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Australia

ABN: 54 010 830 421

Our ref: L.002857.001.02_FRA.docx

28 November 2023

Hunter Development Brokerage Pty Ltd
44 Church Street (PO Box 40)
Maitland, NSW 2320

Attention: Aprajita Gupta

Dear Aprajita

RE: FLOOD IMPACT ASSESSMENT FOR PROPOSED DEVELOPMENT AT 103 CABBAGE TREE ROAD, WILLIAMTOWN 2318

BMT Commercial Pty Ltd ("BMT") has been commissioned by Hunter Development Brokerage Pty Ltd to undertake a flood risk assessment (FRA) for the proposed development of the BESS facility at 103 Cabbage Tree Road, Williamtown.

The assessment focuses on risks of debris, blocked access, and damage to structure, as well as considers consequences of further raising the site, as requested by Council. This letter documents a summary of the analysis and outcomes of the FRA undertaken by BMT.

We trust that the assessment is adequate for your purposes. If you require further information or clarification regarding any aspect of this assessment, please do not hesitate to contact the undersigned.

Yours Sincerely,

BMT

Richard Wang
Consultant Engineer

1 Introduction

HDB Town Planning & Design on behalf of Clean Energy Transfer Fund Battery Developments Pty Ltd engaged BMT Commercial Australia (BMT) to complete a flood risk assessment as part of its development application (DA) for a proposed fill pad and associated driveway at 103 Cabbage Tree Road, Williamtown ('the Site'), including risk identification, analysis, evaluation and treatment options.

As noted by Port Stephens Council ('Council'), results of the Flood Assessment prepared in July 2023 by BMT for the Site ('the flood assessment') indicate that the Site access will be subject to flooding in the PMF event and in the 1% AEP + Climate Change event. As such, this risk assessment was requested to include:

- Assessment of debris flowing through the site and/or produced at the site due to damage to development in case of inundation;
- Consequences of cancelled maintenance due to flooding;
- Consideration and implication of raising site access;
- Whether developments are capable of withstanding the effects of flood waters, including immersion, structural stability, buoyancy and impact and loading from debris up to and including the 1% Annual Exceedance Probability (AEP) event.

1.1 Study Area and Proposed Development

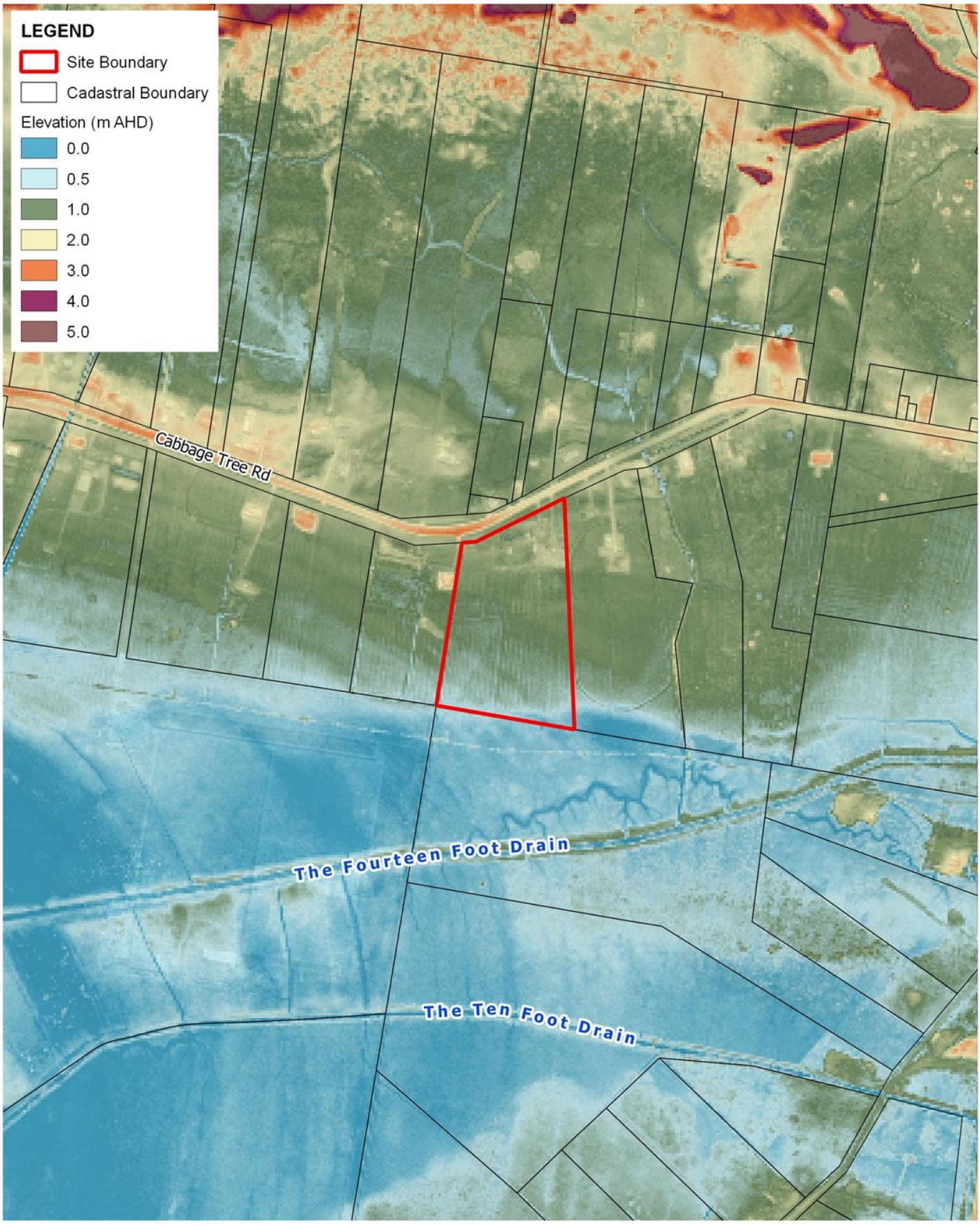
Figure 1.1 shows the locality map and existing topography. The Site (Lot 1 DP 996491) is located within the Port Stephens Local Government Area (LGA) on the lower Hunter River floodplain at Williamtown between Fullerton Cove and Medowie. The Site is bounded by Cabbage Tree Road to the north, the Fourteen Foot Drain to the south and rural residential lots to the east and west.

Site topography, as defined by the available LiDAR and survey data, ranges from a low point of 0.1 m AHD at the south-eastern corner of the Site, to a high point of 1.9 m AHD at the north-eastern corner.

The proposed development at the Site consists of construction of a fill pad to house a battery compound and associated infrastructure (Figure 1.2). It is noted that the development is a non-habitable structure with no permanent staff located at the Site, with fortnightly to monthly general maintenance visits.

1.2 Flood Hazard Classification

The Williamtown Salt Ash FRMS&P definition of flood hazard and the Guideline 7-3 of the *Australian Disaster Resilience Handbook 7 Managing the Floodplain: A Guide to Best Practice in Flood Risk Management in Australia (AIDR, 2017)* have been used for this risk assessment (Figure 1.2). A thorough description of both classifications is presented on the Site's flood assessment.



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Site Locality and Topography

Figure: 1-1

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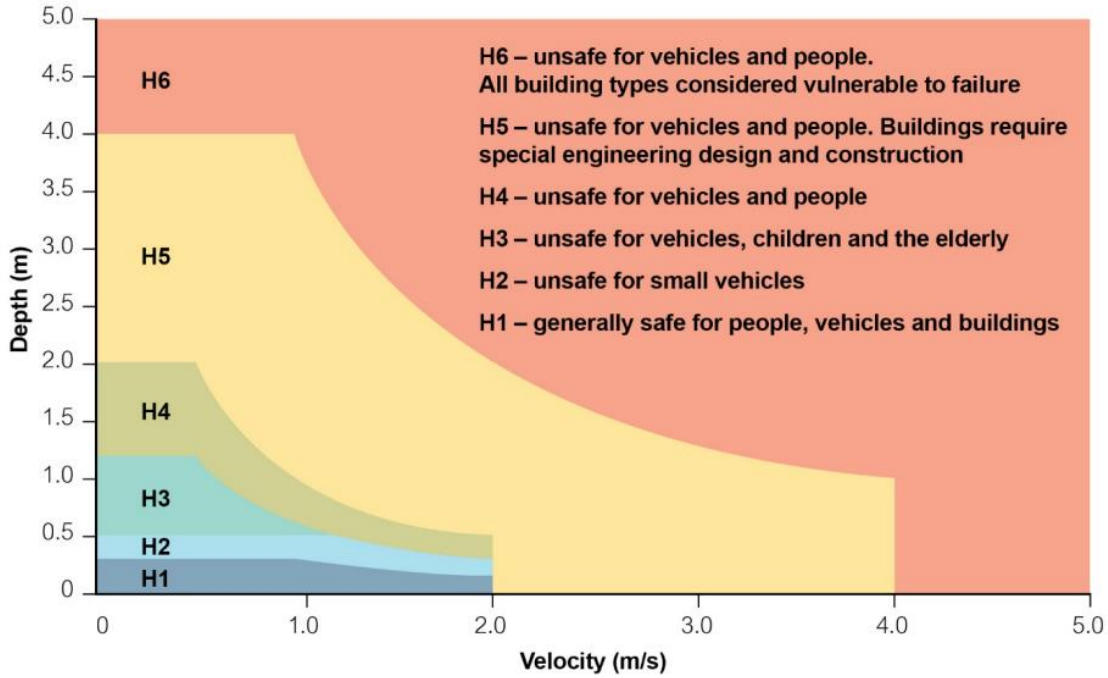


Figure 1.1 Combined Flood Hazard Curves – Vulnerability Thresholds

2 Risk Assessment

The below sections analyse risks of debris, cancelled maintenance, and effects of floodwaters on structures, the impact of raising the site on such risks, and any additional treatment options.

2.1 Debris Assessment

The Debris Assessment considers two risks associated with debris flow, up to the 1% AEP + climate change event:

- Loading from debris flowing into the site;
- Production of debris at the site from damage to structure and equipment and loose goods.

To determine characteristics of debris flowing into the site, levels of debris availability, mobility, transportability and potential employed in the assessment (Table 2.1 to 2.5) were drawn from Table 6.6.1 to 6.6.5 of the *Australian Rainfall and Runoff Guidelines* (Geoscience Australia, 2019) and applied to the 1% + Climate Change event.

Debris Load

Debris from vegetation on Fullerton Cove embankment is first channelled into Fourteen Foot Drain, Ten Foot Drain and the adjacent flat areas located south of the Site, at lower elevations (Figure 2.1). Flow into the site happens from the south-west at low velocities against the terrain gradient, through a well-maintained area.

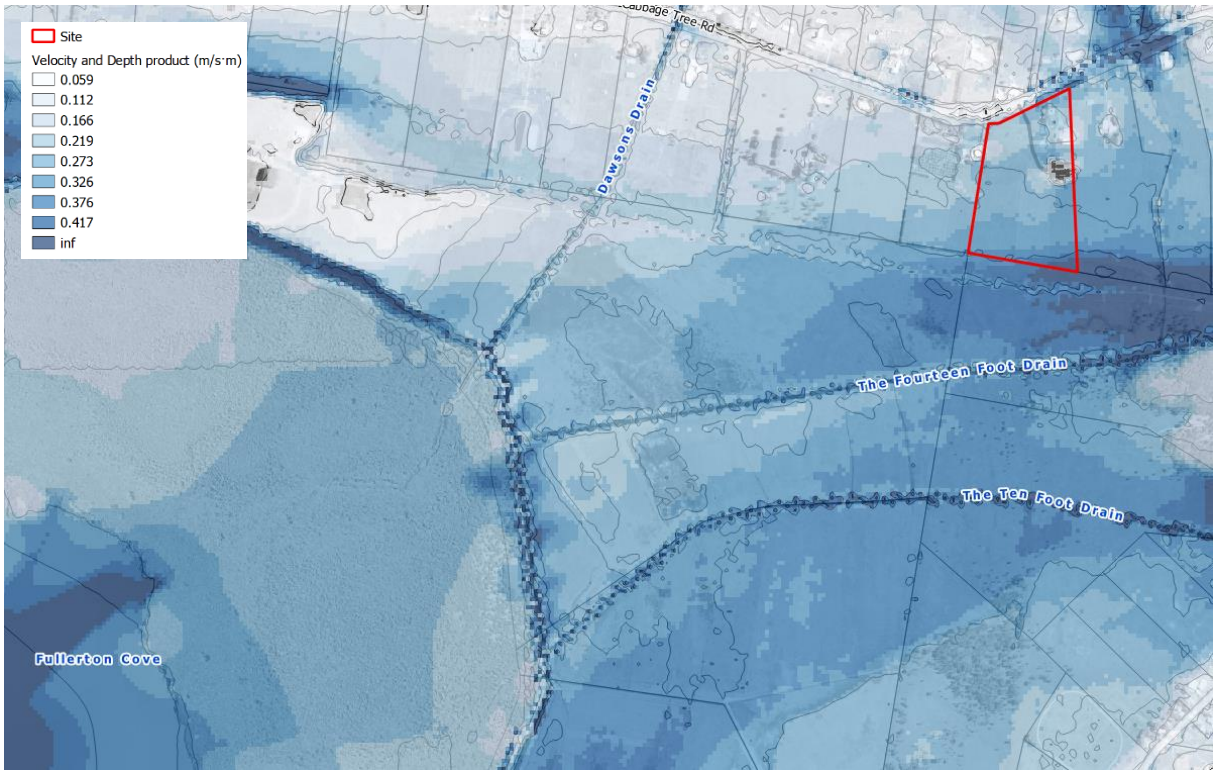


Figure 2-1 Flow over Fullerton Cove tidal flats (debris source area) and site location at the 1% AEP + Climate Change scenario.

Debris availability, mobility, transportability and potential classifications at the site are presented in Tables 2.1 to 2.4.

Table 2.1 Debris Availability - in Source Area of a Particular Type/Size of Debris

Classification	Typical Source Area Characteristics (1% AEP + Climate Change Event)	Site classification
High	• Natural forested areas with thick vegetation and extensive canopy cover, difficult to walk through with considerable fallen limbs, leaves and high levels of floor litter. • Streams with boulder/cobble beds and steep bed slopes and steep banks showing signs of substantial past bed/bank movements. • Arid areas, where loose vegetation and exposed loose soils occur and vegetation is sparse. • Urban areas that are not well maintained and/or where old paling fences, sheds, cars and/or stored loose material etc., are present on the floodplain close to the water course.	High - Fullerton Cove's tidal flats, vegetated by dense mangroves, are located less than 2kms upstream of the site.
Medium	• State forest areas with clear understory, grazing land with stands of trees. • Source areas generally falling between the High and Low categories.	
Low	• Well maintained rural lands and paddocks with minimal outbuildings or stored materials in the source area. • Streams with moderate to flat slopes and stable bed and banks. • Arid areas where vegetation is deep rooted and soils are resistant to scour. • Urban areas that are well maintained with limited debris present in the source area.	

Table 2.2 Debris Mobility - Ability of a Particular Type/Size of Debris to be Moved into

Classification	Typical Source Area Characteristics (1% AEP + Climate Change Event)	Site Classification
High	• Steep source areas with fast response times and high annual rainfall and/or storm intensities and/or source areas subject to high rainfall intensities with sparse vegetation cover. • Receiving streams that frequently overtop their banks. • Main debris source areas close to streams.	Medium – Overtopping of Fullerton Cove's tidal flats happens during frequent events (10% AEP). Fullerton Cove's tidal flats and low areas adjacent to The Fourteen Foot Drain characterise a large, flat source area.
Medium	• Source areas generally falling between the High and Low mobility categories	
Low	• Low rainfall intensities and large, flat source areas. • Receiving streams infrequently overtops their banks. • Main debris source areas well away from streams.	

Table 2.3 Debris Transportability - Ability of a Stream to Transport Debris Down to the

Classification	Typical Transporting Stream Characteristics (1% AEP + Climate Change Event) (Where V = velocity, D is depth, W is width and L10 is average length of the longest 10% of the debris that could arrive at the site)	Site Classification
High	• Steep bed slopes (> 3%) and/or high stream velocity (V > 2.5 m/s) • Deep stream relative to vertical debris dimension (D > 0.5L10) • Wide stream relative to horizontal debris dimension.(W > L10) • Stream relatively straight and free of major constrictions or snag points. • High temporal variability in maximum stream flows.	Low – bed slopes of stream between Fullerton Cove and the site are below 1%, combined with low stream velocity (0.1 – 0.2 m/s at the 1% AEP + Climate Change).
Medium	• Stream generally falling between High and Low categories.	
Low	• Flat bed slopes (< 1%) and/or low stream velocity (V < 1m/s). • Shallow depth relative to vertical debris dimension (D < 0.5L10). • Narrow stream relative to horizontal debris dimension (W < L10). • Stream meanders with frequent constrictions/snag points. • Low temporal variability in maximum stream flows	

Table 2.4 1% AEP + Climate Change Debris Potential

Classification	Combinations of the Above (any order)	Site Classification
High	HHH or HHM	HML - Medium
Medium	MMM or HML or HMM or HLL	
Low	LLL or MML or MLL	

It is relevant to note that, although mapping results indicate flooding on the North-West and South-East corner of the fill pad during the 1% AEP + Climate Change, such depths can be attributed to model limitations due to the grid cell size and elevation interpolation. As the water level surrounding the fill pad during the 1% AEP + Climate Change event is up to 2.5m AHD and the FFL of the fill pad is of 3m AHD, the development remains flood-free and battery structures are not subjected to the debris potential of such flooding.

Potential of debris from the site

There is no potential of debris being produced onsite due to damage to equipment up to and including the 1% AEP + Climate Change event.

During the PMF event, the entire fill pad is classified as hazard level H5, with water level up to 5.2m AHD and velocity up to 0.75m/s. Such flooding could cause damage to equipment and generate debris that would be transported eastwards of the site. Structures subjected to such hazard level require special engineering design and construction. It would also be required that fencing used around the fill pad is verified by a suitably qualified structural engineer to ensure it would not become source of debris. Such requirements could be included as conditions of approval, to be assessed at the detailed design phase.

2.2 Cancelled Maintenance Due to Blocked Access

Although the proposed driveway is flood-free up to and including the 5% AEP event, flooding of local public connecting roads happens more frequently and would result in cancelled maintenance due to access being cut off before the driveway is inundated. Such risk is present from the 10% AEP, when Cabbage Tree Road experiences hazard classification H3 – unsafe for vehicles - at about 275m northeast of the site (Figure A-1). Hence, raising the site's access does not improve access conditions in case of flooding.

Nevertheless, it is relevant to note that the site is remotely operated, and access is only required once to twice a month for maintenance. Combined with a 10-year recurrence time for flood events that would block access, it is unlikely that such events would happen on a day of scheduled maintenance. Additionally, it is expected that maintenance is carried out in a preventive basis and not scheduled with urgency, so rescheduling maintenance in the case of flooding should not seriously impact operations.

To further minimize impacts to business operations and to staff safety, it is recommended that the person managing maintenance is registered to receive Hunter River flood warnings so that staff can be alerted not to attempt to access the site during a 10% AEP event.

2.3 Capability of Development to withstand the effects of flood waters up to the 1% AEP

Parts of driveway are flood affected from the 1% AEP event, and water level surrounding the fill pad reaches 1.4m during the 1% AEP, and 2.5m during the 1% AEP + Climate Change, however the fill pad and battery cubes remain flood free for the 1% AEP event. Hence, structures on the fill pad are not required to be assessed for immersion, structural stability, buoyancy and impact and loading from debris up to and including the 1% Annual Exceedance Probability (AEP) event.

The proposed fill pad is completely submerged within hazard classification H5 in the PMF at water level up to 5.2m AHD and velocity 0.75m/s, hence verification by a suitably qualified structural engineer and compliance with the Building Code of Australia would be required.

2.4 Raising the Site

At the proposed level, the fill pad and battery area meet the Floor Planning Level of the Flood Certificate and has flood immunity up to and including the 1% AEP + Climate Change event. As HDB has presented the option of raising the site above 3m AHD to improve flood immunity, consideration is given to such approach.

The battery units located on the fill pad are only flooded during the PMF event, when water level reaches 5.2m AHD and would permanently damage electrical equipment. Raising the site to 5.2m AHD removes risks associated with damage to equipment and interruption of services, and potential for

debris due to damaged equipment during the PMF event. In this case, battery units and fencing would not require engineering verification to withstand PMF flood levels. However, risk to site access cannot be mitigated as the lower immunity of local connecting roads are a limiting factor, as discussed in section 2.1.

2.5 Risk identification, Analysis, Evaluation, and Treatment Options

A summary of the risks discussed above, and proposed treatment options are presented in Table 2.5.

The consequence and likelihood levels employed in the risk analysis were drawn from Table 3, Table 6 and Table 10 of the National Emergency Risk Assessment Guidelines, Handbook 10 (Australian Government Attorney General's Department, 2015). It can be noted that the consequence and likelihood levels nominated for each identified risk relate to conditions without management measures in place.

Table 2.5 Risk Assessment

Hazard	Vulnerable Element	Risk	Likelihood Rating	Consequence Rating	Risk Rating	Treatment options	Impact of raising the site to 5.2m AHD
Flooding	Maintenance/Access	Access to and from site may not be possible during flood events.	Unlikely – public roads are blocked from the 5% AEP upwards, however maintenance only occurs once to twice a month.	Minor – preventive maintenance can be rescheduled once there is no more flooding.	Low	Acceptable risk. Risk cannot be mitigated onsite as the proposed driveway has higher flood immunity than connecting roads.	No impact.
	Debris	Loading of debris transported by floodwaters and production of debris onsite due to flood damage to equipment/building.	Very Rare – medium potential of debris reaching the site; structures on fill pad are only subjected to risk from debris during the PMF.	Major – hazardous debris produced at the site during a PMF event.	Medium	Acceptable risk. Risk only present in the PMF.	Raises flood immunity above the PMF.
	Building/ Equipment/ Goods	Damage to building, equipment, and goods as a result of flood waters, including immersion, structural stability, buoyancy and impact and loading from debris up to and including the 1% Annual Exceedance Probability (AEP) event.	Very Rare – risk of damage only present during PMF event.	Major – permanent damage to equipment during a PMF event.	Medium	Acceptable risk. Risk only present in the PMF.	Raises flood immunity above the PMF.

3 Conclusion

BMT has undertaken a site-specific FRA for the proposed development at 103 Cabbage Tree Road, Williamstown. The risk assessment involved analysing BMT's flood assessment previously prepared for the site to determine existing flood risks to access, debris loading, and structures.

The key outcomes of the FRA include:

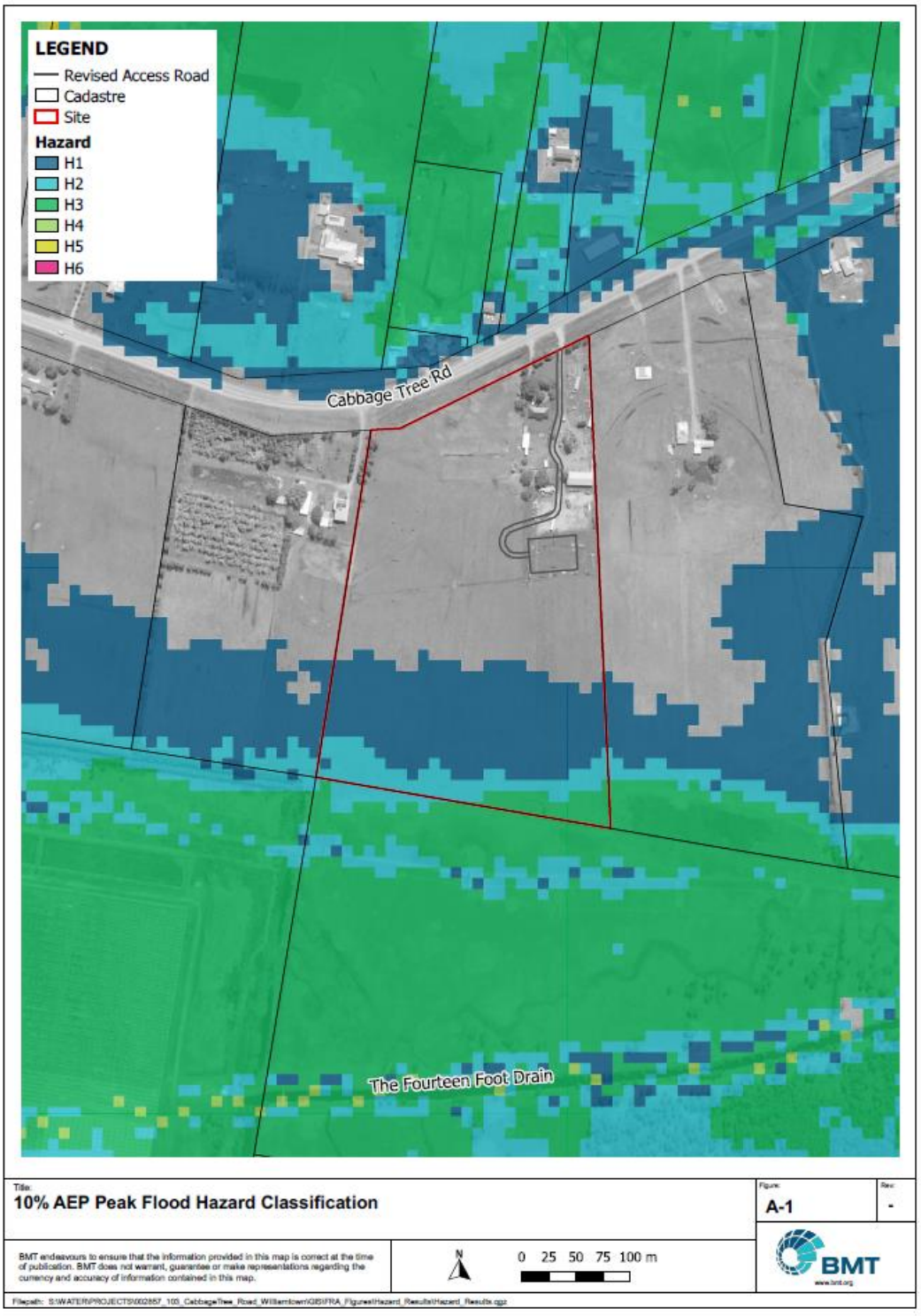
- Risk of Cancelled Maintenance: The proposed driveway is only flooded from the 1% AEP upwards, however the local connecting roads have lower level of immunity and would block access into the site from the 10% AEP. As such, raising the driveway does not improve access conditions during flooding. Nevertheless, the site is only accessed once or twice a month for preventive maintenance, so flooding would result in rescheduled maintenance and such risk is accepted.

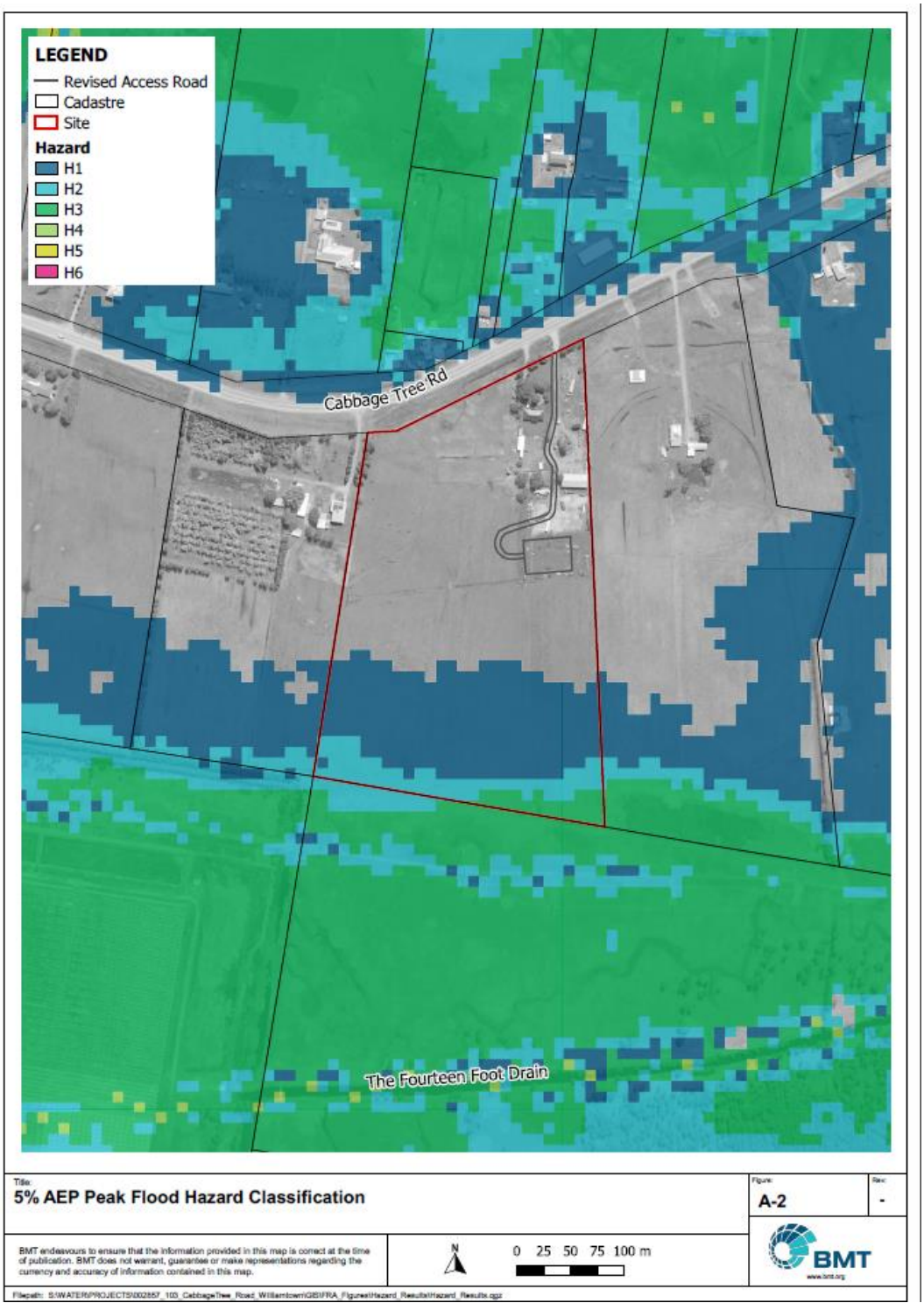
- Debris Assessment: The site has medium debris potential in the 1% AEP + Climate change, however risk of debris loading and generation of debris onsite due to equipment damage is only present in the PMF when there is water over the fill pad. During the PMF, fencing and battery structures could generate hazardous debris.

- Capability of Development to Withstand the Effects of Flood Waters Up to the 1% AEP: The proposed FFL of 3m AHD for the proposed storage area is well above the 1% AEP, during which water level up to 1.4m surrounds the fill pad. The fill pad is submerged within hazard classification H5 in the PMF, hence verification by a suitably qualified structural engineer and compliance with the Building Code of Australia would be required.

- Raising the site: raising site access does not impact on the flood immunity of the site as local roads are blocked before the driveway is flooded. However, raising the fill pad to 5.2m AHD removes risks of debris and damage to equipment during the PMF.

Annex A Flood Hazard Classification Mapping

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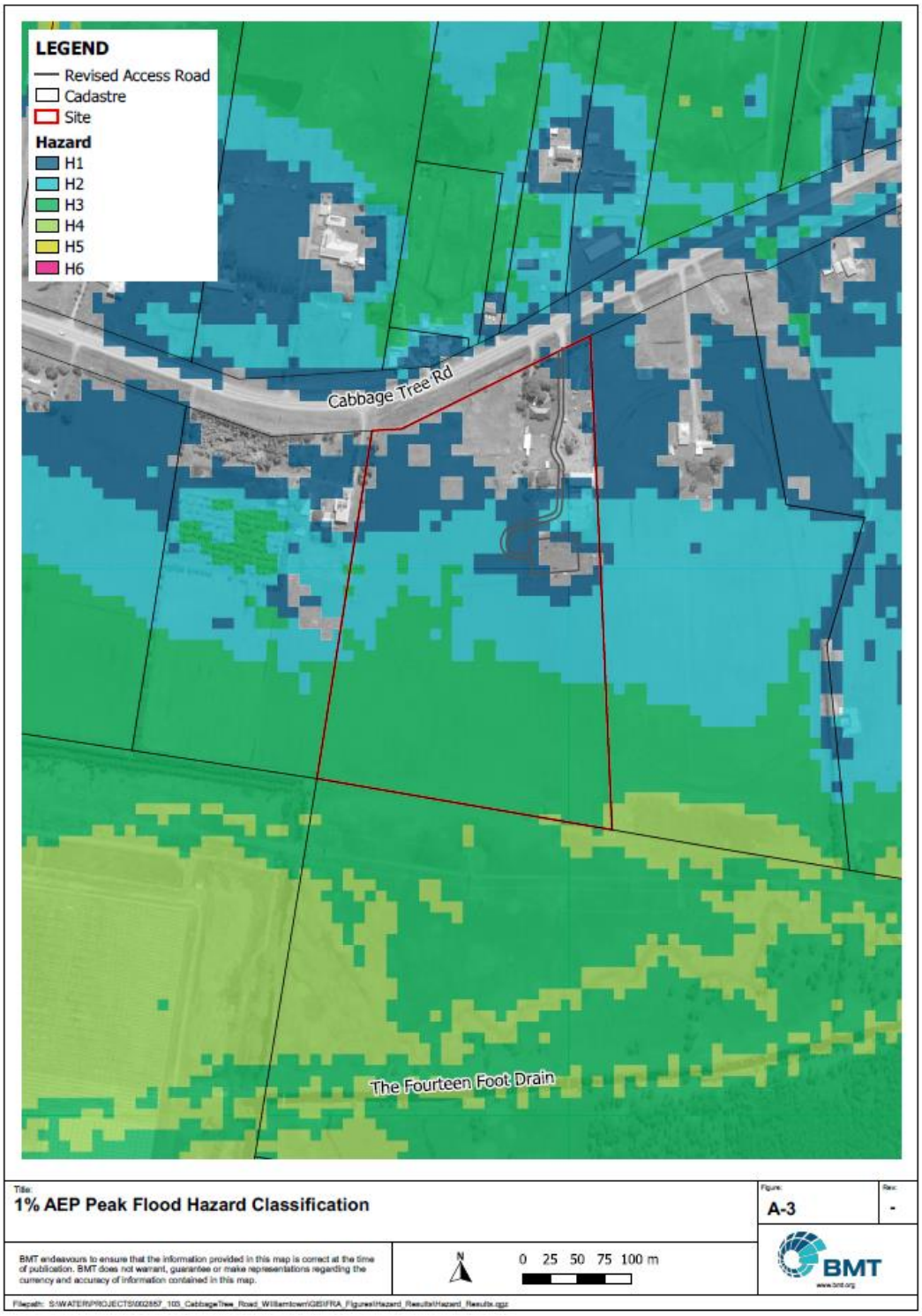
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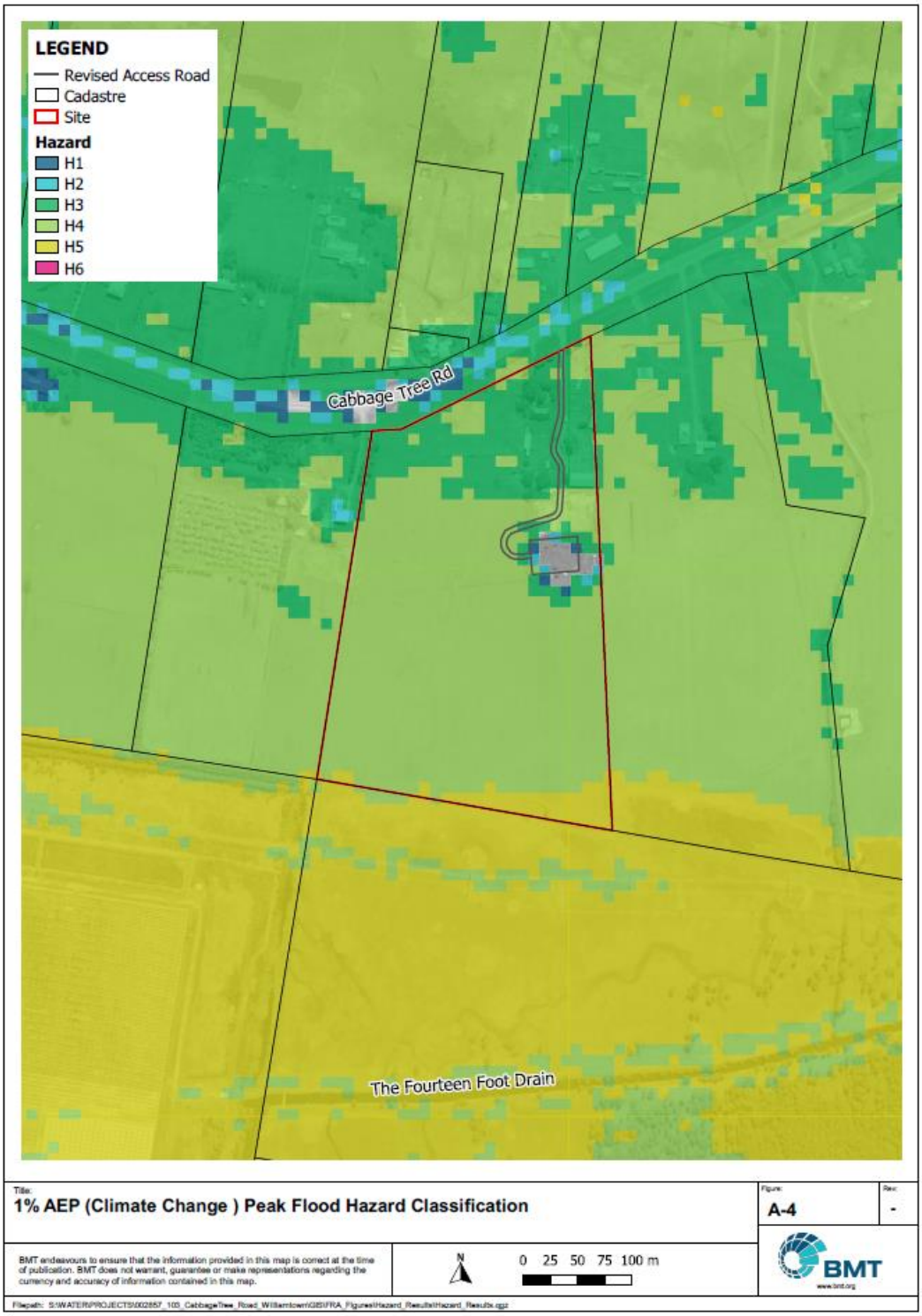
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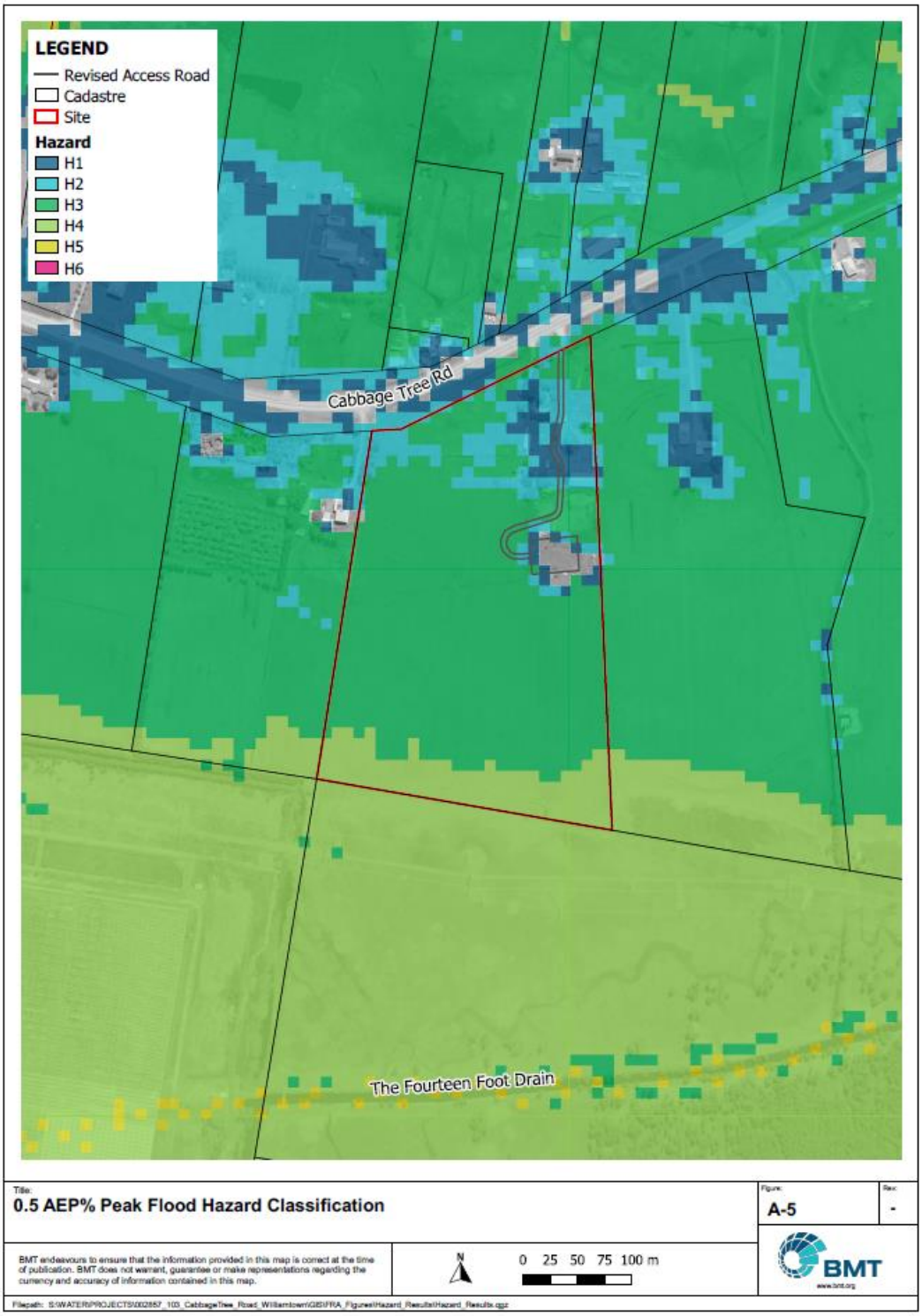
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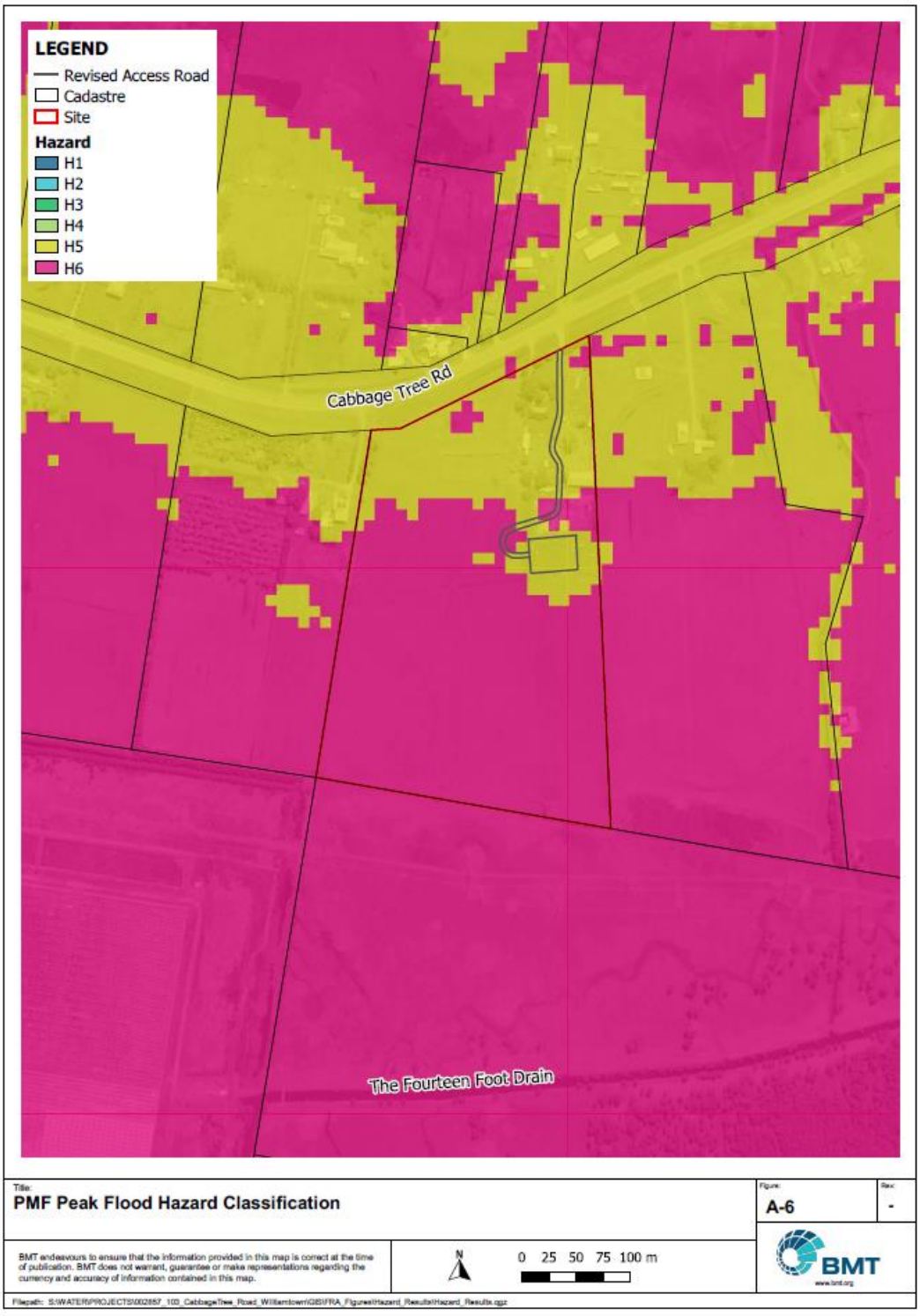
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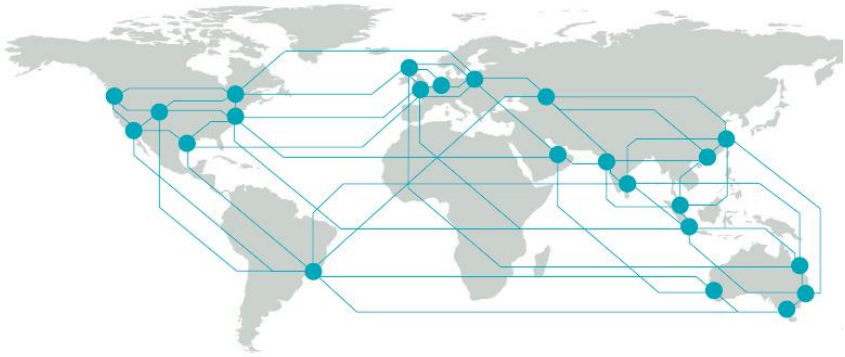

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ABN: 54 010 830 421

Our ref: L.002857.002.01_FIA_Addendum.docx

28 November 2023

HDB
44 Church Street
Maitland, NSW 2320

Attention: Aprajita Gupta

Dear Aprajita

RE: FLOOD IMPACT ASSESSMENT FOR UPDATED PROPOSED DEVELOPMENT AT 103 CABBAGE TREE ROAD, WILLIAMTOWN 2318

BMT Commercial Pty Ltd ("BMT") has been commissioned by Hunter Development Brokerage Pty Ltd to assess the flood impact assessment (FIA) of the updated BESS design layout.

BMT previously undertook TUFLOW flood modelling based on the original design layout, as documented in the "Proposed Fill Pad at 103 Cabbage Tree Road, Williamtown – Flood Assessment", version 01, dated 24 July 2023 (referred hereafter as the "July 2023 FIA")

This letter addendum documents a summary of a qualitative assessment of the updated design layout undertaken by BMT, with the aim of demonstrating that the updated design would produce flood impacts that are consistent with the July 2023 FIA.

We trust that the assessment is adequate for your purposes. If you require further information or clarification regarding any aspect of this assessment, please do not hesitate to contact the undersigned.

Yours Sincerely,

BMT

Richard Wang
Consultant Engineer

Previous versus Updated Design Layout

Figure 1.1 presents the changes to the design layout, with the previous design layout marked in red, and the updated design layout marked in blue.

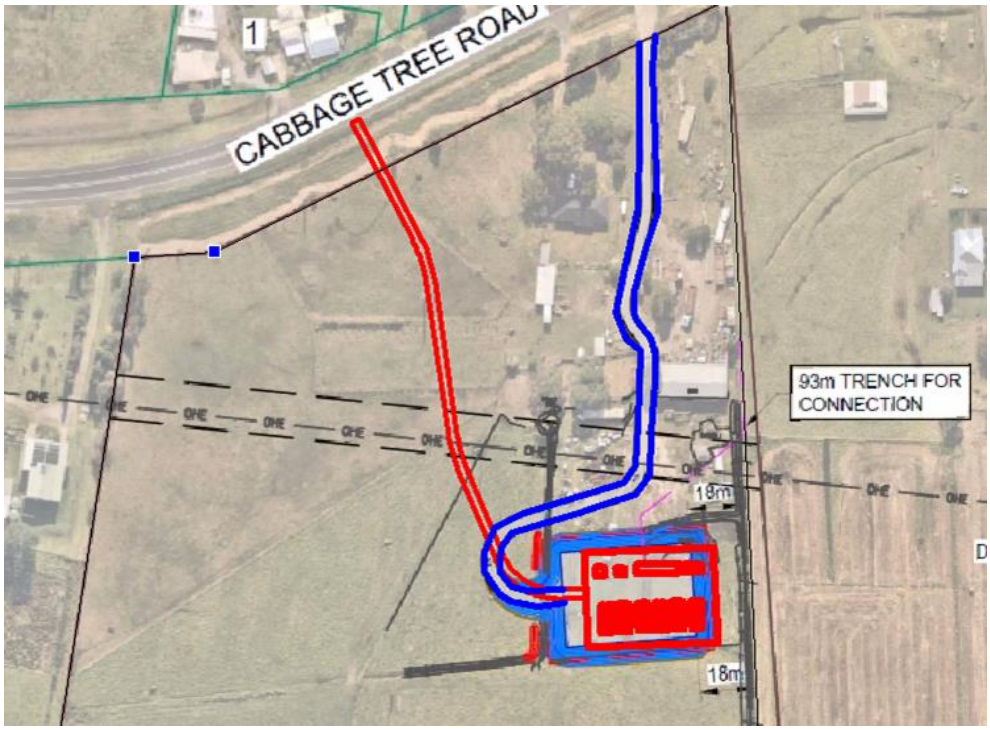


Figure 1.1 Revised Post-development Site Layout

July 2023 FIA

In the July 2023 FIA, the BESS fill pad (shown in Figure 1.1 above) was raised to the flood planning level of 3 m AHD. Due to the grid resolution (20 m) adopted, the fill pad was represented as mound of 160 m^2 (4 model cell sizes), representing a conservative approach in determining flood impacts.

The proposed driveway used existing ground elevations at the Site, assuming a low Manning's roughness value applied to distinguish the road surface from the surrounding grassed surface.

Impacts of Updated Design Layout

Due to the coarse grid size of the model, the revised alignment of the fill pad will still be represented within the model in the same manner as the previous fill pad layout. Therefore, there will be no changes to the flood behaviour as a result of the revised alignment of the fill pad.

The revised alignment of the driveway will continue to use ground elevations but with a lower manning's (n) roughness value applied to distinguish the road surface from the surrounding grassed surface. In the 1% AEP climate change scenario both the previous driveway alignment and the revised driveway alignment are located in a flood storage area (Figure 1.2) with similar peak flood depths (Figure 1.3). Therefore, the changes to the alignment of the revised driveway will have negligible impact to the flood behaviour within the Site and its surrounds.

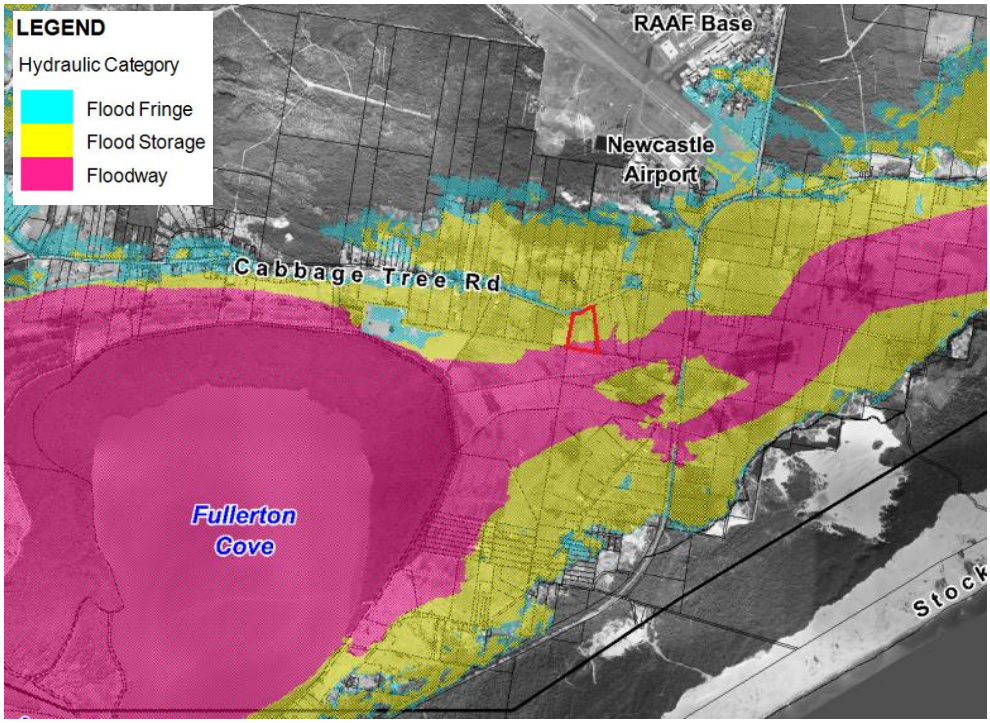


Figure 1.2 Hydraulic Categories – 1% AEP Climate Change [Williamtown - Salt Ash Floodplain Risk Management Study & Plan (BMT, 2017)]

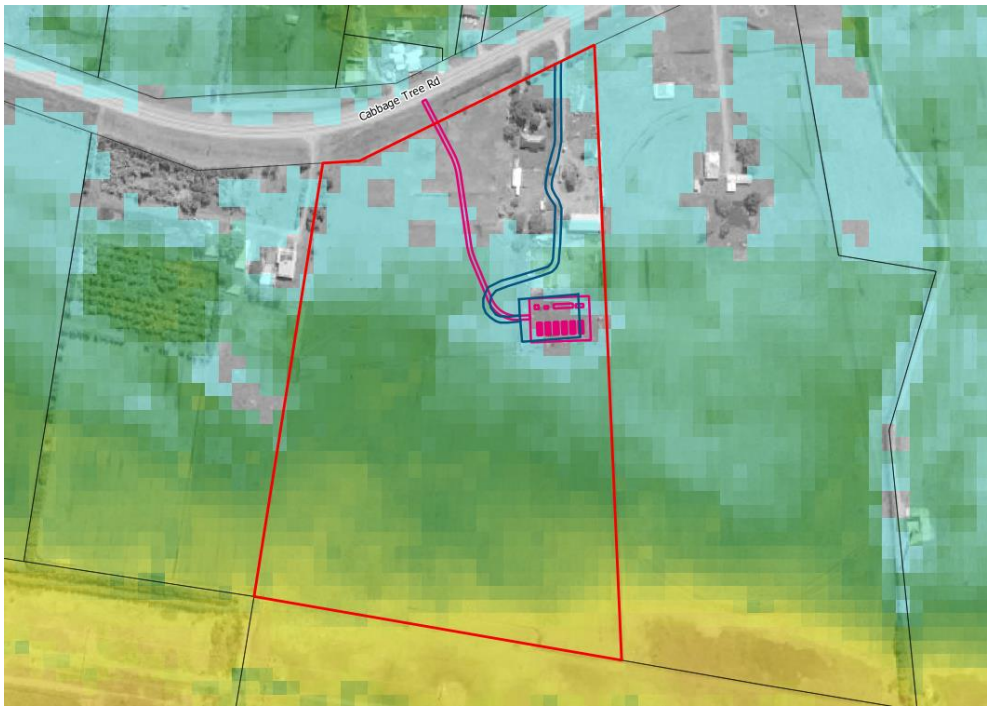
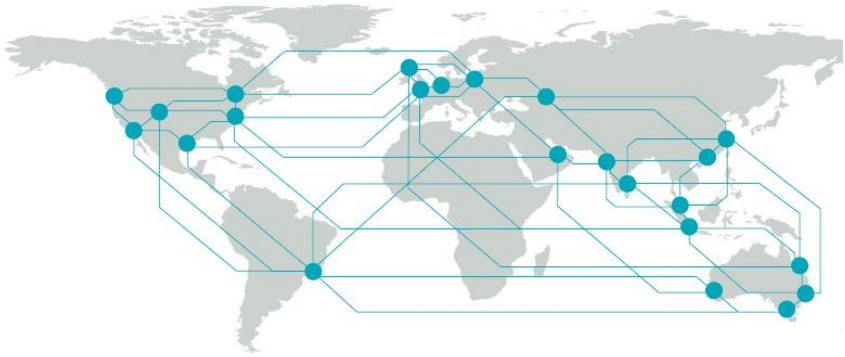


Figure 1.3 Peak Flood Depth – 1% AEP Climate Change Post-Development Scenario



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