



Tweed Valley Hospital – Flooding and Coastal Hazards Assessment

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The Stage 1 (Concept Proposal and Early and Enabling Works) and future Stage 2 (Detailed Design, Construction and Operation) development presents a minimal flood risk as all development is proposed above the regional Tweed River probable maximum flood (PMF) level. Additionally, on site stormwater management infrastructure will be provided as part of the Project to manage peak flow impacts thereby addressing potential local catchment flooding impacts.

The development will give rise to higher volumes of runoff associated with the conversion of the land use from farming (rural) to that of a health services facility (infrastructure) with considerably higher levels of imperviousness. However, it is expected that this incremental increase in runoff volume will not give rise to adverse flood impacts in the Chinderah/Kingscliff area on the basis of previously completed future development scenarios assessed during the preparation of Tweed Council's Floodplain Risk Management Study.

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Introduction

1 Introduction

1.1 Description of the Proposal

1.1.1 Overview

On 13 June 2017, the NSW Government announced the allocation of \$534 million for the development of a new state-of-the-art hospital on a greenfield site in the Tweed, to be known as Tweed Valley Hospital (Project). The Project is located on a portion of 771 Cudgen Road, Cudgen, legally described as Lot 102 DP 870722 (Project Site).

This Flood and Coastal Hazard Assessment forms part of the EIS that has been prepared to accompany a SSD Application for the Tweed Valley Hospital which will be assessed under Part 4 Division 4.1 of the EP&A Act. The Project has been established based on the following supporting documentation:

- Tweed Valley Hospital Business Case;
- Tweed Valley Hospital Masterplan; and
- Tweed Valley Hospital Concept Proposal and design.

The Tweed Valley Hospital Project for which a staged approval is sought consists of:

- Delivery of a new Level 5 major referral hospital to provide the health services required to meet the needs of the growing population of the Tweed-Byron region, in conjunction with the other hospitals and community health centres across the region;
- Masterplanning for additional health, education, training and research facilities to support these health services, which will be developed with service partners over time. These areas will be used initially for construction site/ compound and at-grade car parking; and
- Delivery of the supporting infrastructure required for the new hospital, including green space and other amenities, campus roads and car parking, external road upgrades and connections, utilities connections, and other supporting infrastructure.

The development application pathway for the Project consists of a staged Significant Development Application under section 4.22 of the Environmental Planning and Assessment Act 1979 (EP&A Act) which will consist of:

- A concept proposal and detailed proposal for Stage 1 (early and enabling works); and
- A second development application for Stage 2 works which will include detailed design, construction and operation of the Tweed Valley Hospital.

A detailed description of the proposed staging of the development is provided in the following sections.

1.1.2 Concept Proposal and Stage 1 Early and Enabling Works

This Flooding and Coastal Hazards Assessment supports the EIS for a Concept Proposal of the Tweed Valley Hospital and Stage 1 early and enabling works.

Introduction

By the nature of the flooding and coastal hazard assessment performed, they would also apply to the Stage 2 works although they do not feature as part of the current development application.

The Concept Proposal is informed by service planning to 2031/32 and has an expected gross floor area in the range 55,000m² to 65,000m². The hospital is expected to include (with more detail to be confirmed/provided at Stage 2) the following components/ services:

- A main entry and retail area
- Administration Services
- Ambulatory Services
- Acute and Sub-Acute in-patient units
- Paediatrics
- Intensive Care Unit
- Close Observation Unit
- Mental Health Services
- Maternity Unit
- Renal Dialysis
- Pathology
- Pharmacy
- Cancer Services including Day Oncology and Radiation Oncology
- Emergency Department
- Integrated Interventional Services
- Interventional Cardiology
- Medical Imaging
- Mortuary
- Back of house Services
- Car parking
- Future expansion areas;

Stage 1 includes:

- Early and enabling works (for site clearance and preparation), generally comprising:
 - Construction compound for Stage 1 Works
 - Augmentation and connection of permanent services for the new facility (water, sewer, electricity and telecommunications)
 - General clearance of site vegetation within the footprint of construction works, including tree stumps
 - Chipping of cleared vegetation (excluding weed species) to use on site for ground stabilisation/ erosion control, or off-site disposal as required
 - Bulk earthworks and recycling of material to establish the required site levels and create a stable landform in preparation for hospital construction
 - Piling and associated works
 - Stormwater and drainage infrastructure for the new facility
 - Rehabilitation and revegetation of part of the wetland area
 - Construction of internal road ways for use during construction and in preparation for final road formations in Stage 2
 - Retaining walls.

Introduction

Architectural plans are attached at Appendix B. Further explanation of the Concept Proposal and an outline construction methodology for Stage 1 is provided at Sections 3.7 and 3.8 respectively.

1.1.3 Stage 2: Hospital Delivery - Main Works and Operation

Stage 2 (which will be subject to a separate application) would include the detailed design, construction and operation of the Tweed Valley Hospital. Stage 2 will be subject to a separate application following Stage 1.

1.1.4 Subsequent Stages: Potential Future Expansion

Any subsequent stages would be subject to a separate application(s) as required and would be related to works for potential future expansion of the facility. Details of this are unknown at this stage and would be developed as required.

1.2 Description of the Site

The Project Site is located at 771 Cudgen Road, Cudgen (Lot 102 DP 870722). The Project Site is located north of Cudgen Road and east of Tweed Coast Road, as shown in Figure 1-1. The Project Site is located on the north side of a ridge separating the Tweed River and Cudgen Creek catchments.

The Project Site's topography is varied with its boundary on Cudgen Road representing a high point with maximum elevations of approximately 27m AHD. The Project Site grades relatively evenly from this ridge towards its northern boundary where elevations are approximately 1m AHD. Topography in the far north east of the Project Site adjacent Turnock Street is flat and low.

1.3 SEARS Requirements in respect of Flooding and Coastal Hazards

The following SEARS requirement has been addressed by this Flood and Coastal Hazards Assessment:

"Assess any flood risk on site (detailing the most recent flood studies for the project area) and consideration of any relevant provisions of the NSW Floodplain Development Manual (DIPNR, 2005), including the potential effects of climate change, sea level rise and an increase in rainfall intensity."

Provide the preliminary assessment of the impact of flooding and coastal hazards in relation to the proposed development in accordance with the document 'Attachment A – OEH Standard Environmental Assessment Requirements (sub-points 17 to 22), which is attached to the SEARs.'



LEGEND

-  Site
-  2 Contours (mAHD)
-  Cadastral Boundaries

Title:

Location and Topography

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2 Flood Characteristics of the Project Site

The existing flood characteristics of the Project Site and surrounds (particularly access ways to the Project Site) are presented in this section.

2.1 Data Sources

BMT WBM has previously prepared flood models and mapping for the Tweed River. With permission from Council these models and model outputs have been assessed in the compilation of material provided in this report. The models used to inform this assessment were developed as part of the following studies:

- Tweed Valley Flood Study Update (BMT WBM, 2009); and
- Tweed Valley Floodplain Risk Management Study (BMT WBM, 2014).

Flood model outputs available from the Tweed Valley flood studies and referenced in this assessment include peak 5% AEP, 1% AEP and Probably Maximum Flood (PMF) flood levels, depths and velocity-depth products.

The Tweed Valley Floodplain Risk Management Study (BMT WBM, 2014) was derived from the Tweed Valley Flood Study Update (BMT WBM, 2009), mainly to quantify the hydraulic impacts of potential management measures and future development, as well as evacuation constraints. This study's outputs included mapped hydraulic categories defining Floodways, Flood Storage and Flood Fringe Areas which have been identified. Reference should be made to the above original studies for further detail on modelling development, configuration and outputs.

2.2 Existing Flood Mapping for the Project Site

The Project Site is located within the extent of the *Tweed Valley Flood Study Update* model (BMT WBM, 2009) and the *Tweed Valley Floodplain Risk Management Study* (BMT WBM, 2014). The following maps have been produced to inform the flood characterisation of the Project Site:

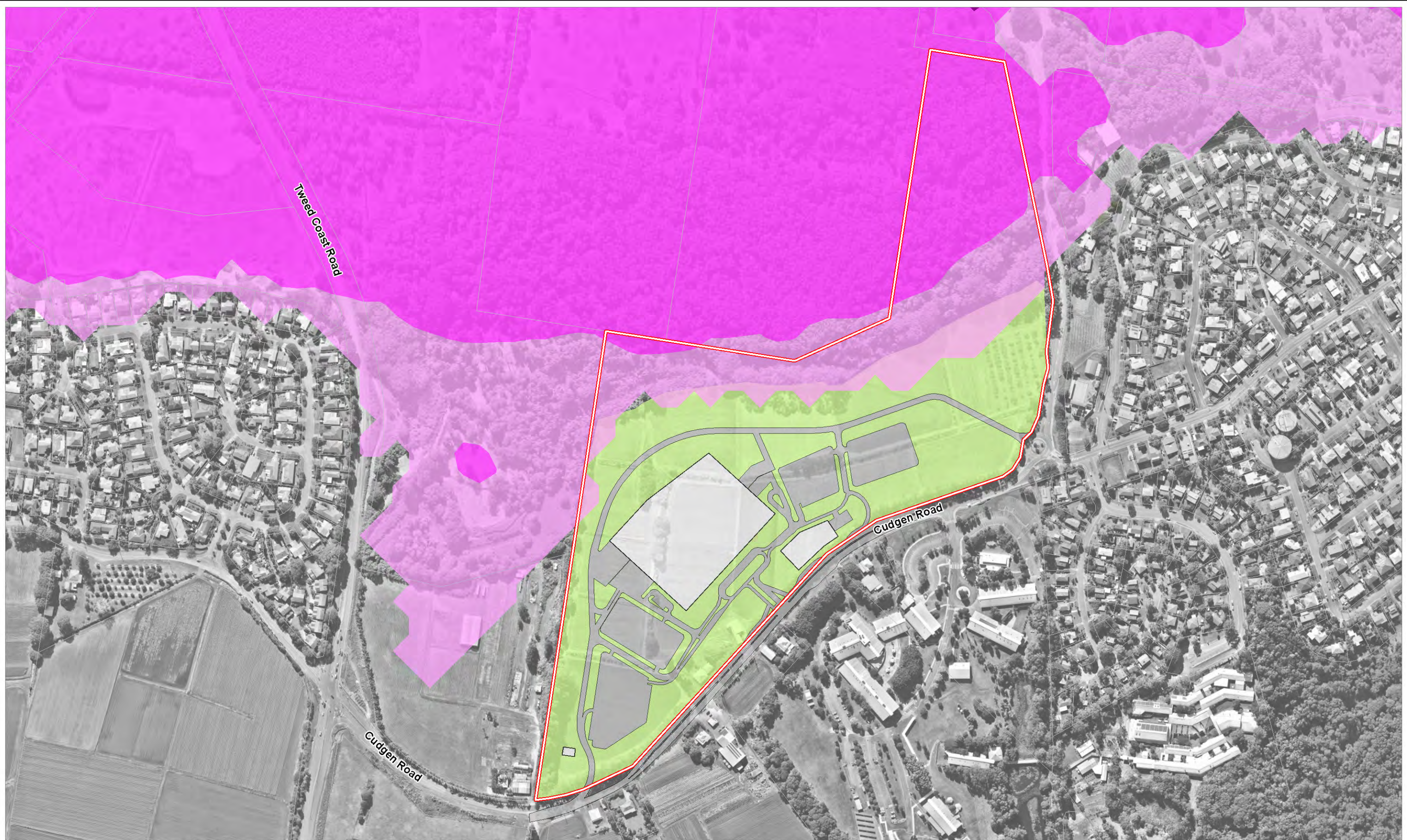
- Figure 2-1 shows the **hydraulic categories**;
- Figure 2-2, Figure 2-3 and Figure 2-4 show the **peak flood level** for the 5% AEP, 1% AEP and PMF flood events, respectively;
- Figure 2-5, Figure 2-6 and Figure 2-7 show the **peak flood depth** for the 5% AEP, 1% AEP and PMF flood events, respectively; and
- Figure 2-8, Figure 2-9 and Figure 2-10 show the **peak flood velocity-depth product** for the 5% AEP, 1% AEP and PMF flood events, respectively.

The flood mapping shows that:

- The northern sections of the Project Site are within the "Flood Fringe" hydraulic category with the north-east portion within the "Flood Storage" hydraulic category (where the Q100 velocity-depth product is between 0.025 - 0.3 m²/s);

Flood Characteristics of the Project Site

- Inundation for the 5% AEP and 1% AEP flood events are similar to each other for the Project Site, with impacts along the northern and north east extents;
- Inundation for the PMF event is similar to the 5% AEP and 1% AEP flood events, but increased in extent to the south;
- Inundation depths within the inundated portions of the Project Site are generally less than 2 m for the 5% AEP flood event and less than 3 m for the 1% AEP flood event, while the inundation depths for the PMF event are predicted to be between 6 and 8 m; and
- The inundation extent to the north of the Project Site is located within the “Low Flood Flow” velocity-depth product category for the 5% AEP and 1% AEP flood events and is almost entirely located within the “High Flood Flow” velocity-depth product category for the PMF event.



LEGEND



Site



Cadastral Boundaries



Development Layout



Floodway ($Q_{100} VxD > 0.3 \text{ m}^2/\text{s}$)



Flood Storage ($Q_{100} VxD > 0.025 \text{ m}^2/\text{s}$)



Flood Fringe (up to PMF extent)

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Title:

Hydraulic Categories

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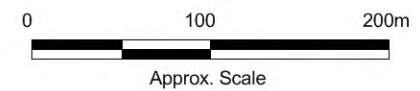


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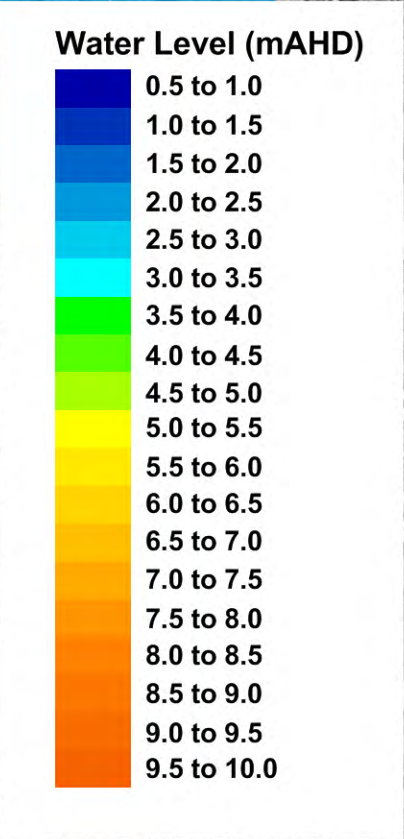
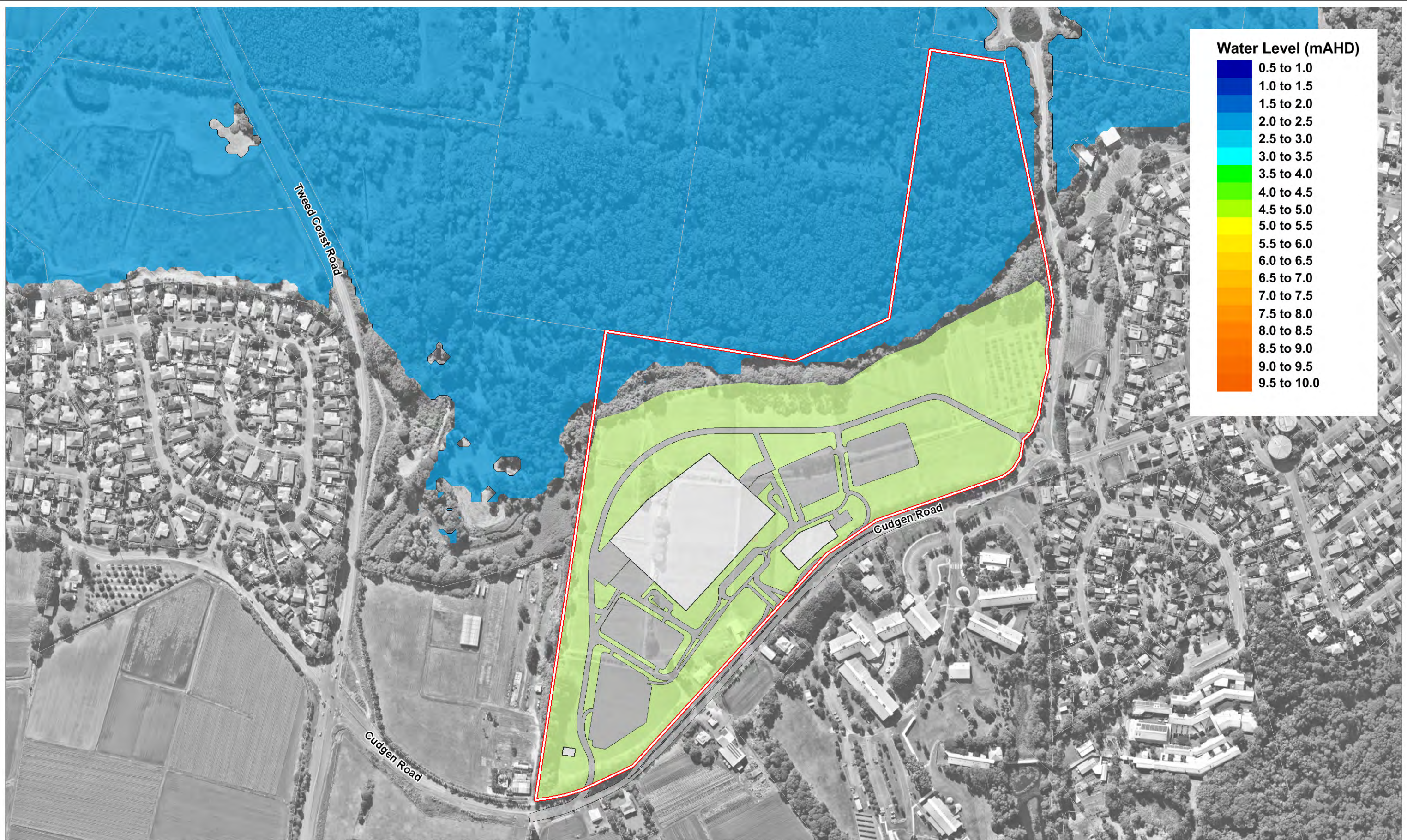
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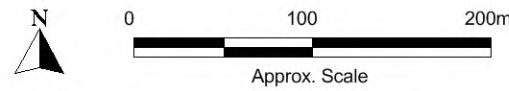


- LEGEND**
- Site
 - Cadastral Boundaries
 - Development Layout

Aerial Photography by nearmap

Title:
Peak 5% AEP Flood Level

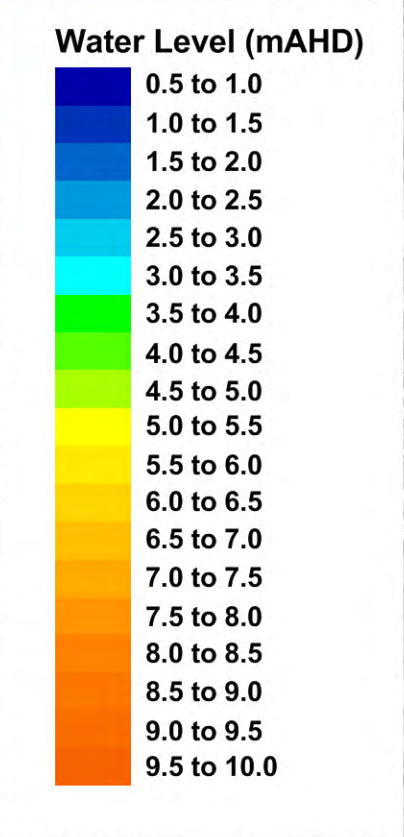
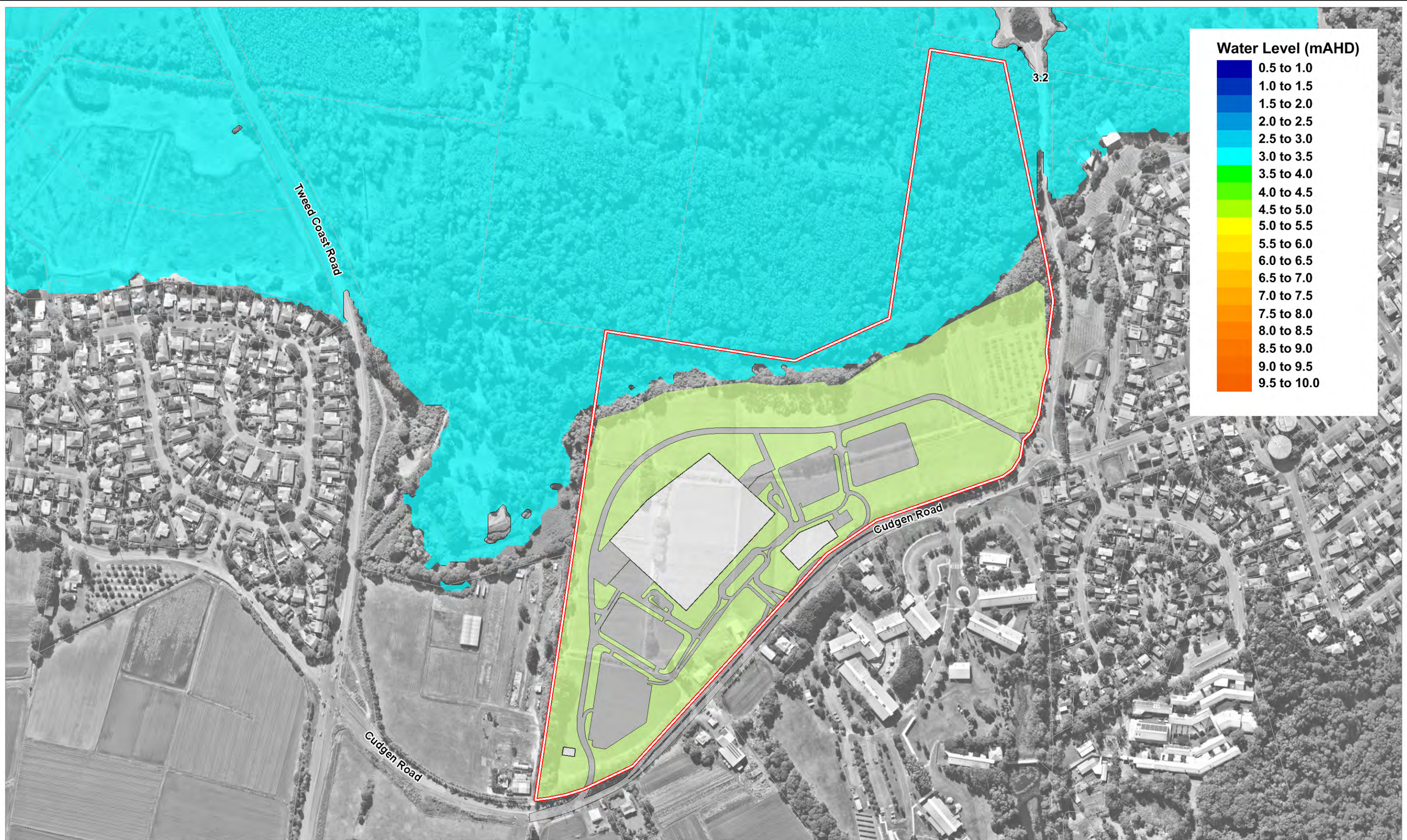
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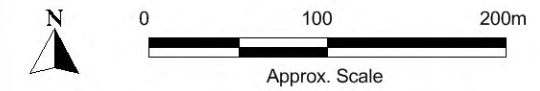


- LEGEND**
- Site
 - Cadastral Boundaries
 - Development Layout

Aerial Photography by [nearmap](#)

Title:
Peak 1% AEP Flood Level

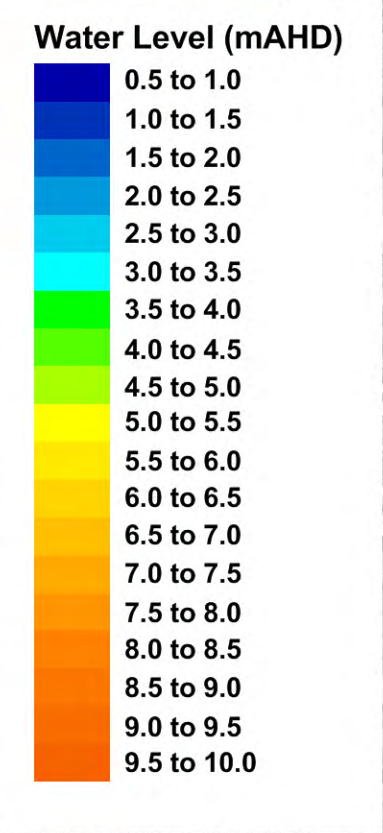
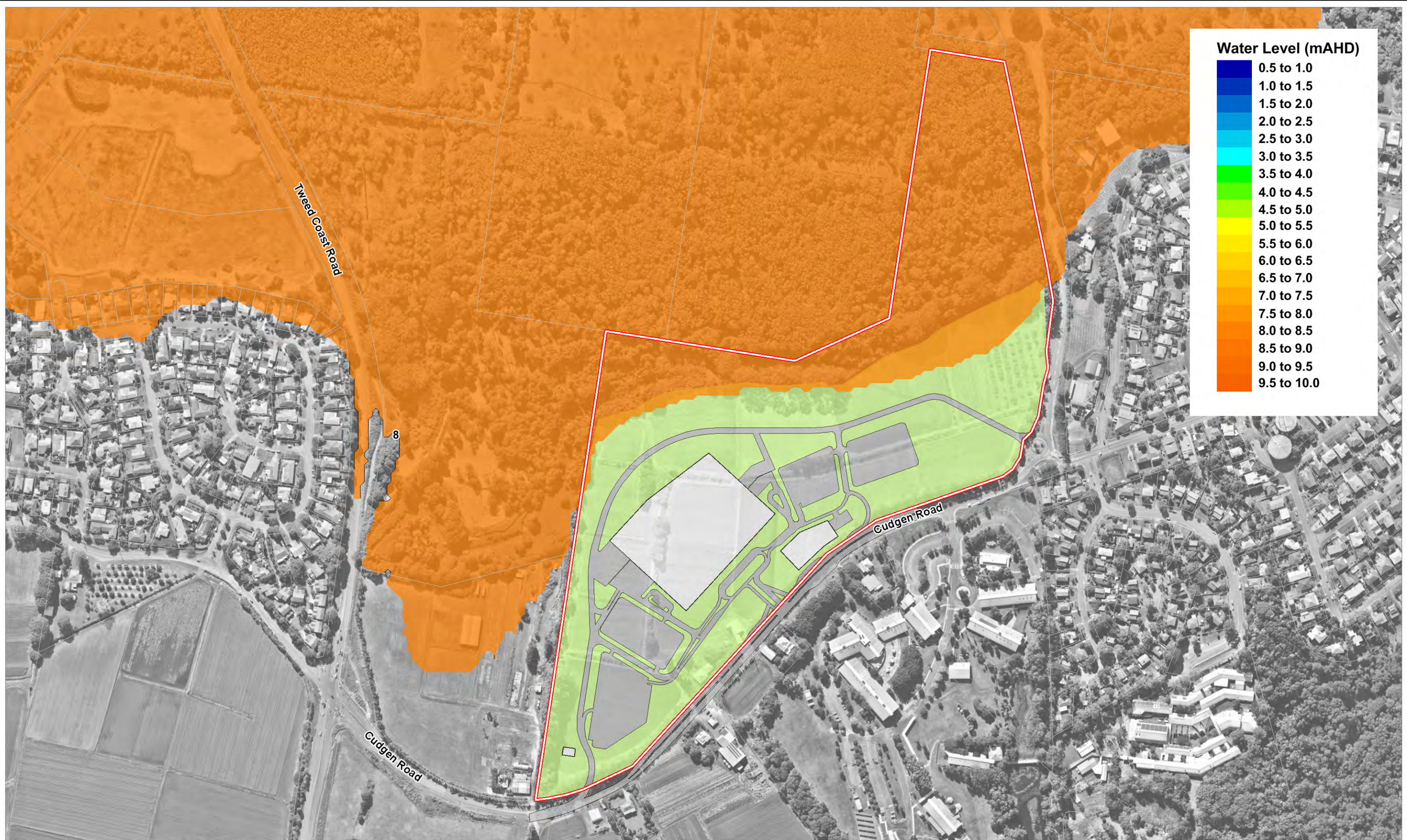
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- LEGEND**
- Site
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Title:
Peak PMF Flood Level

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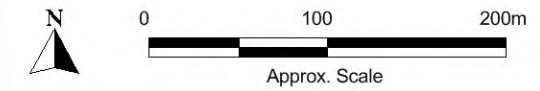


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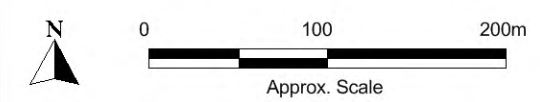


- LEGEND**
- Site
 - Cadastral Boundaries
 - Development Layout

Aerial Photography by nearmap.com

Title:
Peak 5% AEP Flood Depth

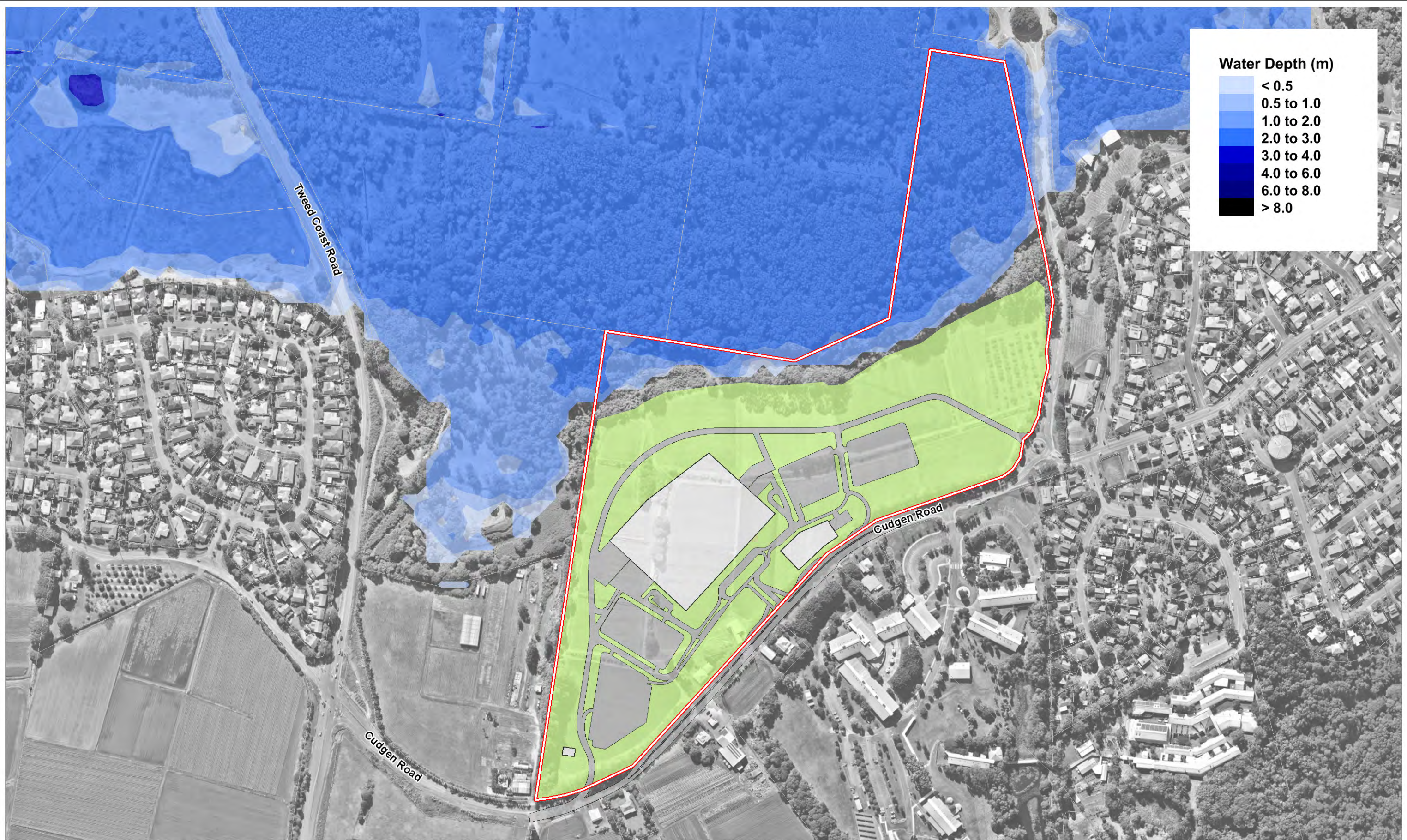
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Water Depth (m)

< 0.5
0.5 to 1.0
1.0 to 2.0
2.0 to 3.0
3.0 to 4.0
4.0 to 6.0
6.0 to 8.0
> 8.0



LEGEND

- Site
- Cadastral Boundaries
- Development Layout

Aerial Photography by nearmap

Title:
Peak 1% AEP Flood Depth

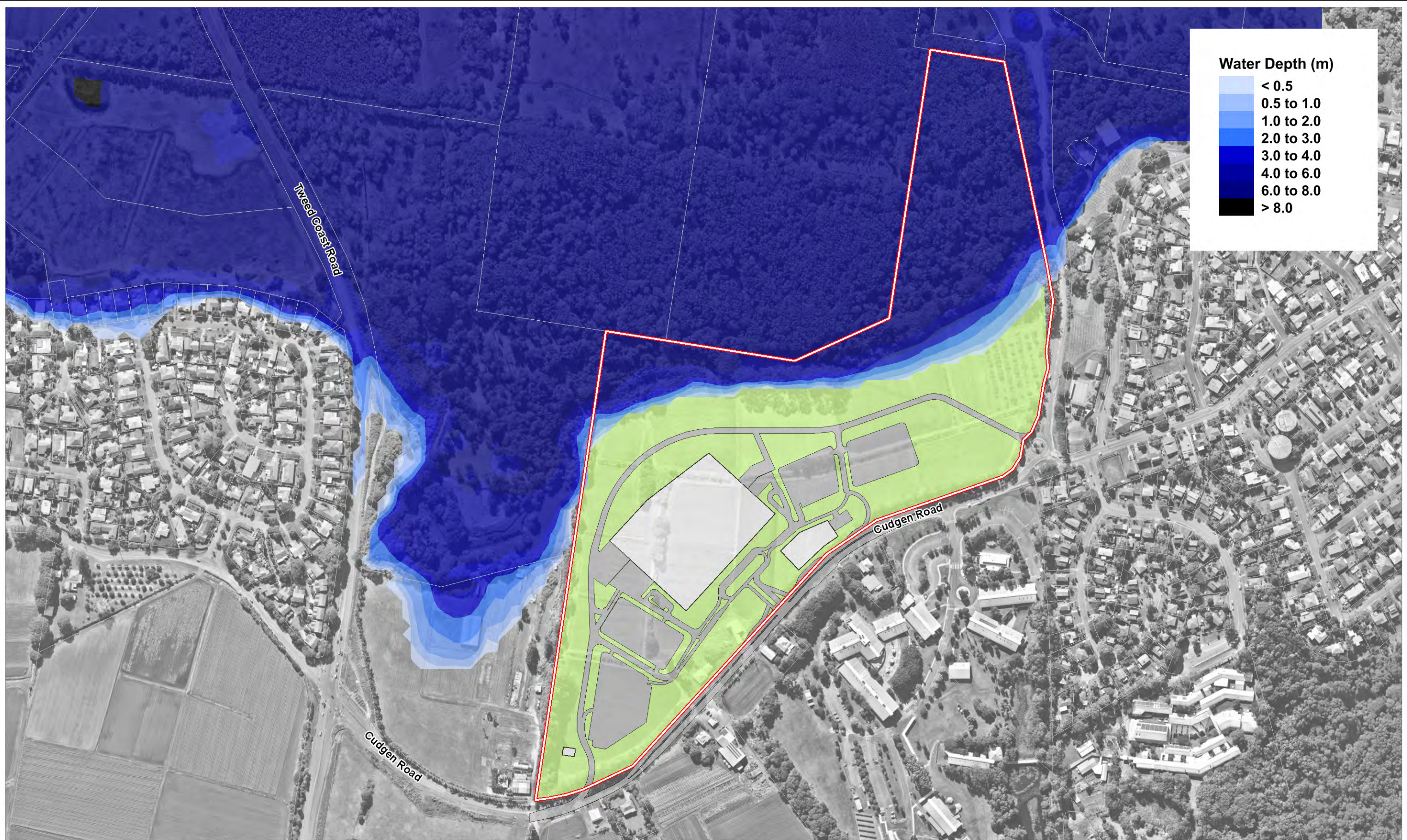
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Water Depth (m)

< 0.5
0.5 to 1.0
1.0 to 2.0
2.0 to 3.0
3.0 to 4.0
4.0 to 6.0
6.0 to 8.0
> 8.0



LEGEND

- Site
- Cadastral Boundaries
- Development Layout

Aerial Photography by nearmap.com

Title:
Peak PMF Flood Depth

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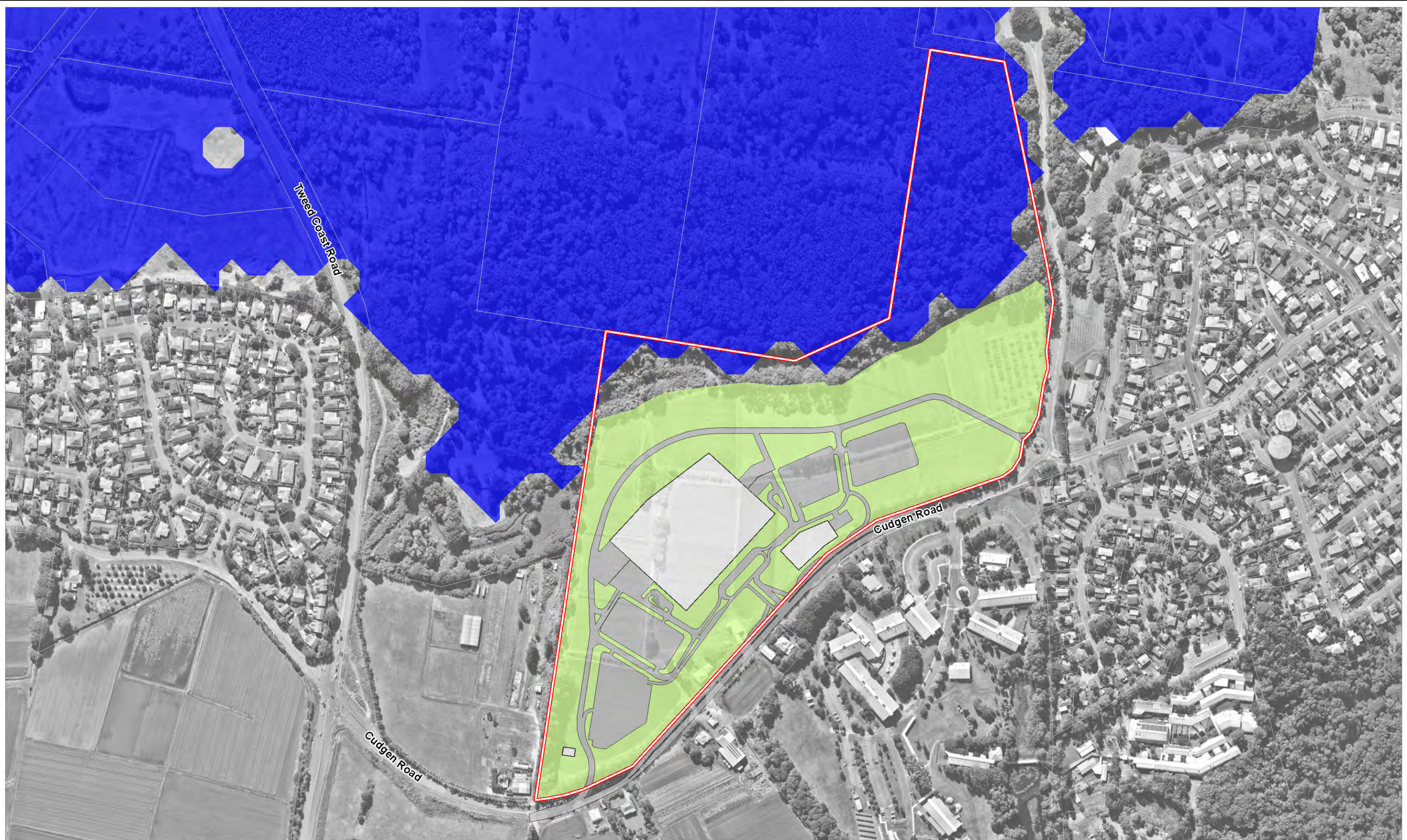
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LEGEND

-  Site
-  Cadastral Boundaries
-  Development Layout

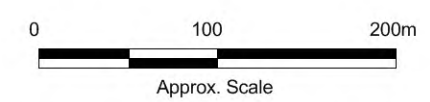
-  $V \times D < 0.3$ Low Flood Flow
-  $V \times D > 0.3$ High Flood Flow

Aerial Photography by 

Title:

Peak 5% AEP Flood Velocity-Depth Products

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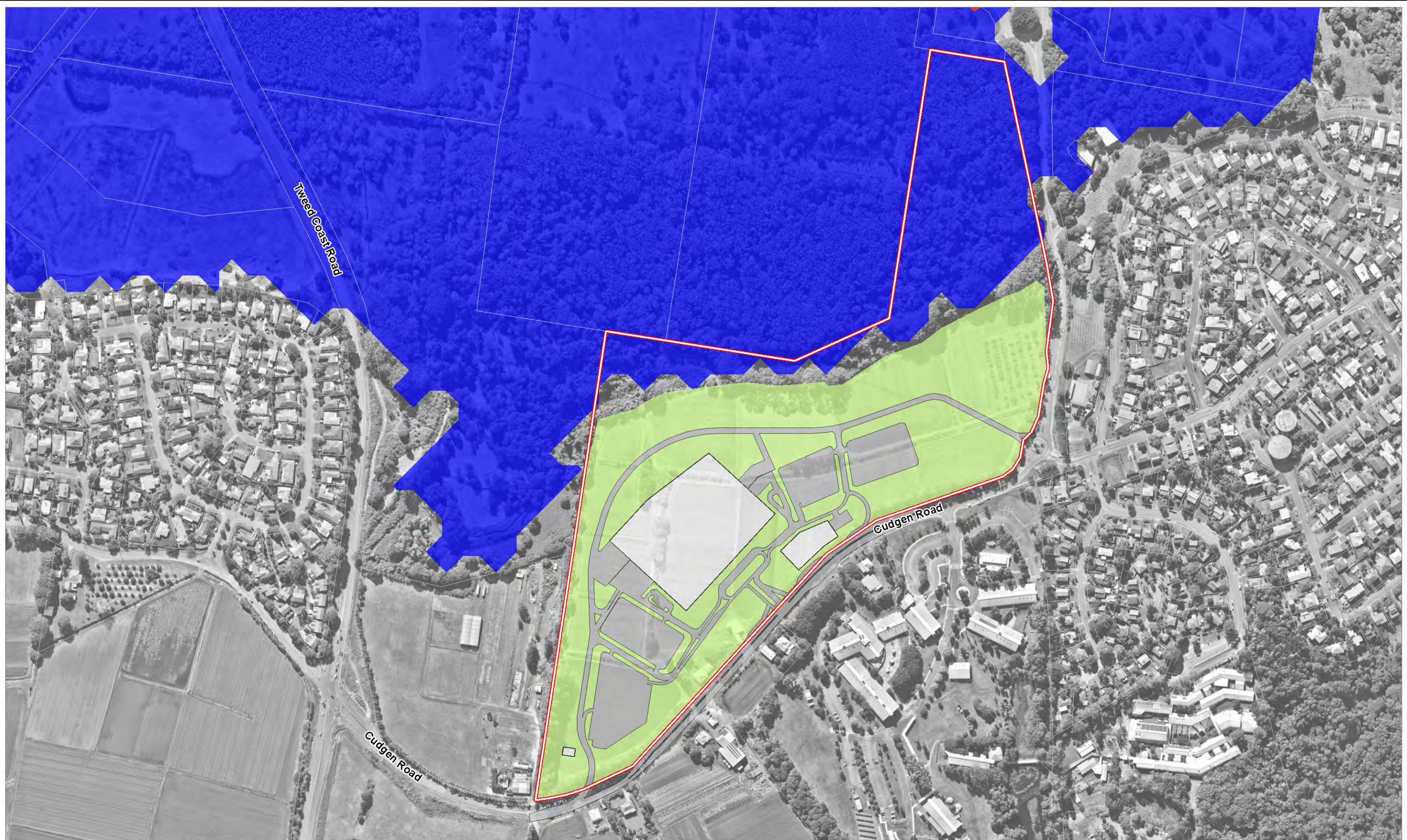
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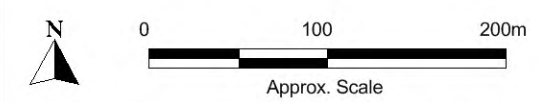
- Site
- Cadastral Boundaries
- Development Layout

- $V \times D < 0.3$ Low Flood Flow
- $V \times D > 0.3$ High Flood Flow

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Title:
Peak 1% AEP Flood Velocity-Depth Products

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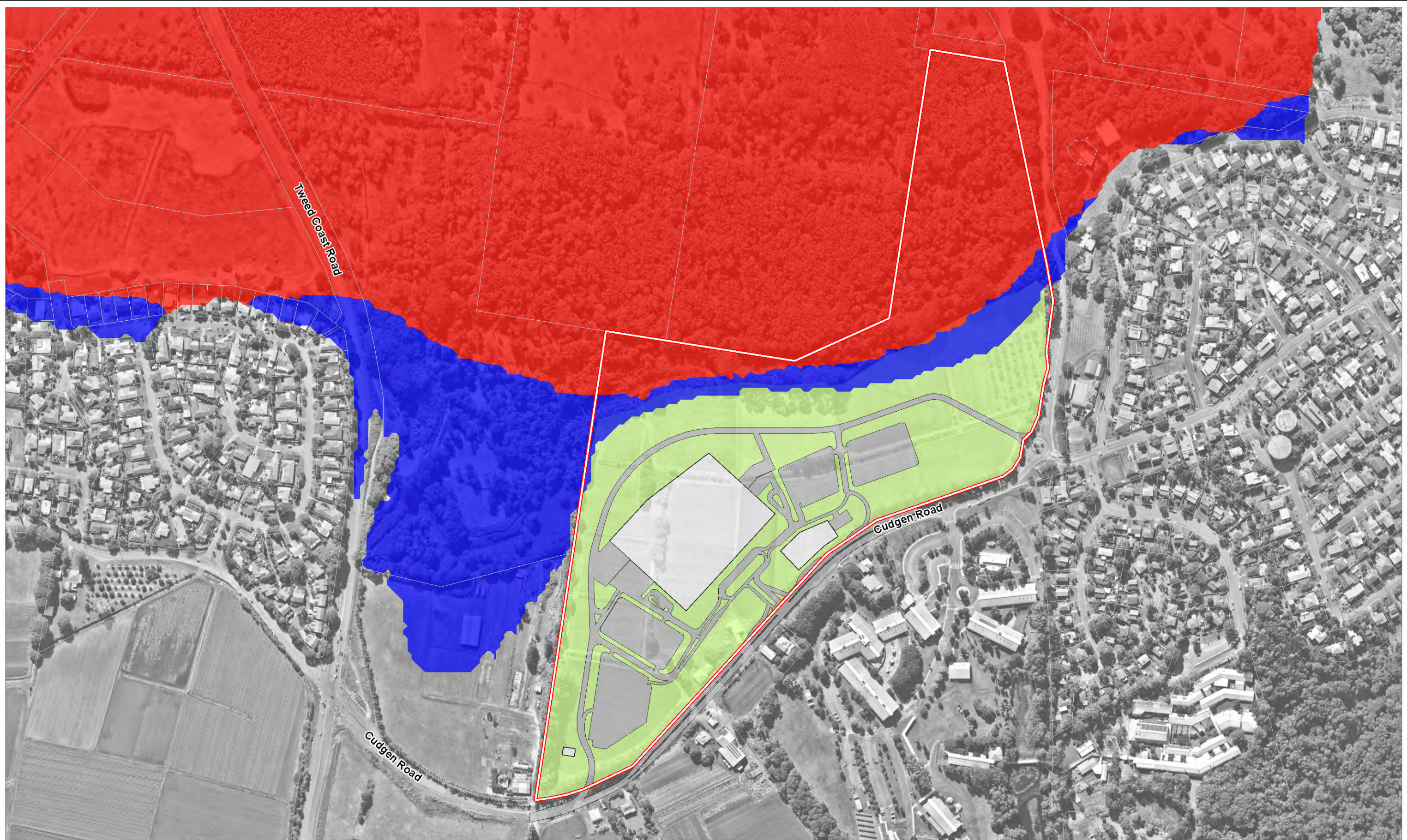


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Figure:
2-9

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LEGEND



Site



Cadastral Boundaries



Development Layout



$V \times D < 0.3$ Low Flood Flow



$V \times D > 0.3$ High Flood Flow

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Title:

Peak PMF Flood Velocity-Depth Products

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0 100 200m
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2.4 Project Site Access

The Project Site has local access points off Cudgen Road that are flood free in events up to the PMF event. However, Cudgen Road connects to other roads which are flood impacted. Maps in the following sections have been produced to identify local traffic access to the Project Site during selected flood events.

The flood mapping outcomes have been interpreted from the regional flood mapping outcomes in consultation with Bitzios traffic consultants, Tweed Council, Queensland TMR and RMS which maintain details of design road immunity and the outcomes of recent flooding events and associated road closures.

2.4.1 Local Egress

Figure 2-11 has been prepared to illustrate local area egress and locations of known or modelled road closure during a 5% AEP event.

It can be seen from this figure that sections of the M1 and Tweed Coast Road are inundated during the 5% AEP event, however, there is alternative road access to the Project Site for the southern coastal populations in this eventuality via Casuarina Way/Tweed Coast Road, or via M1/Clothiers Creek Road/Farrants Road/Eviron Road/Duranbah Road and Cudgen Road. The alternative routes will assist in maintaining access to the Project Site for populations south of the Tweed River during times of flood, with population centres to the north able to access Robina Hospital within approximately 30 minutes.

Consultation with the State Emergency Services confirmed that access to the Project Site during the March/April 2017 flood event (which was of similar magnitude to the modelled 5% AEP event in the Tweed/Kingscliff area) was maintained for the population to the south of the Tweed River. The Project Site remained well above flood levels with the TAFE site opposite being used as a major evacuation centre, which registered almost 400 local residents during that time

Figure 2-12 has been prepared to illustrate local area egress and locations of known or modelled road closure during a 1% AEP event. The figure illustrates a broadly similar flood inundation pattern and predicted locations of road closure to the 5% AEP event. Access via the Clothiers Creek Road may however be impacted during this larger event. Access via Casuarina Way/Tweed Coast Road is predicted to be still flood free.

In respect of travel north from northern Tweed suburbs, Queensland TMR has advised that it understands that during the 1% AEP event, access on the M1 travelling north to either the Robina Hospital or Gold Coast University Hospital may be impacted at Oyster Creek (near Exit 87) and near Mudgeeraba Creek (near Exit 82). TMR has advised that these two sites are subject to current upgrade projects which may improve their existing flood immunity.

Within the road network managed by the City of Gold Coast (which excludes the M1), potential flood free access is possible to the Robina Hospital via Laver Drive or alternatively via the Gold Coast Highway/West Burleigh Road/Bundall Road/Cottesloe Drive/Cheltenham Drive/Robina Parkway and Laver Drive. Potential flood free access to Gold Coast University Hospital is possible via the Southport Nerang Road/Olsen Avenue, or alternatively via Bermuda Street/Bundall Road/Smith Street/Olsen Avenue.

Flood Characteristics of the Project Site

Similarly, the RMS has advised for access from the Byron Central Hospital to the Project Site the flood immunity is generally at or above the 1% AEP flood level except between the Ewingsdale Road interchange and Gulgan Road, where the southbound carriageway is less than the 1% AEP level; on the Yelgun to Chinderah section which has a 5% AEP at the road centreline (for northbound and southbound carriages); and on the Chinderah bypass in the Tweed River floodplain which displays a 5% AEP (for northbound and southbound carriages).





3 Coastal Hazard Features of the Project Site

The existing coastal hazards characteristics of Project Site's surrounds are overviewed in this section.

3.1 Data Sources

BMT has previously assessed coastal hazards for the Tweed Shire coastline. In 2013 BMT prepared a Coastal Hazards Assessment for the combined Byron and Tweed Local Government Area coastal extents. The study included a review of the relevant coastal processes and definition of coastal hazards, where these processes interact (potentially adversely) with existing human settlement and use of the coastal zone or vice versa. The major coastal hazards of note defined in this report included:

- Beach Erosion – relating to periods of intense storminess over seasons to years, and associated dune slope instability;
- Long Term Recession – relating to a long-term sediment deficit and due to both prevailing sediment deficits and sea level rise in the future. Recession rates included Sea Level Rise components which for the purposes of coastal hazard planning were 0.4 m and 0.9 m respectively for the years 2050 and 2100 relative to 1990 sea levels;
- Coastal Inundation associated with during high tides combined with storms, wave runup and sea level rise that may overtop coastal barriers and inundate low lying land adjacent to the lower estuaries of creeks or rivers; and
- Coastal Entrance Instability and effects on immediately adjacent shorelines.

These coastal hazards are considered the most relevant to the Project Site.

3.2 Existing Coastal Hazard Mapping for the Project Site

The Coastal Hazard Assessment including mapping of erosion hazard extents, wave inundation and storm tide inundation. Mapping in the Kingscliff area (reference Figure B1 and Figure B5 of the Coastal Hazards Assessment report) identified that all of these hazards were contained relatively close to the coastline (in the vicinity of Marine Parade) and did not extend to being close to the Project Site.

4 Legislative and Planning Context

This section outlines the legislative and planning context for Tweed Council in relation to flood planning, floodplain management and development control in respect of flooding.

4.1 Tweed Local Environment Plan 2014

Clauses 7.3 'Flood Planning' and 7.4 'Floodplain Risk Management' of the Tweed LEP, 2014 provide Council's adopted flood planning and floodplain management provisions (also included in Appendix A).

4.1.1 Relevance of the LEP

The implementation of Stage 1 and future Stage 2 of the Project does not contradict any of the objectives (and other provisions) of the LEP in relation to flood planning (Clause 7.3). The reasons for this include:

- No development proposed as part of the Project is on land at or below the flood planning level;
- 16 ha of the overall 23 ha Project Site are above the PMF level. Any proposed development on the land for critical infrastructure (such as a hospital) will be consistent with other Council planning recommendations (such as the Development Control Plan as described in Section 4.2) which requires the ground floor level of the infrastructure to be at the PMF level. Development implemented at these levels will minimise risk to life and property as it will not affect the safe occupation of the land during times of large or extreme flooding;
- 7 ha of the northern portions of the Project Site are flood prone. The flood hazard of the flood prone areas varies for different scales of flood. The northern sections of the Project site display low elevations which are subject to inundation from the 5% AEP through to the PMF event (as shown in Figure 2-2 to Figure 2-4). The hazards in these locations vary, with depth of inundation playing a major role in the assessed flood hazard category. The remainder of the Project Site which is above the PMF has no flood hazard category and can successfully support a variety of development including a hospital;
- The Project Site, if developed, is large enough to contain infrastructure that can manage resultant changes in peak flood flows which would be relevant to managing local catchment flood responses as detailed in the Stormwater Management Strategy; and
- Stage 2 of the Project will lead to an increased volume of runoff (due to increases in imperviousness) with the timing of this peak runoff managed by on-site detention/retention infrastructure as detailed in the Stormwater Management Strategy. The additional volume of runoff from the Project Site will incrementally reduce the overall future development capacity of the Chinderah Basin and Kingscliff area. Tweed Council as part of the Floodplain Risk Management Study (BMT WBM, 2014) assessed the cumulative impacts of various developments in this portion of the catchment. Assessments showed that the selected developments (which includes large lots of land for industrial development at Chinderah, residential development along Tweed Coast Road, Old Ferry Road and at Kingscliff in combination with other developments) that involve filling to the minimum 100 year ARI flood

level are possible without exacerbating existing flood impacts at flood sensitive locations. On this basis the incremental contribution of runoff volume from the Project Site is not expected to worsen flood impacts in the Chinderah Basin and Kingscliff areas presently as many of the previously assessed developments are not yet in place. Tweed Council also has the capacity to improve flood conveyance through the Chinderah Basin and Kingscliff area by upgrading existing agricultural drains that convey runoff and flood flows through the area.

Clause 7.4 ('Floodplain Risk Management') only applies to land at or below the flood planning level to the level of the PMF. As the Project Site has extensive land above the PMF which has been identified for development in Stages 1 and 2, and no development is proposed below the PMF this clause is largely not applicable.

However, in relation to objectives of this clause, development associated with the Project will be at or above the PMF and as such will not require evacuation in a flood exceeding the flood planning level or even the PMF. The hospitals operational capacity (for emergency response facilities and critical infrastructure) is largely protected during extreme flood events and limited mainly by loss of access to the hospital from local and regional road network (as discussed in Section 2.4), noting that aerial access would still be possible.

4.2 Tweed Council DCP for Development of Flood Liable Land

Section A3.2.6(a) of Tweed Council's Development Control Plan (DCP) Section A3 - Development of Flood Liable Land (Version 1.4) identifies that critical infrastructure and emergency response facilities in all localities shall comply with the development controls identified in Table 4-1 (and these development controls take precedence over the locality specific clauses of the DCP).

Table 4-1 DCP Requirements for Critical Infrastructure and Emergency Response Facilities

Land Use Risk Class	Development Type	Development Controls	Notes
Critical Development Emergency services facilities and hospitals as defined by Tweed LEP, and critical infrastructure such as major telephone exchanges as per Appendix K3.1 of the Floodplain Development Manual.	New Development	All new critical infrastructure and facilities to be located above PMF level, unless exceptional circumstances can be justified, such as servicing existing flood prone communities where no practical alternative exists. In such cases, and where the development is a habitable land use, adequate PMF refuge must be provided.	Note 1

Note 1 identifies amongst other things the Probable Maximum Flood (PMF) refuge requirements for Critical Development. In general, the PMF refuge must meet the minimum requirements that it be above the PMF level and the minimum floor level needs to be the PMF level (no further freeboard required).

4.2.1 Relevance of the DCP

Delivery of the Project would trigger this DCP requirement. The Project will provide critical infrastructure and facilities above the PMF level, thereby providing PMF refuge. These siting and design outcomes will address this DCP requirement.

4.3 NSW State Planning Directions for Local Government - Flood Prone Land

The NSW Department of Planning and Environment Local Planning Direction 4.3 addresses local government planning for Flood Prone Land (i.e. land susceptible to flooding by the PMF event). These Planning Directions were issued by the NSW State Government 1 July 2009 and are reiterated in Appendix B.

4.3.1 Relevance of the State Planning Direction

The Tweed LEP, 2014 captures the key objectives of this Planning Direction within the objectives of Clause 7.3 (refer Appendix A for wording) by allowing development on land that is compatible with the land's flood hazard, taking into account projected changes as a result of climate change, and avoiding significant adverse impacts on flood behaviour and the environment.

In relation to the Project and Project Site, it is consistent with the objectives of the Planning Directions as no development is proposed in flood prone land (i.e. below the PMF level) and the development is not expected to have a flood impact upon adjacent lands.

5 Assessment of Flood and Coastal Hazard Risks

It is not expected that the Project will give rise to on-site or off-site flood risks. This is on the basis that the Concept Proposal and Stage 1 works (and by association all future Stage 2 works) are to be above the PMF level thereby removing the development entirely from the floodplain. As such the Project would occur without any loss of floodplain storage for any flood event.

Additionally, the Project would be provided with infrastructure to manage local stormwater flows and mitigate peak flows up to and including the 1% AEP event. This will limit the impact of the Project on local catchment flood events.

As described earlier in this assessment the Project (namely Stage 2) will lead to an increased volume of runoff (due to increases in imperviousness) with the timing of this peak runoff managed by on-site detention/retention infrastructure as detailed in the Stormwater Management Strategy. Ecological effects of any changes in flow volume and water quality are addressed through the Biodiversity Development Assessment Report.

The additional volume of runoff from the Project will incrementally reduce the overall future development capacity of the Chinderah Basin and Kingscliff area. However, the development capacity of this region has previously been assessed by Tweed Council during the preparation of its Floodplain Risk Management Study (BMT WBM, 2014). This study found that the region had significant development potential prior to there being identifiable flood impacts. The Project would come 'on-line' prior to many of the potential developments assessed by Council. Council also has a procedure in place to assess the cumulative impacts of specified development in region, ensuring that the incremental impact resulting from the land use change associated with the Project (i.e. rural usage converted to SP2 Infrastructure) would be accounted for in respect of the allowable levels of future development in this area. Council also has the capacity to improve flood conveyance through the Chinderah Basin and Kingscliff by upgrading of existing agricultural drains that convey runoff and flood flows through the area.

In terms of coastal hazards the Project Site is not subject to any currently identified coastal hazards such as coastal erosion or wave/storm tide inundation in the 2050 and 2100 timeframes adopting Council's identified sea level rise estimate of 0.4m (2050) and 0.9m (2100).

In terms of emergency management consultation with Tweed Shire Council and State Emergency Services has identified that Kingscliff TAFE, located opposite the Project Site, is a major disaster evacuation centre for the region. During the 2017 floods, 400 local residents registered at the TAFE evacuation centre. This is an important co-location in terms of an effective and cohesive disaster response for the region. The Project Site maintains flood free access to Kingscliff, meaning that a range of accommodation, food and other essential supplies can be accessed in such events.

Conclusion

6 Conclusion

The Concept Proposal and Stage 1 works (and by association all future Stage 2 works) present a minimal flood risk as all development is proposed above the regional Tweed River probable maximum flood (PMF) level. Additionally, on site stormwater management infrastructure will be provided as part of the Project to manage peak flow impacts thereby addressing potential local catchment flooding impacts. There are no assessed coastal hazards in the immediate vicinity of the Project Site out to the 2100 planning horizon adopted by Tweed Shire Council.

The Project will give rise to higher volumes of runoff associated with the conversion of the land use from rural to a SP2 Infrastructure zone and development of a health services facility, with a higher levels of imperviousness, however, it is expected that this incremental increase in volume will not give rise to adverse flood impacts in the Chinderah/Kingscliff area on the basis of previously completed future-development scenarios assessed during the preparation of Tweed Council's Floodplain Risk Management Study.

Overall, there are no planning, legislative or practical reasons why the Project could not occur on the Project Site from the perspective of achieving suitable extreme flood immunity and addressing the key objectives of Tweed Council for flood planning, floodplain risk management and broader agency requirements for emergency management.

7 References

BMT WBM (2009), *Tweed Valley Flood Study, 2009 Update*, prepared by BMT WBM for Tweed Shire Council, October 2009.

BMT WBM (2013) *Tweed Shire Coastal Hazards Assessment*, prepared by BMT WBM for Tweed Shire Council, November 2013.

BMT WBM (2014), *Tweed Valley Floodplain Risk Management Study, 2014*, prepared by BMT WBM for Tweed Shire Council, October 2014.

NSW Department of Planning (2018), *Section 117 Directions*. [ONLINE] Available at: <http://www.planning.nsw.gov.au/~media/36627A8C16E54FEBA3C2FF5F3E9812D9.ashx>. [Accessed 2 August 2018].

Tweed Shire Council (2011), *Tweed Development Control Plan Section A3 - Development of Flood Liable Land*, Version 1.4.

Tweed Shire Council (2014), *Tweed Local Environmental Plan 2014*. [ONLINE] Available at: <https://www.legislation.nsw.gov.au/#/view/EPI/2014/177>. [Accessed 6 August 2018].

Appendix A Tweed Local Environment Plan, 2014

A.1 Clause 7.3 Flood planning

- (1) The objectives of this clause are as follows:
 - (a) to minimise the flood risk to life and property associated with the use of land,
 - (b) to allow development on land that is compatible with the land's flood hazard, taking into account projected changes as a result of climate change,
 - (c) to avoid significant adverse impacts on flood behaviour and the environment.
- (2) (Repealed)
- (3) Development consent must not be granted to development on land at or below the flood planning level unless the consent authority is satisfied that the development:
 - (a) is compatible with the flood hazard of the land, and
 - (b) will not significantly adversely affect flood behaviour resulting in detrimental increases in the potential flood affectation of other development or properties, and
 - (c) incorporates appropriate measures to manage risk to life from flood, and
 - (d) will not significantly adversely affect the environment or cause avoidable erosion, siltation, destruction of riparian vegetation or a reduction in the stability of river banks or watercourses, and
 - (e) is not likely to result in unsustainable social and economic costs to the community as a consequence of flooding.
- (4) A word or expression used in this clause has the same meaning as it has in the Floodplain Development Manual (ISBN 0 7347 5476 0) published by the NSW Government in April 2005, unless it is otherwise defined in this clause.
- (5) In this clause:

land at or below the flood planning level means land at or below the level of a 1:100 ARI (average recurrent interval) flood event plus 0.5 metre freeboard.

A.2 Clause 7.4 Floodplain risk management

- (1) The objectives of this clause are as follows:
 - (a) in relation to development with particular evacuation or emergency response issues, to enable evacuation of land subject to flooding in events exceeding the flood planning level,
 - (b) to protect the operational capacity of emergency response facilities and critical infrastructure during extreme flood events.
- (2) This clause applies to:
 - (a) land between the flood planning level and the level of the probable maximum flood, and

- (b) land at or below the flood planning level, but does not apply to land subject to the discharge of a 1:100 ARI (average recurrent interval) flood event plus 0.5 metre freeboard.
- (3) Development consent must not be granted to development for the following purposes on land to which this clause applies unless the consent authority is satisfied that the development will not, in flood events exceeding the flood planning level, affect the safe occupation of, and evacuation from, the land:
 - (a) caravan parks,
 - (b) correctional centres,
 - (c) emergency services facilities,
 - (d) group homes,
 - (e) hospitals,
 - (f) residential accommodation (except for dwelling houses, secondary dwellings or dual occupancies) on land in Zone RU5 Village, Zone R1 General Residential, Zone R2 Low Density Residential, Zone R3 Medium Density Residential and Zone R5 Large Lot Residential,
 - (g) residential care facilities,
 - (h) tourist and visitor accommodation.
- (4) In this clause:

flood planning level means the level of a 1:100 ARI (average recurrent interval) flood event plus 0.5 metre freeboard.

probable maximum flood has the same meaning as it has in the Floodplain Development Manual (ISBN 0 7347 5476 0), published in 2005 by the NSW Government.

Note. The ***probable maximum flood*** is the largest flood that could conceivably occur at a particular location, usually estimated from probable maximum precipitation.

Appendix B State Planning Directions for Local Government, Flood Prone Land

Objectives

- (1) The objectives of this direction are:
 - (a) to ensure that development of flood prone land is consistent with the NSW Government's Flood Prone Land Policy and the principles of the *Floodplain Development Manual 2005*, and
 - (b) to ensure that the provisions of an LEP on flood prone land is commensurate with flood hazard and includes consideration of the potential flood impacts both on and off the subject land.

Where this direction applies

- (2) This direction applies to all relevant planning authorities that are responsible for flood prone land within their LGA.

When this direction applies

- (3) This direction applies when a relevant planning authority prepares a planning proposal that creates, removes or alters a zone or a provision that affects flood prone land.

What a relevant planning authority must do if this direction applies

- (4) A planning proposal must include provisions that give effect to and are consistent with the NSW Flood Prone Land Policy and the principles of the *Floodplain Development Manual 2005* (including the *Guideline on Development Controls on Low Flood Risk Areas*).
- (5) A planning proposal must not rezone land within the flood planning areas from Special Use, Special Purpose, Recreation, Rural or Environmental Protection Zones to a Residential, Business, Industrial, Special Use or Special Purpose Zone.
- (6) A planning proposal must not contain provisions that apply to the flood planning areas which:
 - (c) permit development in floodway areas,
 - (d) permit development that will result in significant flood impacts to other properties,
 - (e) permit a significant increase in the development of that land,
 - (f) are likely to result in a substantially increased requirement for government spending on flood mitigation measures, infrastructure or services, or
 - (g) permit development to be carried out without development consent except for the purposes of agriculture (not including dams, drainage canals, levees, buildings or structures in floodways or high hazard areas), roads or exempt development.
- (7) A planning proposal must not impose flood related development controls above the residential flood planning level for residential development on land, unless a relevant planning authority provides adequate justification for those controls to the satisfaction of the Director-General (or an officer of the Department nominated by the Director-General).

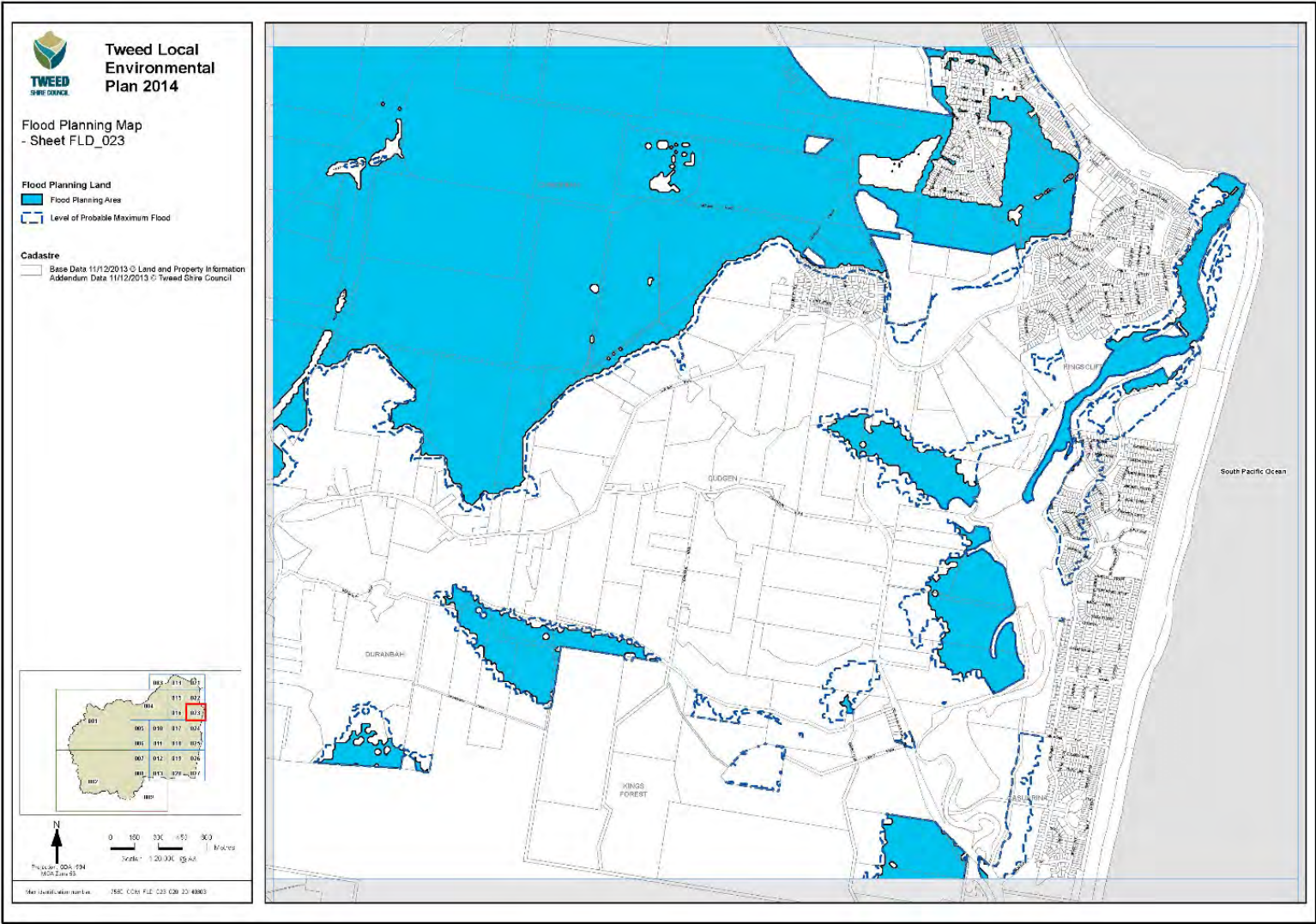
State Planning Directions for Local Government, Flood Prone Land

- (8) For the purposes of a planning proposal, a relevant planning authority must not determine a flood planning level that is inconsistent with the Floodplain Development Manual 2005 (including the *Guideline on Development Controls on Low Flood Risk Areas*) unless a relevant planning authority provides adequate justification for the proposed departure from that Manual to the satisfaction of the Director-General (or an officer of the Department nominated by the Director-General).

Consistency

- (9) A planning proposal may be inconsistent with this direction only if the relevant planning authority can satisfy the Director-General (or an officer of the Department nominated by the Director-General), that:
- (h) the planning proposal is in accordance with a floodplain risk management plan prepared in accordance with the principles and guidelines of the Floodplain Development Manual 2005, or
 - (i) the provisions of the planning proposal that are inconsistent are of minor significance.

Note: “flood planning area”, “flood planning level”, “flood prone land” and “floodway area” have the same meaning as in the *Floodplain Development Manual 2005*.





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