site based on updated versions of Council's adopted TUFLOW models from the Williamtown Salt Ash Floodplain Risk Management Study and Plan (BMT WBM, 2017).

It is demonstrated that all proposed upgrade works lie outside the Hunter River flood extent for all events up to and including the 1%AEP event. The same outcome is achieved when considering the potential impact of Climate Change at the year 2100 design horizon. While the Site is flood free, in the 1%AEP event all evacuation routes are cut off by flood water that isolate the Site making it unreachable by emergency vehicles.

Should flood water rise up to extremely rare levels, the entire Site would be flooded, and, in the PMF event, depths of water would range from 1.4m to 7.0m depending on the ground levels.

From a Flood Emergency Planning perspective, the Site is classified as Low Flood Island (LFI) and, as such, a Flood Emergency Response Plan (reference: R.A12187.001.02_HRHS_FERP) has been prepared for the Site.

Under post-development conditions, similar flood conditions are predicted for all modelled events up to the PMF event. A flood impact assessment has been carried out and results show that, for all trialled events, the proposed development does not result in any increase of peak flood levels nor to other properties or public lands.

Overall, the assessment documented in this report and specifically the responses provided in Table 4.1 demonstrate that the development satisfies Council flood related DCP requirements.

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6 References

BMT (2005). Williamtown- Salt Ash Flood Study, prepared for Port Stephens Council

BMT (2017). Williamtown- Salt Ash Floodplain Risk Management Study & Plan prepared for Port Stephens Council

Port Stephens Council (2022) *Development Control Plan Section B5 Flooding*.

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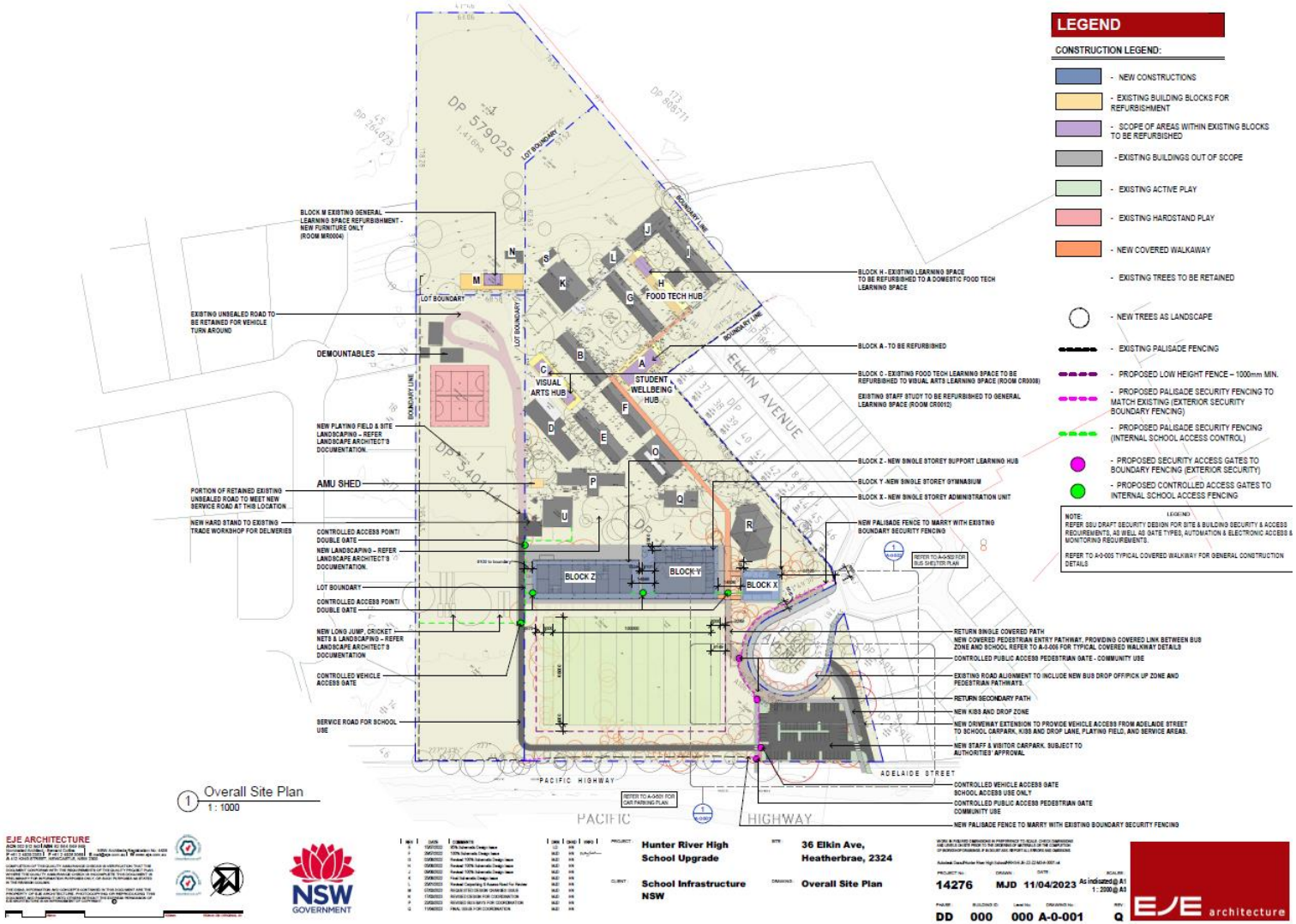
Annex A Proposed Site Plan

© BMT 2023


LEGEND
CONSTRUCTION LEGEND:
- NEW CONSTRUCTIONS
- EXISTING BUILDING BLOCKS FOR REFURBISHMENT
- SCOPE OF AREAS WITHIN EXISTING BLOCKS TO BE REFURBISHED
- EXISTING BUILDINGS OUT OF SCOPE
- EXISTING ACTIVE PLAY
- EXISTING HARDSTAND PLAY
- NEW COVERED WALKAWAY
- EXISTING TREES TO BE RETAINED
- NEW TREES AS LANDSCAPE
- EXISTING PALISADE FENCING
- PROPOSED LOW HEIGHT FENCE – 1000mm MIN.
- PROPOSED PALISADE SECURITY FENCING TO MATCH EXISTING (EXTERIOR SECURITY BOUNDARY FENCING)
- PROPOSED PALISADE SECURITY FENCING (INTERNAL SCHOOL ACCESS CONTROL)
- PROPOSED SECURITY ACCESS GATES TO BOUNDARY FENCING (EXTERIOR SECURITY)
- PROPOSED CONTROLLED ACCESS GATES TO INTERNAL SCHOOL ACCESS FENCING
BLOCK M EXISTING GENERAL LEARNING SPACE REFURBISHMENT - NEW FURNITURE ONLY (ROOM MR0004)
EXISTING UNSEALED ROAD TO BE RETAINED FOR VEHICLE TURN AROUND
DEMOUNTABLES
NEW PLAYING FIELD & SITE LANDSCAPING – REFER LANDSCAPE ARCHITECT'S DOCUMENTATION.
AMU SHED
PORTION OF RETAINED EXISTING UNSEALED ROAD TO MEET NEW SERVICE ROAD AT THIS LOCATION
NEW HARD STAND TO EXISTING TRADE WORKSHOP FOR DELIVERIES
CONTROLLED ACCESS POINT/ DOUBLE GATE
NEW LANDSCAPING – REFER LANDSCAPE ARCHITECT'S DOCUMENTATION.
LOT BOUNDARY
CONTROLLED ACCESS POINT/ DOUBLE GATE
NEW LONG JUMP, CRICKET NETS & LANDSCAPING – REFER LANDSCAPE ARCHITECT'S DOCUMENTATION
CONTROLLED VEHICLE ACCESS GATE
SERVICE ROAD FOR SCHOOL USE
BLOCK H - EXISTING LEARNING SPACE TO BE REFURBISHED TO A DOMESTIC FOOD TECH LEARNING SPACE
BLOCK A - TO BE REFURBISHED
BLOCK C - EXISTING FOOD TECH LEARNING SPACE TO BE REFURBISHED TO VISUAL ARTS LEARNING SPACE (ROOM CR0008)
EXISTING STAFF STUDY TO BE REFURBISHED TO GENERAL LEARNING SPACE (ROOM CR0012)
BLOCK Z - NEW SINGLE STOREY SUPPORT LEARNING HUB
BLOCK Y -NEW SINGLE STOREY GYMNASIUM
BLOCK X - NEW SINGLE STOREY ADMINISTRATION UNIT
NEW PALISADE FENCE TO MARRY WITH EXISTING BOUNDARY SECURITY FENCING
RETURN SINGLE COVERED PATH
NEW COVERED PEDESTRIAN ENTRY PATHWAY, PROVIDING COVERED LINK BETWEEN BUS ZONE AND SCHOOL REFER TO A-0-005 FOR TYPICAL COVERED WALKWAY DETAILS
CONTROLLED PUBLIC ACCESS PEDESTRIAN GATE - COMMUNITY USE
EXISTING ROAD ALIGNMENT TO INCLUDE NEW BUS DROP OFF/PICK UP ZONE AND PEDESTRIAN PATHWAYS.
RETURN SECONDARY PATH
NEW KISS AND DROP ZONE
NEW DRIVEWAY EXTENSION TO PROVICE VEHICLE ACCESS FROM ADELAIDE STREET TO SCHOOL CARPARK, KISS AND DROP LANE, PLAYING FIELD, AND SERVICE AREAS.
NEW STAFF & VISITOR CARPARK, SUBJECT TO AUTHORITIES' APPROVAL
CONTROLLED VEHICLE ACCESS GATE SCHOOL ACCESS USE ONLY
CONTROLLED PUBLIC ACCESS PEDESTRIAN GATE COMMUNITY USE
NEW PALISADE FENCE TO MARRY WITH EXISTING BOUNDARY SECURITY FENCING
FOOD TECH HUB
VISUAL ARTS HUB
STUDENT WELLBEING HUB
BLOCK Z
BLOCK Y
BLOCK X
ELKIN AVENUE
ADELAIDE STREET
PACIFIC HIGHWAY
DP 579025
1 Overall Site Plan
1 : 1000
EJE ARCHITECTURE
NSW GOVERNMENT
Hunter River High School Upgrade
School Infrastructure NSW
36 Elkin Ave, Heatherbrae, 2324
Overall Site Plan
14276
MJD
11/04/2023
As indicated@ A1
1 : 2000@ A3
DD 000 000 A-0-001 Q
EJE architecture

Annex B Port Stephens Council Flood Information Certificates

© BMT 2023

FLOOD CERTIFICATE

File No: PSC2013-05401
Issue date: 18-Jul-22
Property ID: 20943

Barr Planning
92 Young St
Carrington NSW 2294

Certificate number: 83-2022-1027-1

Property details: 40 Elkin Avenue HEATHERBRAE LOT: 1 DP: 540114

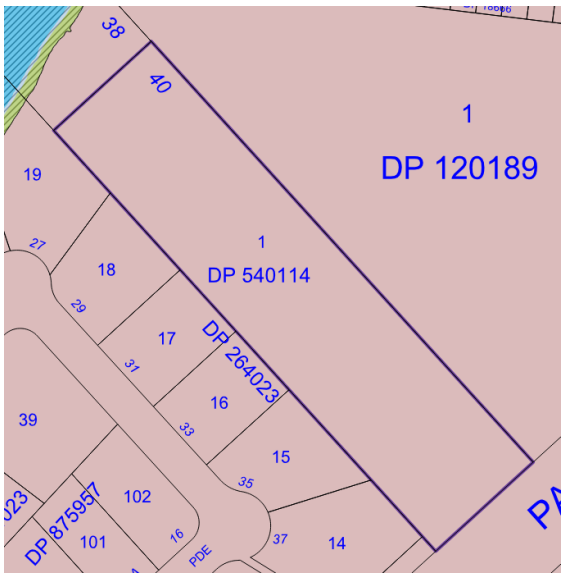
Thank you for your recent flood enquiry regarding the above property. This certificate confirms that this property **is** located in a **flood prone** area. This **is not** a "flood control lot" for the purposes of the *State Environmental Planning Policy (Exempt and Complying Development Codes) 2008*.

Flood Planning Level	**NA**	(This level defines the minimum floor level for habitable rooms and land that is subject to flood-related development controls (refer to Port Stephens DCP Section B5).
Highest Hazard Category	**Minimal Risk Flood Prone Land**	

Flood levels that may be useful are:

Probable maximum flood level	8.5 metres AHD (velocity = 0.6 m/s)	(The highest flood level that could conceivably occur at this location. If required, onsite flood refuges are built at or above this level, refer to the Port Stephens Development Control Plan B5.2)
Current day 1% AEP flood level	4.8 metres AHD	(This level is useful for insurance purposes, refer to your insurance policy and the Insurance Contracts Regulation 1985 (Cwealth).)
Minimum onsite wastewater level	NA	(The 5% AEP level 50 years from now, refer to the Port Stephens On-site Sewage Management Development Assessment Framework and AS/NZS 1547:2012 5.5 land application system design.)

Flooding extent on subject lot, categorised by hazard



Flood Hazard Categories

- Flood Prone Land
- Flood Planning Level
- Low Hazard Flood Fringe area
- Low Hazard Flood Storage area
- Low Hazard Overland Flow Path area
- Low Hazard Floodway area
- High Hazard Flood Fringe area
- High Hazard Flood Storage area
- High Hazard Overland Flow Path area
- High Hazard Floodway area
- Flood Prone Land subject to further investigation

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Information derived from Port Stephens Council 2012, *Williamtown / Salt Ash Flood Study Review*, BMT WBM, Newcastle and Port Stephens Council 2017, *Williamtown / Salt Ash Floodplain Risk Management Study & Plan*, BMT WBM, Newcastle

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ABN 16 744 377 876

IMPORTANT INFORMATION

This Certificate is provided in good faith and in accordance with the provisions of section 733 of the Local Government Act 1993. This certificate provides an estimate of real flood characteristics. Any particular flood may be different to the conditions that were assumed to determine the information shown in this certificate.

The provided flood information has been compiled from information provided by external consultants and flood studies completed by Council in accordance with the NSW Floodplain Development Manual. The information has not been independently verified or checked beyond the agreed scope of work and Council does not accept liability in connection with unverified information.

Council acknowledges that its flood information may be incomplete and varying in accuracy, however it is the best information available to Council at the time of issue.

The information is provided to give the applicant an understanding as to the extent of flooding affecting the property as well as assist in the preparation of a Floodplain Risk Management Report. The information is subject to change if more accurate data becomes available to Council. Accordingly the information in this certificate is not warranted after the day of issue.

Council is not responsible for updating flood data when site conditions have change from the time of the original flood study and does not accept responsibility arising from any change in site conditions.

Where the relevant information is available, Council's Flood Planning Levels include the estimated impact of climate change.

Council recommends that the information contained in this Certificate be interpreted by a suitably qualified professional. It is the responsibility of the applicant to obtain survey level data (in metres AHD) for the site.

Council disclaims responsibilities to any other person other than the person nominated on the Flood Certificate arising from or in connection with the information provided.

The floor level survey for the property (if available) is based on the conditions on the date of the survey. Any changes to buildings since the survey may alter the appropriate floor level. Refer to the Port Stephens LEP 2013 Section 5.21 and Port Stephens Development Control Plan Section B5 for details on development controls on flood prone land.

For information, the insurance industry uses its own estimates of flood risk and its own definitions for flooding, which may differ when compared with Council's information and the NSW Floodplain Development Manual. You should contact your insurance company to find out if a flood certificate may influence your insurance premium.

The information provided may contain personal information as defined under the Privacy and Personal Information Protection Act 1998. The purpose of collecting this information is to enable Council to consider matters under related legislation, issue related documentation where required and other associated matters as provided by law and will be utilised by Council officers in assessing the proposal and other associated activities. The information may also be made available to other persons in accordance with the relevant Acts and regulations, such as the Government Information (Public Access) Act 2009 and will be stored in Council's record system.

DEFINITIONS

"Flood Planning Level" defines the area of land below the 1% AEP flood event in the year 2100 plus freeboard and is the area of land subject to flood-related development controls (refer to Port Stephens Development Control Plan Section B5). The Flood Planning Level defines the minimum floor level for habitable rooms.

"Freeboard" is a safety margin applied to the estimation of flood levels to compensate for uncertainties due to factors such as wave action, localised hydraulic behaviour (eg flow path blockages caused by natural and urban debris such as trees, 'wheelie' bins, cars, containers) and changes in rainfall patterns and ocean water levels as a result of the changing climate (refer Flood Manual Section 4).

"Habitable room" in a residential situation is a living or working area, such as a lounge room, dining room, rumpus room, kitchen, bedroom or workroom; in an industrial or commercial situation is an area used for offices or to store valuable possessions susceptible to flood damage (refer Flood Manual Section 4).

"Adaptable minimum floor level" is the reduced flood planning level allowed in Council's Development Control Plan where the proposed development facilitates ongoing flood adaptation (for example, where the design facilitates building raising in the future, such as a pier and beam housing design).

"Probable maximum flood level" is the flood level that arises from the largest flood that could conceivably occur at a particular location (the "PMF" or extreme design event). This level does not include any freeboard and provides an upper limit of flooding and associated consequences for the problem being investigated. It is used for emergency response planning purposes to address the safety of people and defines the floodplain and identifies "Flood Prone" land.

"AEP" (Annual Exceedance Probability) is the chance of a flood of a given or larger size occurring in any one year (for example, the 1% AEP event has a 1% chance of occurring every year; the 5% AEP event has a 5% chance of occurring every year).

"Surveyed floor level" is the surveyed level at the entrance to the residence, usually measured as part of the floodplain risk management plan undertaken for the area.

"AHD" (Australian Height Datum) a common national survey level datum, approximately corresponding to mean sea level set in the mid to late 1960s.

Hazard Categories

"High hazard" flood area is the area of flood which poses a possible danger to personal safety, where the evacuation of trucks would be difficult, where able-bodied adults would have difficulty wading to safety or where there is a potential for significant damage to buildings (refer Flood Manual Appendix L).

"Low hazard" flood area is the area of flood where, should it be necessary, a truck could evacuate people and their possessions or an able-bodied adult would have little difficulty in wading to safety (refer Flood Manual Appendix L).

Hydraulic Categories

"Floodways" are those areas where a significant volume of water flows during floods and are often aligned with obvious natural channels. They are areas that, even if only partially blocked, would cause a significant increase in flood levels and/or a significant redistribution of flood flow, which may in turn adversely affect other areas (refer Flood Manual Section 4).

"Overland flow path" is land inundated by local runoff on its way to a waterway, rather than overbank flow from a stream, river, estuary, lake or dam (refer Flood Manual Section 4).

"Flood Storage" areas are those parts of the floodplain that are important for the temporary storage of floodwaters during the passage of a flood. The loss of storage areas may increase the severity of flood impacts by reducing natural flood attenuation (refer Flood Manual Section 4).

"Flood Fringe" is the remaining land in the Flood Planning Area after the Floodway area and Flood Storage area have been defined (refer Flood Manual Section 4).

"Flood Prone Land subject to further investigation" refers to the area of land susceptible to flooding where a comprehensive technical investigation of flood behaviour (to define the variation over time of flood levels, extent, velocity, flood hazard and the Flood Planning Level up to and including the probable maximum flood) has not yet been carried out (refer Flood Manual Appendix F).

"Minimal Risk Flood Prone Land" is land on the floodplain that is above the Flood Planning Level. This means that there are no flood-related development controls that apply to residential development, but critical emergency response and recovery facilities, such as evacuation centres and vulnerable development types, such as aged care and child care facilities, may not be appropriate in this location.

FLOOD CERTIFICATE

File No: PSC2013-05401
Issue date: 18-Jul-22
Property ID: 23840

Barr Planning
92 Young St
Carrington NSW 2294

Certificate number: 83-2022-1025-1

Property details: 36 Elkin Avenue HEATHERBRAE LOT: 1 DP: 120189

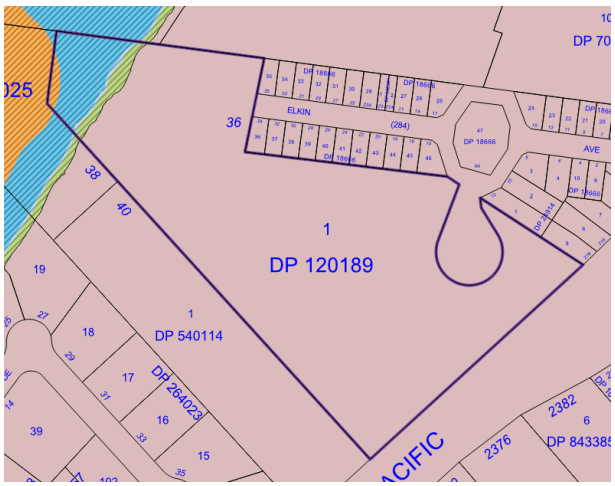
Thank you for your recent flood enquiry regarding the above property. This certificate confirms that this property **is** located in a **flood prone** area. This **is** a "flood control lot" for the purposes of the *State Environmental Planning Policy (Exempt and Complying Development Codes) 2008*.

Flood Planning Level	**5.7 metres AHD** (velocity = 0.3 m/s)	(This level defines the minimum floor level for habitable rooms and land that is subject to flood-related development controls (refer to Port Stephens DCP Section B5).
Highest Hazard Category	**High Hazard Floodway area**	

Flood levels that may be useful are:

Probable maximum flood level	8.5 metres AHD (velocity = 0.7 m/s)	(The highest flood level that could conceivably occur at this location. If required, onsite flood refuges are built at or above this level, refer to the Port Stephens Development Control Plan B5.2)
Current day 1% AEP flood level	4.8 metres AHD	(This level is useful for insurance purposes, refer to your insurance policy and the Insurance Contracts Regulation 1985 (Cwealth).)
Adaptable minimum floor level	5.7 metres AHD	(The 1% AEP flood level plus 0.5m, 50 years from now, refer to the Port Stephens Development Control Plan B5.2.)
Minimum onsite wastewater level	3.4 metres AHD	(The 5% AEP level 50 years from now, refer to the Port Stephens On-site Sewage Management Development Assessment Framework and AS/NZS 1547:2012 5.5 land application system design.)

Flooding extent on subject lot, categorised by hazard



Flood Hazard Categories

- Flood Prone Land
- Flood Planning Level
- Low Hazard Flood Fringe area
- Low Hazard Flood Storage area
- Low Hazard Overland Flow Path area
- Low Hazard Floodway area
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Information derived from Port Stephens Council 2012, *Williamtown / Salt Ash Flood Study Review*, BMT WBM, Newcastle and Port Stephens Council 2017, *Williamtown / Salt Ash Floodplain Risk Management Study & Plan*, BMT WBM, Newcastle.

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DEFINITIONS

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"Flood Fringe" is the remaining land in the Flood Planning Area after the Floodway area and Flood Storage area have been defined (refer Flood Manual Section 4).

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"Minimal Risk Flood Prone Land" is land on the floodplain that is above the Flood Planning Level. This means that there are no flood-related development controls that apply to residential development, but critical emergency response and recovery facilities, such as evacuation centres and vulnerable development types, such as aged care and child care facilities, may not be appropriate in this location.

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File No: PSC2013-05401
Issue date: 18-Jul-22
Property ID: 23840

Barr Planning
92 Young St
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Certificate number: 83-2022-1025-1

Property details: 36 Elkin Avenue HEATHERBRAE LOT: 1 DP: 120189

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Highest Hazard Category	**High Hazard Floodway area**	

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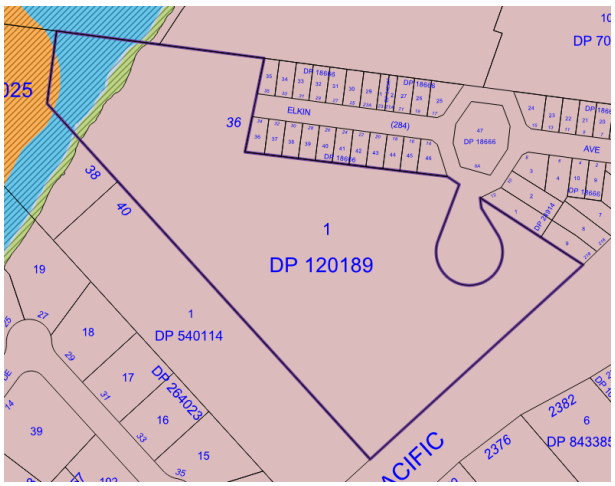
Minimum onsite wastewater level	3.4 metres AHD	(The 5% AEP level 50 years from now, refer to the Port Stephens On-site Sewage Management Development Assessment Framework and AS/NZS 1547:2012 5.5 land application system design.)

Flooding extent on subject lot, categorised by hazard



Flood Hazard Categories

- Flood Prone Land
- Flood Planning Level
- Low Hazard Flood Fringe area
- Low Hazard Flood Storage area
- Low Hazard Overland Flow Path area
- Low Hazard Floodway area
- High Hazard Flood Fringe area
- High Hazard Flood Storage area
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Council acknowledges that its flood information may be incomplete and varying in accuracy, however it is the best information available to Council at the time of issue.

The information is provided to give the applicant an understanding as to the extent of flooding affecting the property as well as assist in the preparation of a Floodplain Risk Management Report. The information is subject to change if more accurate data becomes available to Council. Accordingly the information in this certificate is not warranted after the day of issue.

Council is not responsible for updating flood data when site conditions have change from the time of the original flood study and does not accept responsibility arising from any change in site conditions.

Where the relevant information is available, Council's Flood Planning Levels include the estimated impact of climate change.

Council recommends that the information contained in this Certificate be interpreted by a suitably qualified professional. It is the responsibility of the applicant to obtain survey level data (in metres AHD) for the site.

Council disclaims responsibilities to any other person other than the person nominated on the Flood Certificate arising from or in connection with the information provided.

The floor level survey for the property (if available) is based on the conditions on the date of the survey. Any changes to buildings since the survey may alter the appropriate floor level. Refer to the Port Stephens LEP 2013 Section 5.21 and Port Stephens Development Control Plan Section B5 for details on development controls on flood prone land.

For information, the insurance industry uses its own estimates of flood risk and its own definitions for flooding, which may differ when compared with Council's information and the NSW Floodplain Development Manual. You should contact your insurance company to find out if a flood certificate may influence your insurance premium.

The information provided may contain personal information as defined under the Privacy and Personal Information Protection Act 1998. The purpose of collecting this information is to enable Council to consider matters under related legislation, issue related documentation where required and other associated matters as provided by law and will be utilised by Council officers in assessing the proposal and other associated activities. The information may also be made available to other persons in accordance with the relevant Acts and regulations, such as the Government Information (Public Access) Act 2009 and will be stored in Council's record system.

DEFINITIONS

"Flood Planning Level" defines the area of land below the 1% AEP flood event in the year 2100 plus freeboard and is the area of land subject to flood-related development controls (refer to Port Stephens Development Control Plan Section B5). The Flood Planning Level defines the minimum floor level for habitable rooms.

"Freeboard" is a safety margin applied to the estimation of flood levels to compensate for uncertainties due to factors such as wave action, localised hydraulic behaviour (eg flow path blockages caused by natural and urban debris such as trees, 'wheelie' bins, cars, containers) and changes in rainfall patterns and ocean water levels as a result of the changing climate (refer Flood Manual Section 4).

"Habitable room" in a residential situation is a living or working area, such as a lounge room, dining room, rumpus room, kitchen, bedroom or workroom; in an industrial or commercial situation is an area used for offices or to store valuable possessions susceptible to flood damage (refer Flood Manual Section 4).

"Adaptable minimum floor level" is the reduced flood planning level allowed in Council's Development Control Plan where the proposed development facilitates ongoing flood adaptation (for example, where the design facilitates building raising in the future, such as a pier and beam housing design).

"Probable maximum flood level" is the flood level that arises from the largest flood that could conceivably occur at a particular location (the "PMF" or extreme design event). This level does not include any freeboard and provides an upper limit of flooding and associated consequences for the problem being investigated. It is used for emergency response planning purposes to address the safety of people and defines the floodplain and identifies "Flood Prone" land.

"AEP" (Annual Exceedance Probability) is the chance of a flood of a given or larger size occurring in any one year (for example, the 1% AEP event has a 1% chance of occurring every year; the 5% AEP event has a 5% chance of occurring every year).

"Surveyed floor level" is the surveyed level at the entrance to the residence, usually measured as part of the floodplain risk management plan undertaken for the area.

"AHD" (Australian Height Datum) a common national survey level datum, approximately corresponding to mean sea level set in the mid to late 1960s.

Hazard Categories

"High hazard" flood area is the area of flood which poses a possible danger to personal safety, where the evacuation of trucks would be difficult, where able-bodied adults would have difficulty wading to safety or where there is a potential for significant damage to buildings (refer Flood Manual Appendix L).

"Low hazard" flood area is the area of flood where, should it be necessary, a truck could evacuate people and their possessions or an able-bodied adult would have little difficulty in wading to safety (refer Flood Manual Appendix L).

Hydraulic Categories

"Floodways" are those areas where a significant volume of water flows during floods and are often aligned with obvious natural channels. They are areas that, even if only partially blocked, would cause a significant increase in flood levels and/or a significant redistribution of flood flow, which may in turn adversely affect other areas (refer Flood Manual Section 4).

"Overland flow path" is land inundated by local runoff on its way to a waterway, rather than overbank flow from a stream, river, estuary, lake or dam (refer Flood Manual Section 4).

"Flood Storage" areas are those parts of the floodplain that are important for the temporary storage of floodwaters during the passage of a flood. The loss of storage areas may increase the severity of flood impacts by reducing natural flood attenuation (refer Flood Manual Section 4).

"Flood Fringe" is the remaining land in the Flood Planning Area after the Floodway area and Flood Storage area have been defined (refer Flood Manual Section 4).

"Flood Prone Land subject to further investigation" refers to the area of land susceptible to flooding where a comprehensive technical investigation of flood behaviour (to define the variation over time of flood levels, extent, velocity, flood hazard and the Flood Planning Level up to and including the probable maximum flood) has not yet been carried out (refer Flood Manual Appendix F).

"Minimal Risk Flood Prone Land" is land on the floodplain that is above the Flood Planning Level. This means that there are no flood-related development controls that apply to residential development, but critical emergency response and recovery facilities, such as evacuation centres and vulnerable development types, such as aged care and child care facilities, may not be appropriate in this location.

Annex C Flood Maps

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LEGEND

Site Boundary

Peak Flood Level (m AHD)

0.05m

Peak Flood Depth (m)

0.5
1
3
3.5
4
4.5
5

MILLERS FOREST
Hunter River
4.65
RAYMOND TERRACE
Windeyers Creek
Grahams Town Drain
Speedy Lock Ln
Adelaide St
Elkin Ave
HEATHERBRAE
Kingston Pde
Pacific Highway
Motto Ln
Masonite Rd

Title:
Peak Flood Depth - Existing Scenario - 1% AEP Flood

Figure: **C-01**

Rev: **A**

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N

0 140 280 m

BMT

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LEGEND

Site Boundary

Peak Flood Level (m AHD)

0.05m

Peak Flood Depth (m)

0.5
1
3
3.5
4
4.5
5

MILLERS FOREST
Hunter River
4.65
RAYMOND TERRACE
Windeyers Creek
Grahams Town Drain
Speedy Lock Ln
Adelaide St
Elkin Ave
HEATHERBRAE
Kingston Pde
Pacific Highway
Motto Ln
Masonite Rd

Title:
Peak Flood Depth - Post-development Scenario - 1% AEP Flood

Figure: **C-02**

Rev: **A**

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LEGEND

Site Boundary

Peak Flood Velocity (m/s)

- < 0.2
- 0.2 to 0.4
- 0.4 to 0.6
- 0.6 to 0.8
- 0.8 to 1.0
- 1.0 to 1.5
- 1.5 to 2.0
- 2.0 to 3.0
- 3.0 to 4.0
- > 5.0

Hunter River

RAYMOND TERRACE

Windeyers Creek

Grahams Town Drain

Speedy Lock Ln

Adelaide St

Elkin Ave

HEATHERBRAE

Kingston Pde

Pacific Highway

Motto Ln

Masonite Rd

Title:

Peak Flood Velocity - Existing Scenario - 1% AEP Flood

Figure: **C-03**

Rev: **A**

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LEGEND

Site Boundary

Peak Flood Velocity (m/s)

- < 0.2
- 0.2 to 0.4
- 0.4 to 0.6
- 0.6 to 0.8
- 0.8 to 1.0
- 1.0 to 1.5
- 1.5 to 2.0
- 2.0 to 3.0
- 3.0 to 4.0
- > 5.0

Hunter River

RAYMOND TERRACE

Windeyers Creek

Grahams Town Drain

Speedy Lock Ln

Adelaide St

Elkin Ave

HEATHERBRAE

Kingston Pde

Pacific Highway

Masonite Rd

Motto Ln

Title:

Peak Flood Velocity - Post-development Scenario - 1% AEP Flood

Figure: C-04

Rev: A

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LEGEND

Site Boundary

Peak Flood Hazard

Low Hazard

Intermediate Hazard

High Hazard

MILLERS FOREST

Hunter River

RAYMOND TERRACE

Windeyers Creek

Grahams Town Drain

Speedy Lock Ln

Adelaide St

Elkin Ave

HEATHERBRAE

Kingston Pde

Pacific Highway

Masonite Rd

Motto Ln

Title:

Flood Hazard - Existing Scenario - 1% AEP Flood

Figure: **C-05**

Rev: **A**

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LEGEND

Site Boundary

Peak Flood Hazard

Low Hazard

Intermediate Hazard

High Hazard

MILLERS FOREST

Hunter River

RAYMOND TERRACE

Windeyers Creek

Grahams Town Drain

Speedy Lock Ln

Adelaide St

Elkin Ave

HEATHERBRAE

Kingston Pde

Pacific Highway

Motto Ln

Masonite Rd

Title:

Flood Hazard - Post-development Scenario - 1% AEP Flood

Figure: C-06

Rev: A

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Title:
Change in Peak Flood Level - 1% AEP Flood

Figure: **C-07**

Rev: **A**

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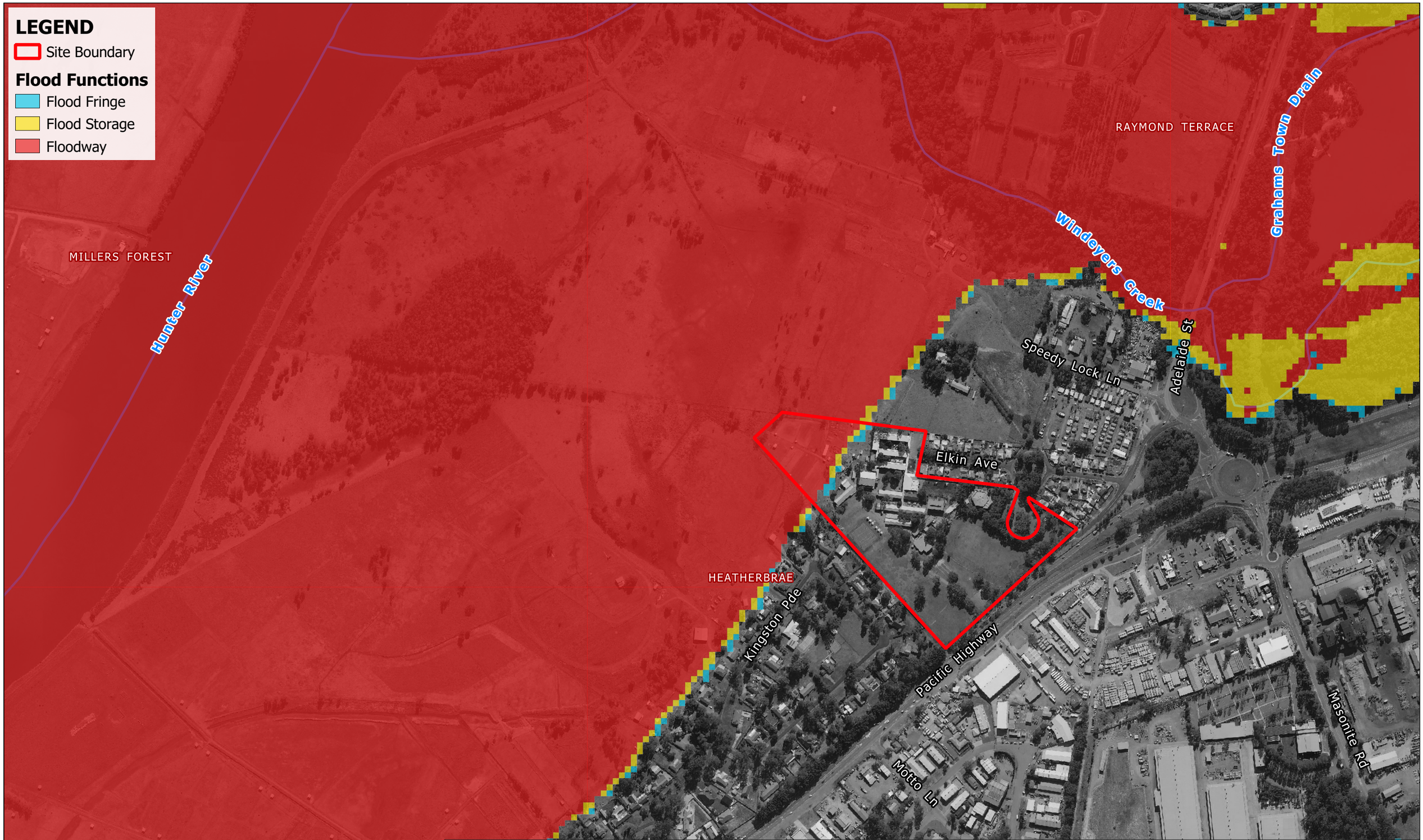

Title:
Peak Flood Functions - Existing Scenario - 1% AEP Flood

Figure: **C-08**

Rev: **A**

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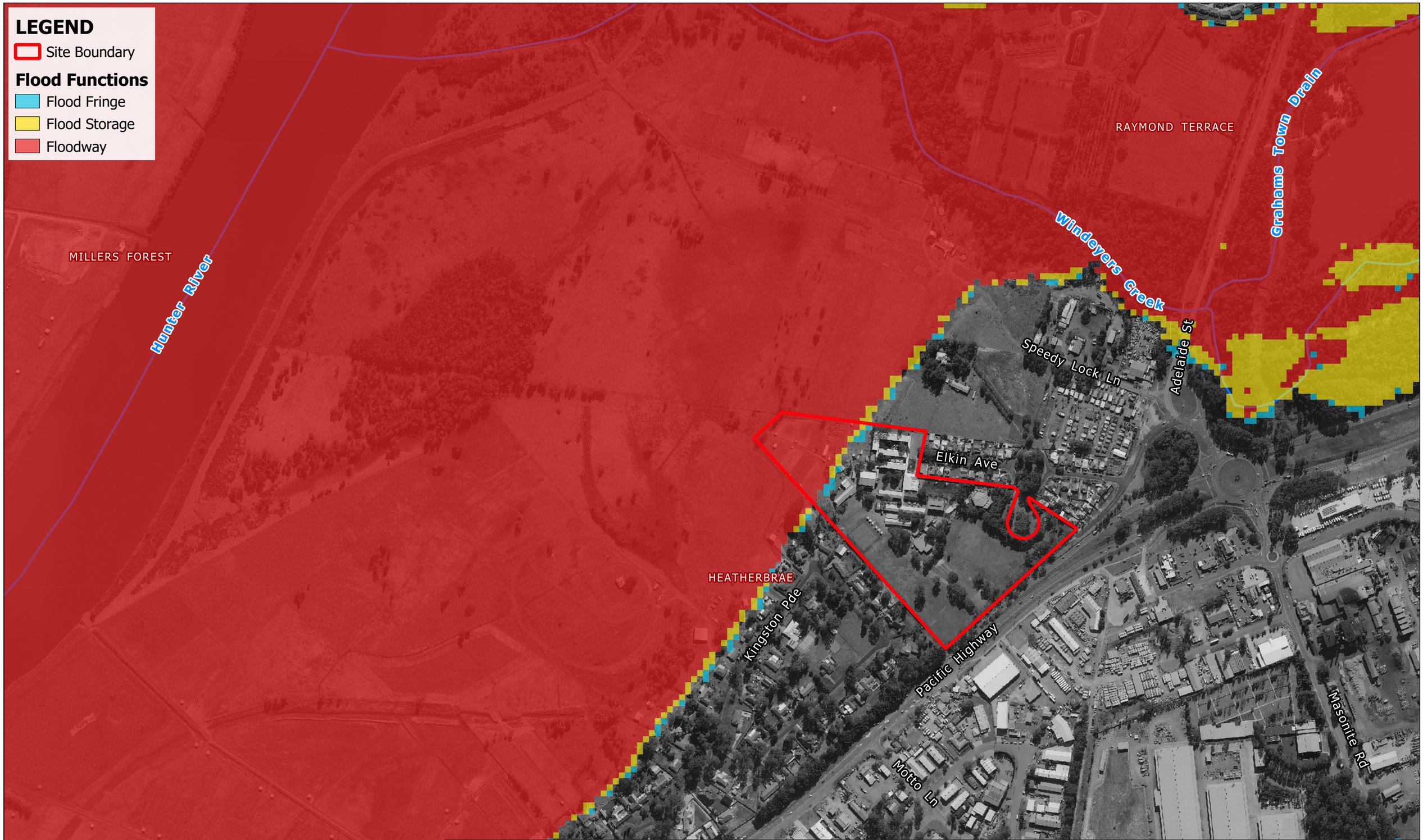

Title:
Peak Flood Functions - Post-Development Scenario - 1% AEP Flood

Figure: **C-09**

Rev: **A**

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LEGEND

Site Boundary

Peak Flood Level (m AHD)

0.05m

Peak Flood Depth (m)

0.5
1
3
3.5
4
4.5
5

MILLERS FOREST
Hunter River
5.20
5.20
5.20
RAYMOND TERRACE
Windeyers Creek
Grahams Town Drain
Speedy Lock Ln
Adelaide St
Elkin Ave
HEATHERBRAE
Kingston Pde
Pacific Highway
Motto Ln
Masonite Rd

Title:
Peak Flood Depth - Existing Scenario - 1% AEP Flood 2100 Planning Conditions

Figure: **C-10**

Rev: **A**

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LEGEND

Site Boundary

Peak Flood Level (m AHD)

0.05m

Peak Flood Depth (m)

0.5
1
3
3.5
4
4.5
5

MILLERS FOREST
Hunter River
5.20
5.20
5.20
RAYMOND TERRACE
Windeyers Creek
Grahams Town Drain
Speedy Lock Ln
Adelaide St
Elkin Ave
HEATHERBRAE
Kingston Pde
Pacific Highway
Motto Ln
Masonite Rd

Title:

Peak Flood Depth - Post-development Scenario - 1% AEP Flood 2100 Planning Conditions

Figure: C-11

Rev: A

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LEGEND

Site Boundary

Peak Flood Velocity (m/s)

- < 0.2
- 0.2 to 0.4
- 0.4 to 0.6
- 0.6 to 0.8
- 0.8 to 1.0
- 1.0 to 1.5
- 1.5 to 2.0
- 2.0 to 3.0
- 3.0 to 4.0
- > 5.0

RAYMOND TERRACE

Grahams Town Drain

Windeyers Creek

Hunter River

Speedy Lock Ln

Adelaide St

Elkin Ave

HEATHERBRAE

Kingston Pde

Pacific Highway

Masonite Rd

Motto Ln

Title:

Peak Flood Velocity - Existing Scenario - 1% AEP Flood 2100 Planning Conditions

Figure: **C-12**

Rev: **A**

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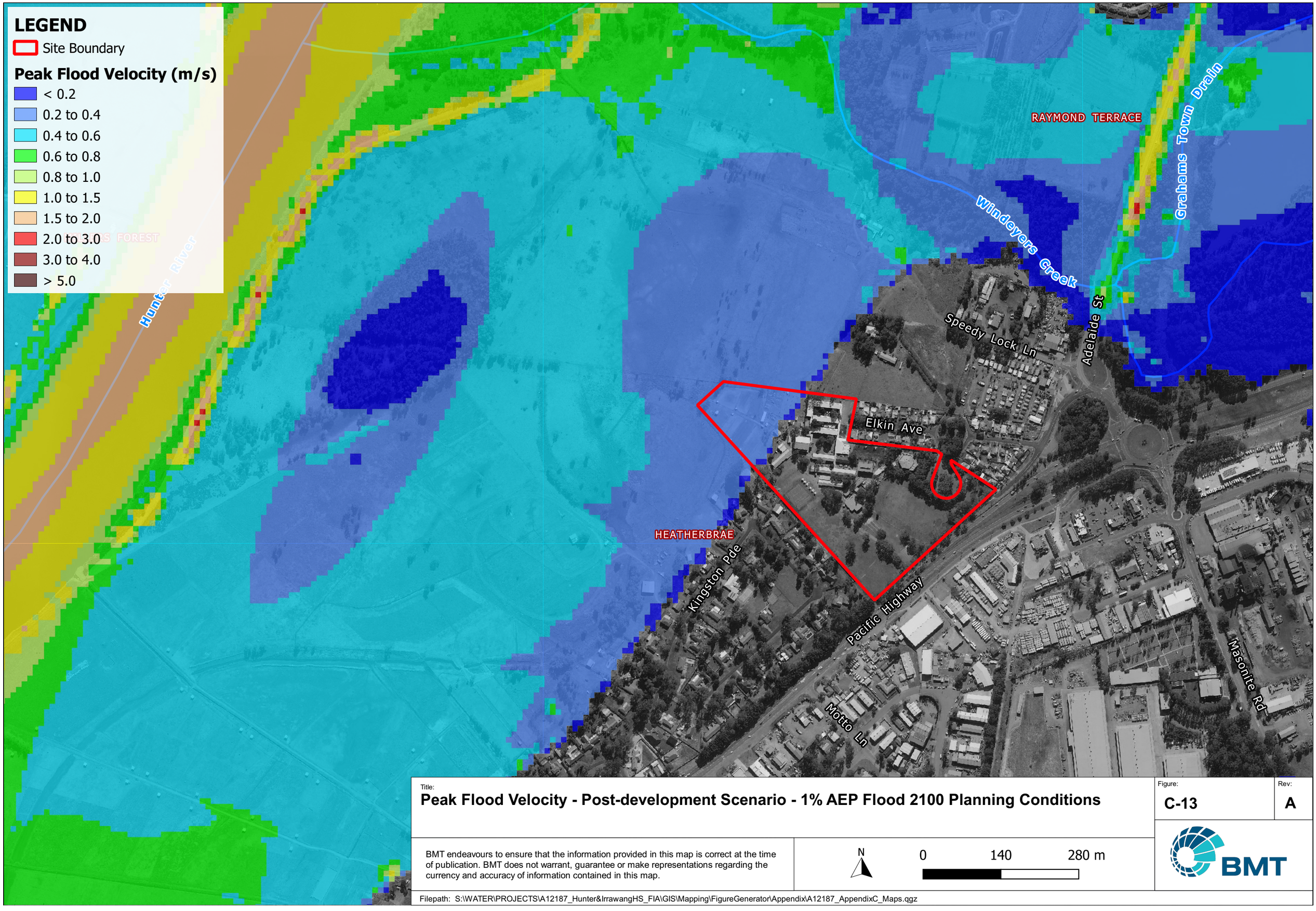

Title:

Peak Flood Velocity - Post-development Scenario - 1% AEP Flood 2100 Planning Conditions

Figure: C-13

Rev: A

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LEGEND

Site Boundary

Peak Flood Hazard

Low Hazard

Intermediate Hazard

High Hazard

MILLERS FOREST

Hunter River

RAYMOND TERRACE

Windeyers Creek

Grahams Town Drain

Speedy Lock Ln

Adelaide St

Elkin Ave

HEATHERBRAE

Kingston Pde

Pacific Highway

Masonite Rd

Motto Ln

Title:

Flood Hazard - Existing Scenario - 1% AEP Flood 2100 Planning Conditions

Figure: C-14

Rev: A

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LEGEND

Site Boundary

Peak Flood Hazard

Low Hazard

Intermediate Hazard

High Hazard

MILLERS FOREST

Hunter River

RAYMOND TERRACE

Windeyers Creek

Grahams Town Drain

Speedy Lock Ln

Adelaide St

Elkin Ave

HEATHERBRAE

Kingston Pde

Pacific Highway

Masonite Rd

Motto Ln

Title:

Flood Hazard - Post-development Scenario - 1% AEP Flood 2100 Planning Conditions

Figure: C-15

Rev: A

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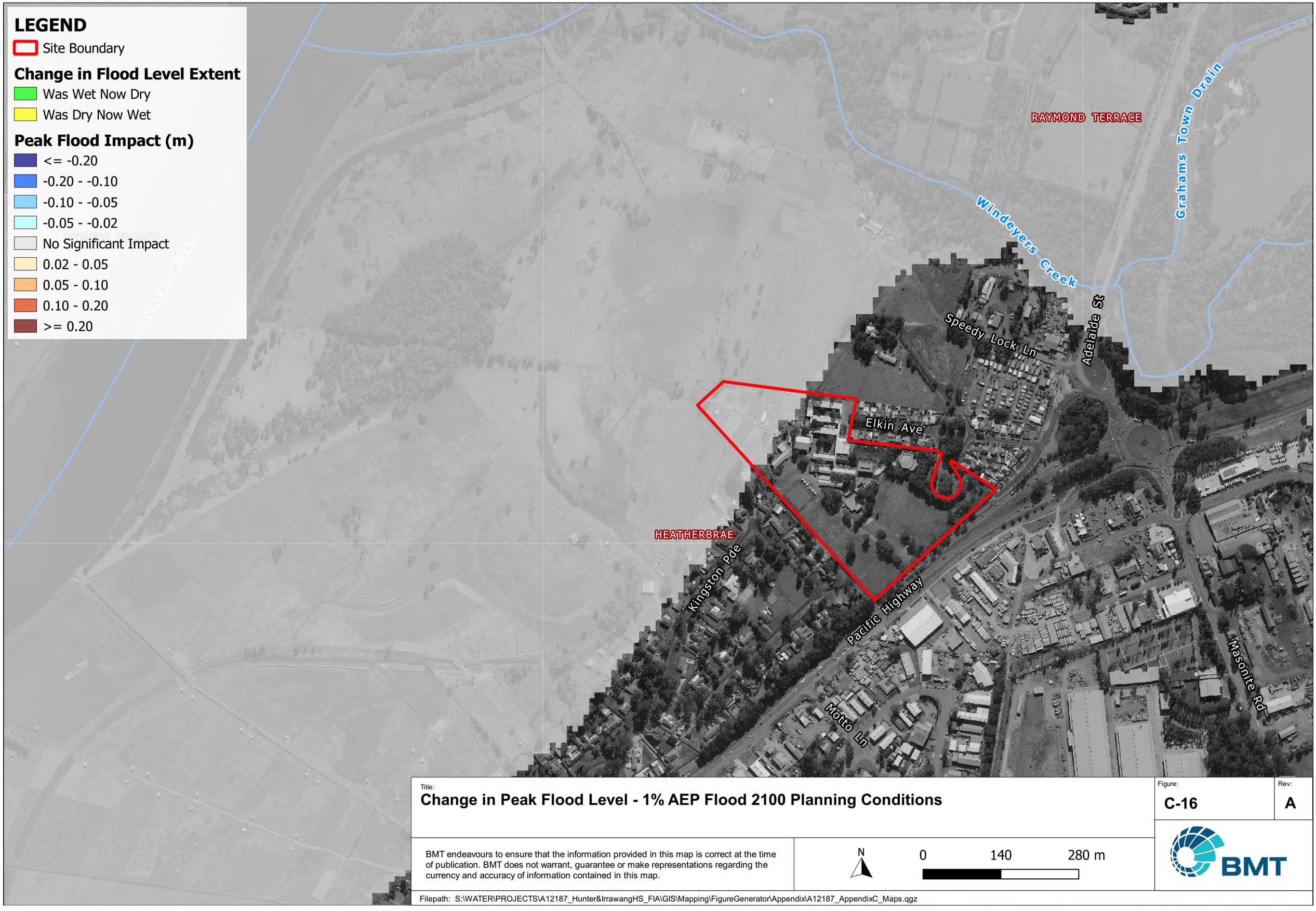

Title:

Change in Peak Flood Level - 1% AEP Flood 2100 Planning Conditions

Figure: C-16

Rev: A

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LEGEND

Site Boundary

Flood Functions

Flood Fringe

Flood Storage

Floodway

MILLERS FOREST

Hunter River

RAYMOND TERRACE

Windeyers Creek

Grahams Town Drain

Speedy Lock Ln

Adelaide St

Elkin Ave

HEATHERBRAE

Kingston Pde

Pacific Highway

Motto Ln

Masonite Rd

Title:

Peak Flood Function - Existing Scenario - 1% AEP Flood 2100 Planning Conditions

Figure: **C-17**

Rev: **A**

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LEGEND

Site Boundary

Flood Functions

Flood Fringe

Flood Storage

Floodway

MILLERS FOREST

Hunter River

RAYMOND TERRACE

Windeyers Creek

Grahams Town Drain

Speedy Lock Ln

Adelaide St

Elkin Ave

HEATHERBRAE

Kingston Pde

Pacific Highway

Motto Ln

Masonite Rd

Title:

Peak Flood Function - Post-development Scenario - 1% AEP Flood 2100 Planning Conditions

Figure: C-18

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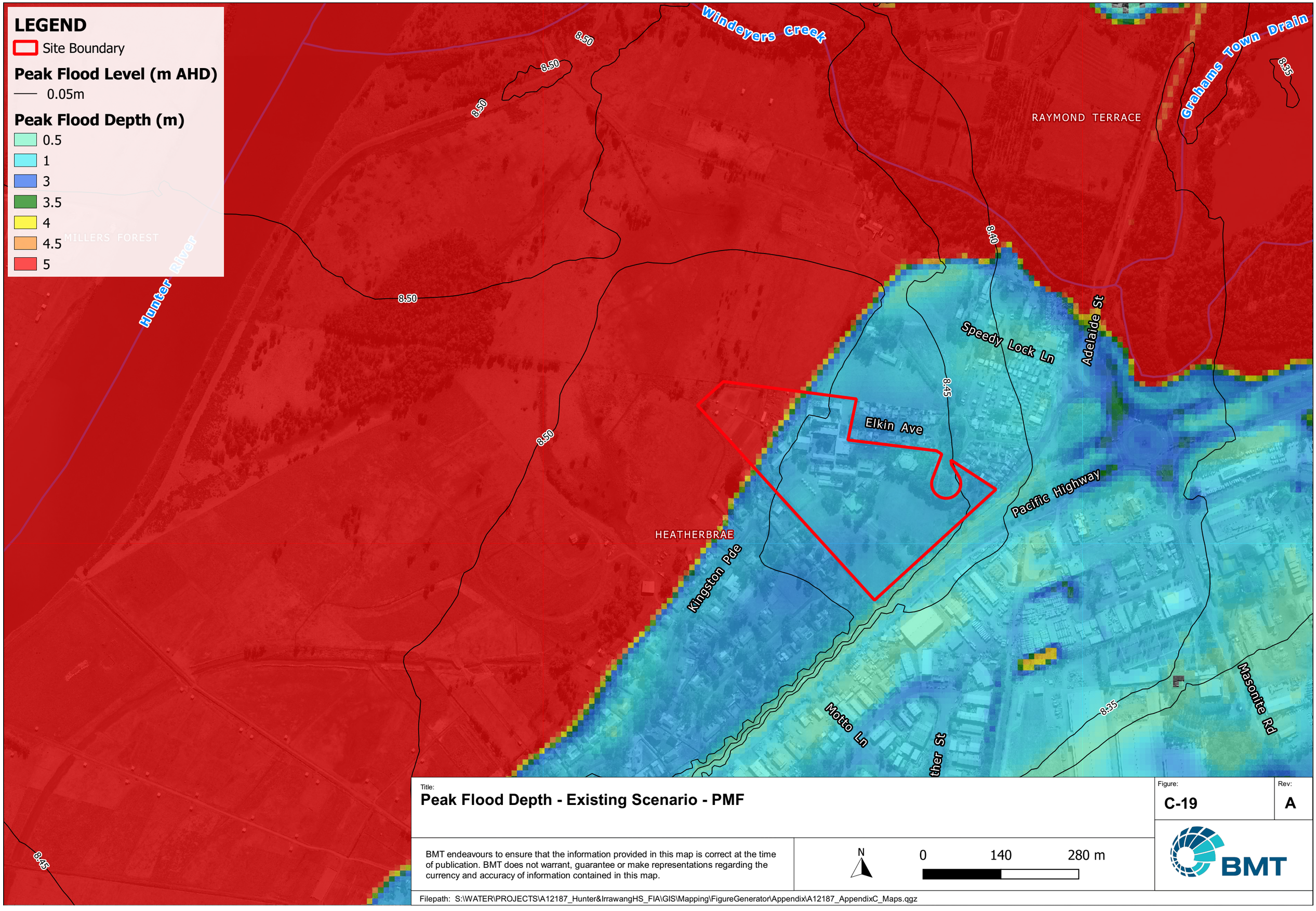

Title:
Peak Flood Depth - Existing Scenario - PMF

Figure: **C-19**

Rev: **A**

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N

0 140 280 m

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LEGEND

Site Boundary

Peak Flood Level (m AHD)

0.05m

Peak Flood Depth (m)

0.5
1
3
3.5
4
4.5
5

Windeyers Creek
Grahams Town Drain
RAYMOND TERRACE
MILLERS FOREST
Hunter River
HEATHERBRAE
Speedy Lock Ln
Adelaide St
Elkin Ave
Pacific Highway
Kingston Pde
Motto Ln
Masonite Rd
8.50
8.45
8.40
8.35

Title:
Peak Flood Depth - Post-development Scenario - PMF

Figure: **C-20**

Rev: **A**

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N

0 140 280 m

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LEGEND

Site Boundary

Peak Flood Velocity (m/s)

- < 0.2
- 0.2 to 0.4
- 0.4 to 0.6
- 0.6 to 0.8
- 0.8 to 1.0
- 1.0 to 1.5
- 1.5 to 2.0
- 2.0 to 3.0
- 3.0 to 4.0
- > 5.0

Hunter River

RAYMOND TERRACE

Windeyers Creek

Grahams Town Drain

Speedy Lock Ln

Adelaide St

Elkin Ave

HEATHERBRAE

Kingston Pde

Pacific Highway

Masonite Rd

Motto Ln

Title:
Peak Flood Velocity - Existing Scenario - PMF

Figure: **C-21**

Rev: **A**

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N

0 140 280 m

BMT

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LEGEND

Site Boundary

Peak Flood Velocity (m/s)

- < 0.2
- 0.2 to 0.4
- 0.4 to 0.6
- 0.6 to 0.8
- 0.8 to 1.0
- 1.0 to 1.5
- 1.5 to 2.0
- 2.0 to 3.0
- 3.0 to 4.0
- > 5.0

Hunter River

RAYMOND TERRACE

Grahams Town Drain

Windeyers Creek

Speedy Lock Ln

Adelaide St

Elkin Ave

HEATHERBRAE

Kingston Pde

Pacific Highway

Masonite Rd

Motto Ln

Title:

Peak Flood Velocity - Post-development Scenario - PMF

Figure: C-22

Rev: A

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N

0 140 280 m

BMT

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LEGEND

Site Boundary

Peak Flood Hazard

Low Hazard

Intermediate Hazard

High Hazard

MILLERS FOREST

Hunter River

RAYMOND TERRACE

Grahams Town Drain

Windeyers Creek

Adelaide St

Speedy Lock Ln

Elkin Ave

HEATHERBRAE

Kingston Pde

Pacific Highway

Masonite Rd

Motto Ln

Title:

Flood Hazard - Existing Scenario - PMF

Figure: C-23

Rev: A

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N

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BMT

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LEGEND

Site Boundary

Peak Flood Hazard

Low Hazard

Intermediate Hazard

High Hazard

MILLERS FOREST

Hunter River

RAYMOND TERRACE

Windeyers Creek

Grahams Town Drain

Adelaide St

Speedy Lock Ln

Elkin Ave

HEATHERBRAE

Kingston Pde

Pacific Highway

Motto Ln

Masonite Rd

Title:

Flood Hazard - Post-development Scenario - PMF

Figure: **C-24**

Rev: **A**

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N

0 140 280 m

BMT

Filepath: S:\WATER\PROJECTS\A12187_Hunter&IrrawangHS_FIA\GIS\Mapping\FigureGenerator\Appendix\A12187_AppendixC_Maps.qgz

LEGEND

Site Boundary

Change in Flood Level Extent

- Was Wet Now Dry
- Was Dry Now Wet

Peak Flood Impact (m)

- <= -0.20
- -0.20 - -0.10
- -0.10 - -0.05
- -0.05 - -0.02
- No Significant Impact
- 0.02 - 0.05
- 0.05 - 0.10
- 0.10 - 0.20
- >= 0.20

RAYMOND TERRACE
HEATHERBRAE
Hunter River
Windeyers Creek
Grahams Town Drain
Speedy Lock Ln
Adelaide St
Elkin Ave
Kingston Pde
Pacific Highway
Masonite Rd
Motto Ln

Title:
Change in Peak Flood Level - PMF

Figure: **C-25**

Rev: **A**

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LEGEND

Site Boundary

Flood Functions

Flood Fringe

Flood Storage

Floodway

MILLERS FOREST

Hunter River

RAYMOND TERRACE

Windeyers Creek

Grahams Town Drain

Speedy Lock Ln

Adelaide St

Elkin Ave

HEATHERBRAE

Kingston Pde

Pacific Highway

Motto Ln

Masonite Rd

Title:

Peak Flood Function - Existing Scenario -PMF

Figure: **C-26**

Rev: **A**

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LEGEND

Site Boundary

Flood Functions

Flood Fringe

Flood Storage

Floodway

MILLERS FOREST

Hunter River

RAYMOND TERRACE

Windeyers Creek

Grahams Town Drain

Speedy Lock Ln

Adelaide St

Elkin Ave

HEATHERBRAE

Kingston Pde

Pacific Highway

Motto Ln

Masonite Rd

Title:

Peak Flood Function - Post-development Scenario - PMF

Figure: C-27

Rev: A

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0 140 280 m

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Filepath: S:\WATER\PROJECTS\A12187_Hunter&IrrawangHS_FIA\GIS\Mapping\FigureGenerator\Appendix\A12187_AppendixC_Maps.qgz

Annex D Response to Comments raised by Council in the Pre-DA meeting.

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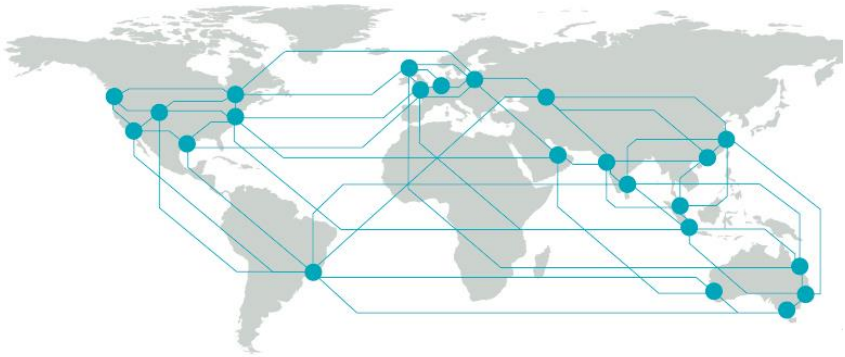
Item	BMT Response
General: General Update for Currency	
PSCC Comment / Town Planner Advice: Firstly, in accordance with the flood certificate and council pre-DA minutes, it is agreed that the development is considered vulnerable. In relation to the Figure BI, I note on the flood certificate that the area that the buildings sit within is in the Flood Prone Category which has an associated minimal risk as identified on the flood certificate for Lot 1 DP540114 and figure 1.2 of the FIA. As such, it is justified that the development is suitable provided the development meets the development **controls**. In strict accordance with the DCP, the title for Figure BI states suitable land uses by flood hazard category (as identified on a flood certificate). The flood certificate for Lot 1 DP 120189 has the highest hazard category – High hazard flood way area however this limited the north west corner of the allotment. Council raise that the departure, based on the flood certificate, however the justification is provided that the development is on the lowest flood risk area. This is noted in BMTs part 4 assessment against the DCP.	As noted by Council, the FIA documents that the development is proposed on the part of the subject site that is subject to the lowest flood risk.
Town Planner Advice: In relation to FFLs control B5.2 requires the FFL for a vulnerable development to be at the PMF level, in this instance, this is 8.5mAHD. The departure from the DCP should be justified by BMT in their response. I believe that they have used the adoptable minimum floor level of 5.7m AHD for residential development. Please have BMT review this assessment against Figure BJ	The Flood Impact Assessment (R.A12187.001.02_HRHS_FIA) and Flood Emergency Response Plan (R.A12187.001.02_HRHS_FERP) prepared by BMT for the Hunter River High School take into consideration the Site's high level of flood immunity (higher than the 1%AEP+CC flood level for the portion of the Site subject to development), as well as the presence of flood-free evacuation routes in the 1%AEP event. The proposal is for addition of building structures to an existing school complex, which does not introduce additional people into the floodplain Data provided by SINSW states the projected number of Site occupants is expected to remain relatively stable over time. The current maximum number of site occupants is 931, and School Infrastructure NSW is expecting only a slight increase (less than 5%) in the number of students in the next couple of years, followed by a subsequent decrease that will bring the number of occupants back to levels similar to the current ones. As part of the FERP, careful consideration has been given to the existing on-site available space above the PMF level. Specifically, the plan ensures that the upper storeys of existing buildings G,H,I,J and K are suitable and sufficient to accommodate the maximum number of people reasonably expected to be on site. This means that in the event of a flood, the occupants of the

Item	BMT Response
	site will be able to shelter at a safe height above the floodwaters. It is important to consider that the SES (State Emergency Service) does not endorse development plans that involve deliberate isolation or sheltering in buildings surrounded by floodwater. These strategies do not offer the same level of risk management as evacuation. The SES stresses that sheltering in a building within the flood extent is not safe, as larger floods can result in entrances and exits becoming flooded and potentially isolating children without food or water for several hours or more. This increases the risk of fire or medical emergencies and the likelihood of caregivers entering floodwater to reach the children. As a school complex, HRHS does not have any permanent residents on the site. Therefore, the emergency strategy preferred by the school is early closure, ideally before the start of the school day, with a trigger based on a severe weather warning. However, in case of severe weather conditions that arise while people are already on site, the FERP proposes to evacuate the site. To ensure timely evacuation, an on-site flood warning signal will be installed: this will allow flood warning redundancy if the BoM gauge of Raymond Terrace fails to warn. The FERP demonstrates that, in the 1%AEP event there would be no less than 10 hours available to evacuate after the order is issued. Similarly, in the unlikely event of a PMF (Probable Maximum Flood) occurrence, there would be around 5 hours available for evacuation after the warning is issued. Based on the information provided, the proposal is seeking consent to set the Finished Floor Level (FFL) of the proposed buildings at 7.3mAHD, which is 1.6 metres higher than the Flood Planning Level (FPL) of 5.7mAHD as indicated in the council's flood certificate.
Town Planner Advice As detailed at the front end of the BMT report, the location of the development is on the lowest flood risk area and noted in Figure 1.2 of the BMT report to be of minimal flood risk, however the flood modelling for the PMF event in Figures C-23 -C27 identify the area as High Hazard Flood Way. I curious in the significant change in flood hazard mapping against Figure 2 and the Modelling. In relation to risk and addressing suitability of the site for development and	While the Williamtown Salt Ash Flood Study did not consider any design flood events between the 0.5% Annual Exceedance Probability (AEP) and the Probable Maximum Flood (PMF), it is still possible to provide an estimate of flood levels for these rare events by using a log-normal interpolation. This involves considering the design flood levels for AEPs up to 0.5% and

Item	BMT Response
justification against a reduction in FFL, I consider BMT need to provide clarification and additional justification. To this extent, I then question the level of construction to address Control B5.3.	the PMF event, assuming that the PMF has an AEP of 1:1,000,000. Based on this analysis, it has been determined that flood levels of 7.3mAHD will be exceeded for events with a rarity of approximately 1:5,000 AEP which would be classed as an 'extreme' flood under the ARR 2019 guideline. Therefore, it is clear that the proposed development will have a very high level of flood immunity that supports the proposed FFL. With regards to Control B5.3 of Port Stephens DCP, a certified structural engineer shall confirm that Existing Buildings designated for sheltering in place, are able to withstand the PMF hydraulic force. Buildings' structures will need to be checked considering depths of water up to 2m and velocities up to 0.6m/s (conservatively highest depth and velocity values sampled around the polygons of the existing buildings G,H,I,J and K)
Town Planner Advice: I note Control B5.6 which relates to hazardous or potentially hazardous materials. Whilst it has been noted within the SEE that the gas cylinders do not meet the threshold for potentially hazardous materials, the statement that 'no hazardous or polluting material is expected to be stored on Site' should be revised to note the relocation of the LPG cylinders. BMT should assess whether the relocation needs to be above the FPL of 5.7mAHD and appropriately anchored to meet the flood hazard to avoid displacement during a flood event.	An addition has been made to the response of Control B.5.6 in Table 4.1 of the report with regards to gas cylinders, their appropriate storage, and anchoring.
Town Planner Advice: Control B5.9 Should be not applicable for the vulnerable development.	Noted and response to DCP control has been edited.
Town Planner Advice: Control 5.10 pertains to alts and adds to residential accommodation. This should be N/A	Noted and response to DCP control has been edited.
Town Planner Advice: Table 4.2 should be considered to be updated in relation control B5.2 and justification for the departure provided.	Based on the observations made in support of adopting a Flood Freeboard Level (FFL) lower than the PMF level, it is requested to retain the existing table 4.2
Town Planner Advice: See the link here for Clause 5.22 under the SI for BMT to include in the amended report: https://legislation.nsw.gov.au/view/html/inforce/current/epi-2006-155a#sec.5.22	According to Clause 5.22 of the 2022 Principal Local Environmental Plan, any development on land subject to this clause must meet the following requirements: (a) Ensure the safety of occupants and enable efficient evacuation during a flood event. (b) Include measures to manage the risk to life in the event of a flood. (c) Avoid any adverse effects on the environment during a flood event.

Item	BMT Response
	After reviewing the proposed measures, we are satisfied that the development meets the necessary criteria. To address point (a), SINSW projections have confirmed that the proposed development will not result in an increase in the current number of people in the floodplain. Therefore, even in the post-development scenario, the existing available space in buildings suitable for emergency sheltering in place will be sufficient. This ensures that the flood safety of the site will not be affected. To manage the risk to life in the event of a flood, point (b), a Flood Emergency Response Plan (FERP) has been drafted for the site. The FERP includes school closure before the start of the day in the event of a severe flood warning. Given that a Probable Maximum Flood (PMF) event is an extremely rare occurrence, early forecast is likely to be available, and therefore it is highly likely that no occupants will be on site during a PMF event due to the early closure. Additionally, an on-site flood alarm system has been installed and it has been demonstrated that timely evacuation is possible via a flood-free route. The residual flood risk will be managed with the provision for sheltering in place in the existing 2-storey buildings on site should timely evacuation not be possible. Furthermore, it is important to note that the FFL for the proposed buildings is significantly higher than the 1%AEP+CC+freeboard level, providing additional safety margins against flooding. Together, these measures offer a robust approach to managing flood risk for the proposed development. According to the flood impact maps presented as part of the FIA, afflux caused by the proposed works is negligible. Therefore, from a flooding perspective, the development will not have an adverse effect on the environment during a flood event, addressing point (c). Based on the above, we believe that the proposed measures are appropriate for managing the risk to life in the event of a flood, and therefore we request a reduced Flood Planning Level (FPL) for the proposed development.



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