NORTHROP


CIVIL AND STRUCTURAL CONCEPT DESIGN REPORT

# Waverley Council Chambers

**PREPARED FOR**
Lahznimmo Architects

Ref: SY203446-SR01
Rev: 3
Date: 28 February 2022

# Structural Report

## Revision Schedule

| Date | Revision | Issue | Prepared By | Approved By |
|---|---|---|---|---|
| 09.07.21 | 1 | Preliminary Issue | Rod Pratt and Brendan Stokes | Rod Pratt |
| 12.10.21 | 2 | REF Community Consultation | Rod Pratt and Brendan Stokes | Rod Pratt |
| 28.02.22 | 3 | Ground and L3 structural sketches in Appendix A updated | Rod Pratt | Rod Pratt |

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# Executive Summary

Northrop Consulting Engineers (Northrop) have been engaged by Lahznimmo Architects to provide civil and structural engineering services for the proposed alterations and additions to the Waverley Council Chambers.

The purpose of this report is to provide a summary of the works undertaken to date and provision of a high level concept design to progress the design both from an architectural and services coordination perspective.

We have visited the site on numerous occasions now and have a reasonable grasp of the building structure and site surrounds. We have not undertaken destructive investigation works and we have only been provided with a small number of historical structural documents for an extension at Level 3.

Following this report we plan to progress the design with Lahznimmo and the rest of the design team.

We remain available to provide additional civil and structural advice as required.

Yours faithfully,

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# 1. Introduction

Northrop Consulting Engineers (Northrop) have been engaged by Lahznimmo Architects to provide structural engineering services for the proposed alterations and additions to the Waverley Council Chambers.

This report has been prepared in support of the proposed development at the above location.

The purpose of this report is to provide a summary of the works undertaken to date and provision of a high level concept design to progress the design both from an architectural and services coordination perspective.

## 1.1 Site Location

The development site is located on the corner of Bondi Road and Paul Street Bondi Junction, and is within the City of Sydney Local Government Area. The building is situated at the top of the rise and adjoins Waverley Gardens to the east and south.

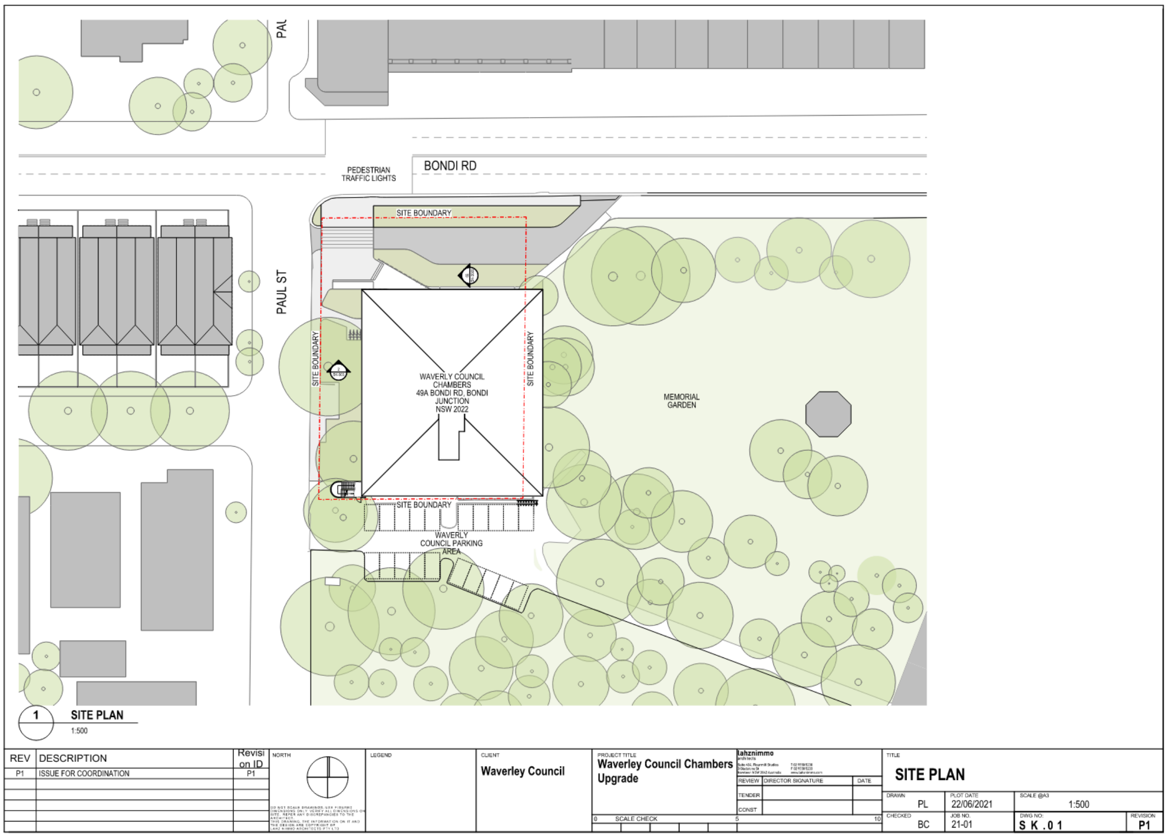



Figure 1. Site Plan prepared by Lahznimmo Architects

For this report, North is up the page in accordance with the Figure above.

## 1.2 Site Investigations

Rodney Pratt of Northrop Engineers attended site on 26 February 2021 and Bradley Whiting of Northrop Engineers attended site on 9 March and 20 March 2021.

The purpose of these inspections was to ascertain the observable structural components of the building with a view to forming an opinion on the existing building structure and associated opportunities and constraints.

These site inspections have formed the basis of our current concept design, which is significantly influenced by the proposal to remove the older portions of the building whilst retaining the more recent additions to the building.

## 1.3 Proposed Development

The proposed development is the full refurbishment of the existing building, with the intent being to open up floor plates and provide a regular level across all floor plates. This will be achieved by substantial alterations to the internal building structure, including the extraction of the original brick masonry building.

There is significant works proposed to the front façade of the building, which will involve the removal of the façade and extension of all floor plates, incorporating both a fire stair and lift shaft into the extended floor plates.

It is proposed to provide a structural steel roof across the existing concrete roof for the full building extent.

# 2. Structural Concept Design

## 2.1 Existing Building Structure

### 2.1.1 General Description

The existing Waverley Council Chambers is a four-storey building that has a rich evolution of the building structure.

The below figure shows indicatively the additions that have been made to the original brick masonry building (shown in pink) that have enveloped the building and have created the current building form.


There are a number of different floor levels across most floor plates that represent different additions to the building.

The ad-hoc nature of the evolution of the building presents a number of challenges from a structural perspective in meeting the client brief.

The following provides a commentary on various structural components of the building.

### 2.1.2 Building Stability

We do not consider that there is any formal lateral stability system to the current building.

Our current concept designs have been progressed taking lateral stability of the structure into account and propose a number of shear walls and cores that will provide the building with a formal lateral stability system.

### 2.1.3 Foundations

Foundations are anticipated to be  pad footings founded in stiff clays. We don’t anticipate that footings are deep piles (though this is possible) as the original footings would have been high-level footings.

Our approach to footings will be to maintain high level footings so as not to bear the building on differing substrates and exacerbate the issues relating to differential movement.

### 2.1.4 Vertical Load Bearing Elements

The original building comprises brick masonry load bearing walls. Further additions to the building comprise concrete columns, concrete and masonry brick/block walls. The main core elements to the centre of the building appear to be brick masonry, although precast concrete panels have also been utilised for the lift overrun and services room at the rooftop levels.

### 2.1.5 Floor Plates

Floor plates are typically suspended concrete slabs, though portions of the ground floor within the original building are timber framed bearers and joists on nominal brick pier footings.

The only structural drawings that we have indicate s Bondek slab at Level 3 which is supported on structural steel framing.

### 2.1.6 Roof Structure

The current roof structure comprises suspended concrete slabs with exposed coffers, upstand beams and flying beams.

The roof has recently been waterproofed but we noted the presence of significant ponding in parts of the roof during our site investigations.

## 2.2 Proposed Building Works

In our review of the existing building and the desire to open up the floor plates, we consider that the greatest challenge is the presence of an ad-hoc building structure and the requirement then to install significant transfer beams and columns in order to remove existing load bearing walls.

This was generally but not exclusively confined to the original building area of the building.

In collaboration with Lahznimmo Architects we have developed a proposal by which the original building was removed from the existing structure and a new grid of columns installed which would provide support to Level 3 and above. The new floors could then be installed in a manner that was sympathetic to a regular column grid layout whilst avoiding the need for significant transfer structures down through the building.

In developing the conceptual design we have put together the following draft construction methodology. This will assist in the ongoing design coordination and preliminary pricing of the refurbishment/alterations.

Per our site investigations, we have focused on two areas as follows:

1. **Retrofitting concrete shear walls inside existing building for Lateral Stability**

No formal stability system has been identified during our site investigations. It is proposed to remove a significant number of the existing load bearing walls which will further reduce the capacity of the existing building to resist lateral loads including earthquake loads.

We propose the following methodology, which is also shown diagrammatically in Sketch SK05 in Appendix A:

1. Remove existing timber flooring and framing on ground floor to access foundations.
2. Widen/strengthen existing footings to support new shear walls.
3. Construct a concrete wall up to the underside of level 1 using a proprietary formwork system. Install large diameter reinforcement bars through existing level 1 slab and lap with wall reinforcement above and below level 1. Allow to install grout to the top 50mm of wall.
4. Repeat set 3 for the remainder of floors.

**2. Removal and replacement of pre-1984 structure**

The building has been constructed in a piecemeal fashion. Removing load bearing walls will necessitate the installation of large transfer beams.

It is proposed to remove a significant portion of these load bearing walls which will be difficult to transfer at each floor using a regular grid of columns. We propose to install new column layout to support a new transfer system on Level 3 (Level 3 also supports Level 4), demolish the existing floors below and install a new infill slab to each level.

We note that it is unlikely that existing foundations can be re-utilised.

We propose the following methodology, which is also shown diagrammatically in Sketch SK05 in Appendix A:

1. Remove existing timber flooring and framing on ground floor.
2. Install new foundations (details pending geotechnical investigation)
3. Install new concrete columns to underside of existing transfer beams on level 1. Locate columns directly under existing columns currently being transferred above.
4. Install new concrete columns up to the underside of the existing level 3 structure. This will require penetrations to be created in the existing level 1 and 2 concrete floor slabs. Temporary propping of existing floors will be required in locations to facilitate the construction of penetrations. Install ferules in the concrete columns at each floor for future connection.
5. Install temporary propping from ground to the underside of existing level 3 structure to support portions of level 3.
6. Trim or remove existing structural steel beams supporting level 3 as per SK09.
7. Install new structural steel transfer beams to underside of level 3. Connect into existing structural steel beams and provide fire protection. Allow for site welding.
8. Allow to remove portions of level 3 and roof.
9. Allow to install new structural steel transfer beams around the perimeter of the original building to facilitate the removal of load bearing walls. This may need temporary propping in areas.
10. Remove temporary propping.
11. Demolish level 2 and level 1 to the extent of the pre-1984 structure.
12. Construct new reinforced concrete slabs to ground floor, level 1 and level 2. Tie new slabs into existing slabs the new concrete column grid.

Points 11 and 12 have been indicatively designed on sketch SK10 and SK11 in Appendix A.

We note that there are significant unknowns in the existing building and as such, the design will necessitate a level of destructive investigatory works as well as a construction contingency to take into account latent conditions that are uncovered during the opening up of the structure.

# 3. Civil Concept Design

## 3.1 Stormwater Management Strategy

The purpose of this section of the report is undertake the following activities in determining an appropriate, site specific stormwater management strategy:

- reviewed the relevant sections of the DCP and accompanying flood information.
- preliminary assessment of existing and proposed site; and

In demonstrating compliance with Section B6 Stormwater of WDCP2012, this proposed stormwater management strategy has considered the following, which will be discussed in this section of the concept design report:

- Stormwater Quality - Nutrient and Pollution Control.
- Onsite Detention.
- Flooding.
- Erosion and Sediment Control

## 3.2 Stormwater Quality - Nutrient and Pollution Control

In order to minimise and adverse impacts upon the ecology of downstream watercourses, stormwater treatment devices have been incorporated into the design of the development. The adopted stormwater quality reduction targets were as specified in Waverley Council's Water Management Technical Manual (July 2014), shown in Table 1 below.

**Table 1: Water Quality Reduction Targets**

| Pollutant Criteria | Required Reduction Target (%) |
|---|---|
| Total Suspended Solids (TSS) | 85% |
| Gross Pollutants (GP) | 90% |
| Total Phosphorus (TP) | 65% |
| Total Nitrogen (TN) | 45% |

The performance of the proposed stormwater quality management measures was assessed against these targets using the conceptual design software MUSIC (Version 6). The MUSIC model was developed using parameters recommended in the *NSW MUSIC Modelling Guidelines* (WBM, 2018). A schematic of the MUSIC model if provided in Figure 2 below.

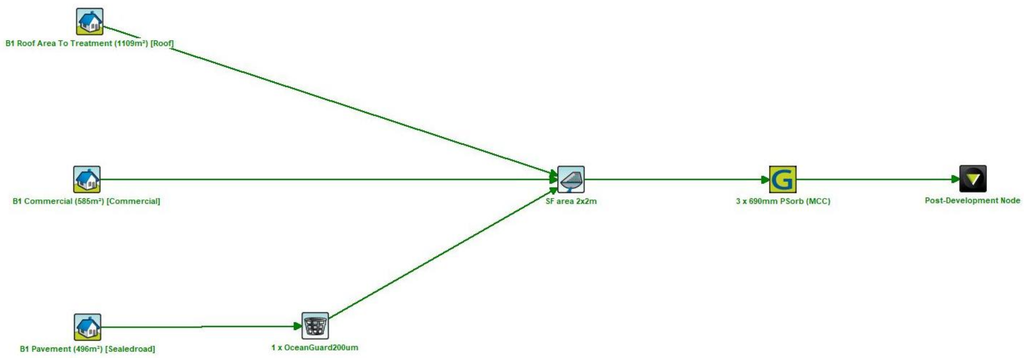



**Figure 2: MUSIC Model Schematic**

Multiple factors were considered in advising the most appropriate stormwater quality improvement devices (SQIDS). The proposed development footprint, usage and scale was determined to restrict treatment measures to more mechanical systems with no opportunity for more natural treatment methods. In addition to these practical constraint's maintenance, operability and aesthetics were considered.

The proposed treatment train incorporates the following measures:

- Primary treatment first flush devices; and
- Secondary treatment via proprietary Ocean Protect filter cartridges.

The following is a summary of the water quality treatment devices that have been utilised in the proposed treatment train. The modelling parameters can be found in the MUSIC Link report in Appendix B.

- Detention Storage – Overflow from the rainwater tank and flow from the stormwater drainage in landscaped areas are collected and directed into an underground detention tank. This also assist to collect gross pollutants and sediments.

- Ocean Protect filter cartridges – Proprietary filter cartridges will be provided within the detention tank that will allow for the treatment of runoff. The filters act to remove fine sediment, suspended solids as well as removing nutrients such as nitrogen and phosphorus before the runoff is discharged offsite.

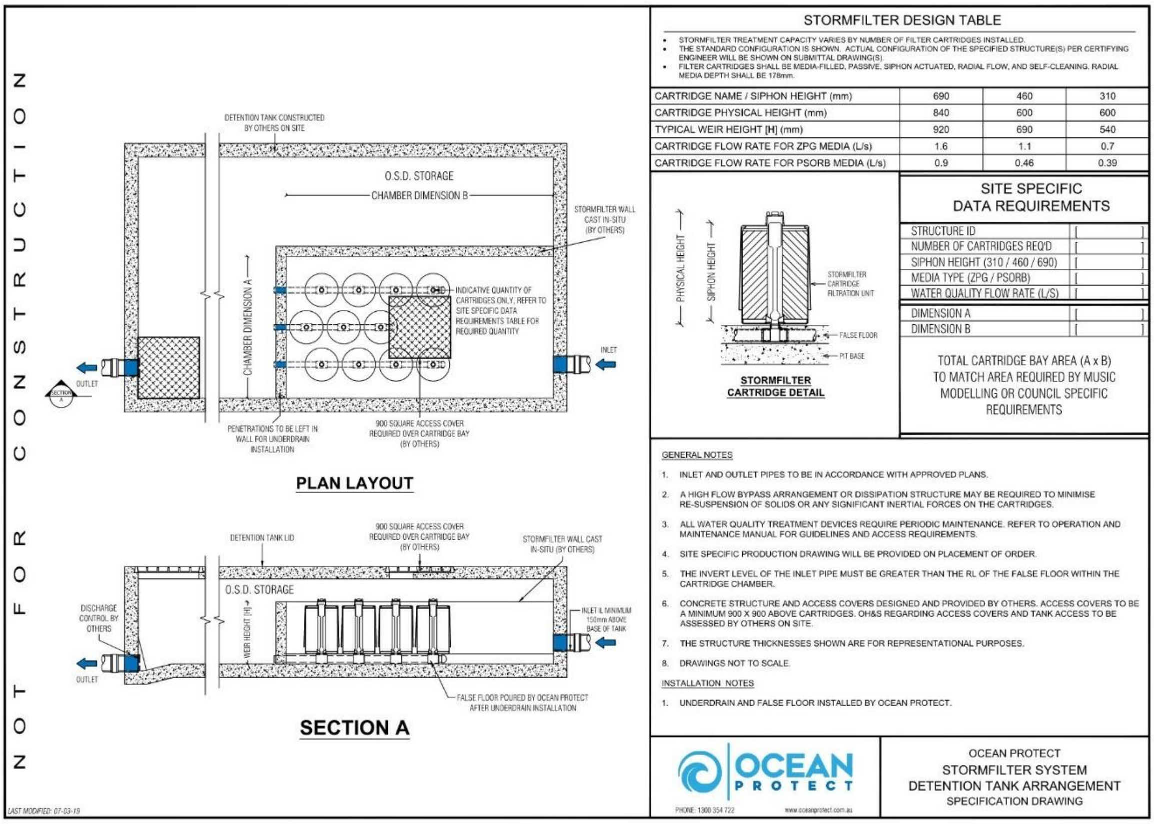



**Figure 4. Ocean Protect Stormfilter System, Detention Tank Arrangement**

Source nodes have been adopted from the *NSW MUSIC Modelling Guideline* (2018). Treatment nodes have been adopted from Ocean Protect.

The MUSIC modelling results for the abovementioned stormwater treatment strategy are in Table 1 below.

Table 1: MUSIC Modelling Results

| Pollutant Criteria | Reduction Target (%) | Sources (kg/yr) | Residual Load (kg/yr) | Achieved Reduction (%) |
|---|---|---|---|---|
| Total Suspended Solids (TSS) | 85 | 197 | 22.7 | 88.5 |
| Total Phosphorus (TP) | 65 | 0.458 | 0.129 | 71.9 |
| Total Nitrogen (TN) | 45 | 3.7 | 1.97 | 46.8 |
| Gross Pollutants (GP) | 90 | 40.8 | 0 | 100 |

Table 1 shows that the proposed stormwater quality management strategy will achieve the required load reduction targets.

### 3.3 On-Site Detention

In accordance with Part B6 of the Waverley Development Control Plan (WDCP2012) and Section 5 of the Water Management Technical Manual 2014 , all major developments are required to provide OSD devices if the increase in impervious area is greater than or equal to 30sqm.

The OSD system must be able to:

- store the runoff caused by a storm event up to the 1% AEP for that site.
- The Permissible Site Discharge (PSD) is limited to the maximum discharge from the site during a 1 in 5-year ARI for a 5minute storm event under the existing site conditions (pre-development)

Runoff from the pre-existing brownfield site and proposed development was modelled using the DRAINS software package, incorporating ARR2019 rainfall data and methodology. The proposed site was calculated to be 73% impervious compared to an impervious area of 64% in the pre-existing brownfield site. The assessment of the existing conditions for the brownfield site utilised the detailed survey completed by Geosuv, refer to Figure 5 below.

The ILSAX hydrological model in DRAINS was used to generate runoff hydrographs for the pre-existing brownfield and post-developed site. Data from the Bureau of Meteorology (BoM) was used to generate the design storms. Runoff parameters were selected to replicate the site conditions that will be present in the post-developed scenario and that which occurred in the pre-existing brownfield scenario. A summary of parameters used for the model are in Table 2 below, these were sourced from Table 5-2 within the adopted Waverley LGA Flood Study (Jan 2021)

Table 2: DRAINS model parameters

| Parameter | Value |
|---|---|
| Impervious depression storage | 1 mm |
| Pervious depression storage | 20 mm |
| Time of concentration (pre) | 5 min |
| Time of concentration (post) | 5 min |
| AMC | 1 |
| Soil type | 1 |

Storm durations ranging from 5 minutes to 360 minutes were investigated for each of the design storm events that were analysed for the catchment of 0.219Ha.

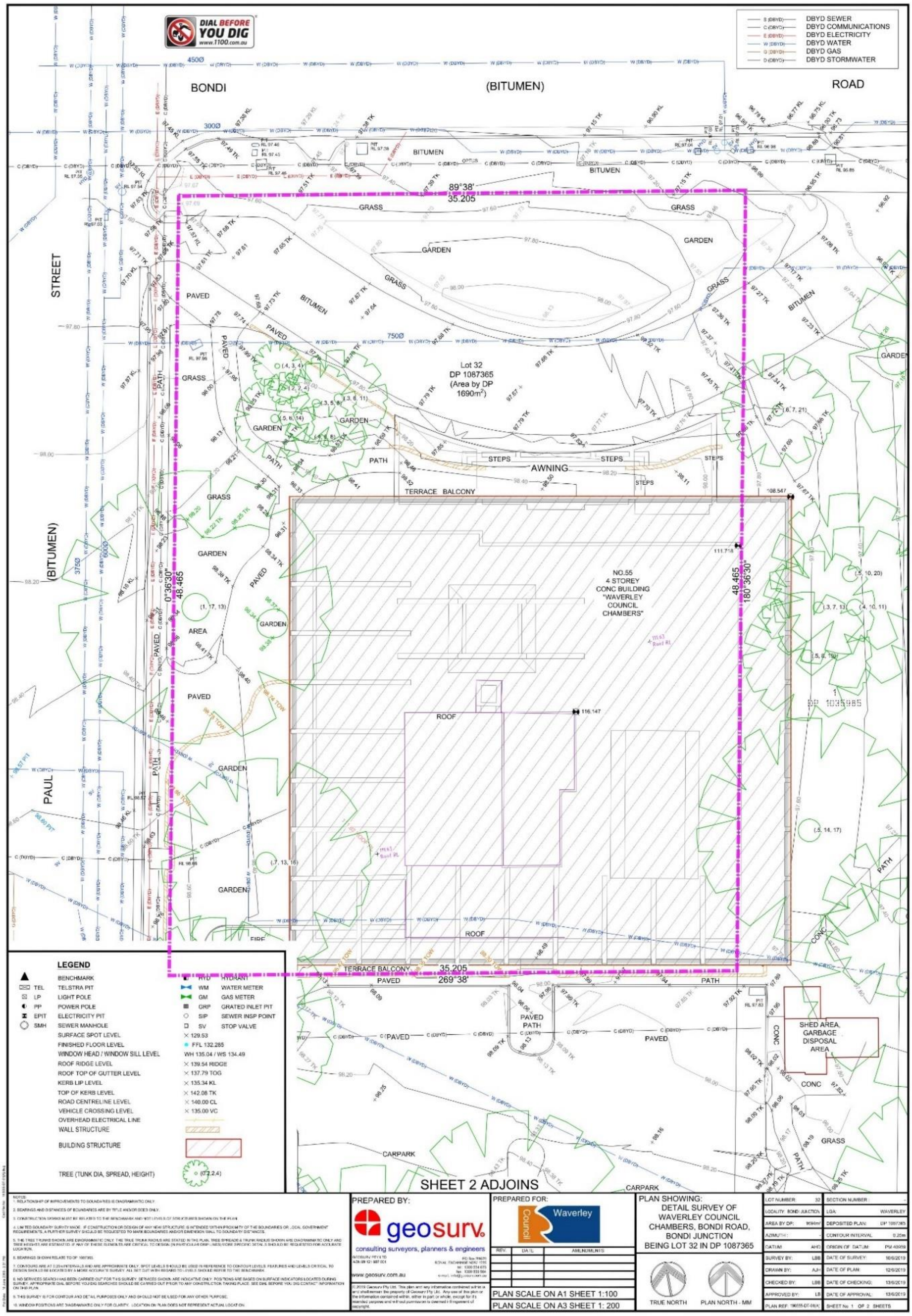



**Figure 5. Contour & Detailed Survey prepared by Geosurv**

It is proposed that OSD will be provided via an underground tank with a volume of 42m$^3$ dedicated storage. A comparison between the pre-existing and post-developed scenario runoff for design storm events up to and including the 1% AEP are presented in Table 3 below.

**Table 3: DRAINS Peak Discharge Comparison**

| AEP | Pre-existing Peak discharge (L/s) | Post-developed Peak discharge (L/s) |
|---|---|---|
| 20% | 7.6 | 4.8 |
| 10% | 9.2 | 5.6 |
| 5% | 10.6 | 6.2 |
| 2% | 12.7 | 7.0 |
| 1% | 14.3 | 7.6 |

As shown above, the peak discharge for all design storms in the post-developed scenario have been detained to equal or less than that for the pre-existing brownfield site, confirming the proposed OSD facility will achieve the design intent. Refer to Figure 5 below shows the concept stormwater layout for the site including the OSD tank.

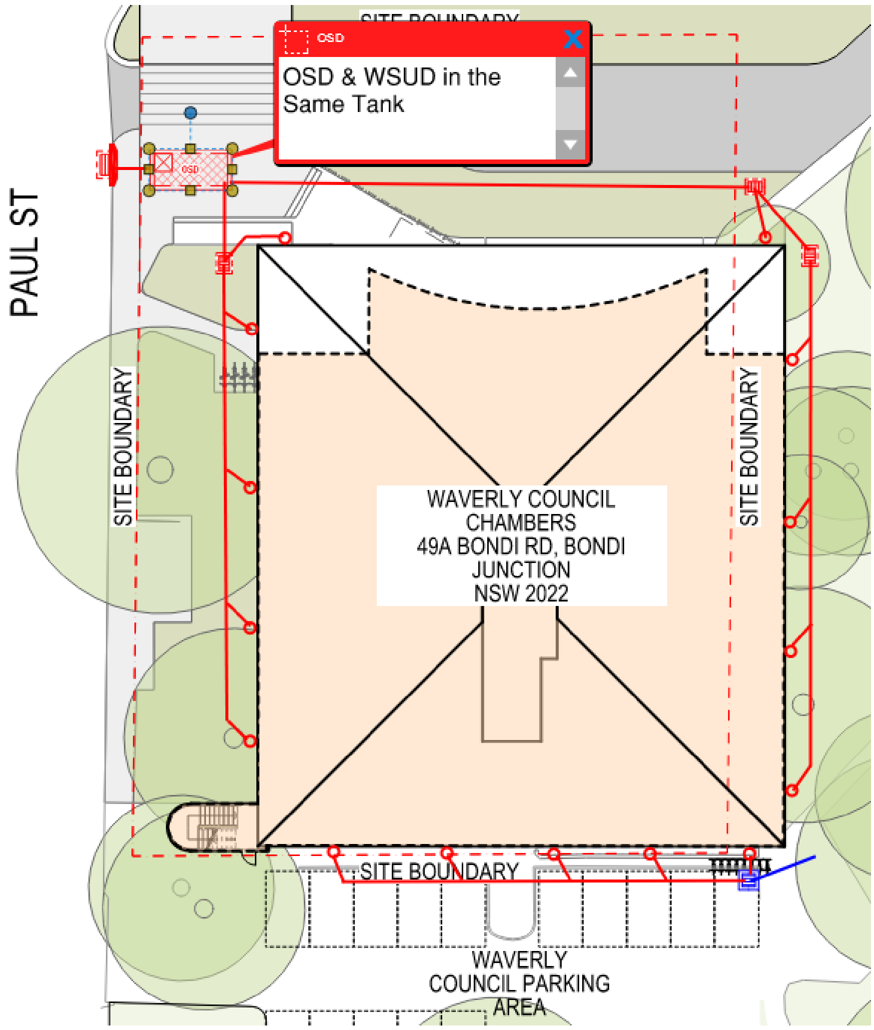



**Figure 6. Concept Stormwater Layout**

## 3.4 Flooding

Flood Hazard Mapping have been sourced from the adopted Waverley LGA Flood Study Final Report (January 2021) to provide flood level data and inundation mapping for the 1% AEP & PMF storm events in the immediate site surrounds (refer to Appendix B for this information). Upon review of this information, the following conclusions can be made: -

- The site is not considered to be flood affected.
- There is no applicable Flood Planning Level (FPL) for the determination of floor levels;

## 3.5 Erosion and Sediment Control

As the disturbed area for the proposed site is greater than 250sqm but less than 2500sqm an Erosion and Sediment Control Plan (ESCP) is required under Section 9.1.2 of the Water Management Technical Manual 2014.

Figure 7 below provides a concept Erosion and Sediment Control Plan for your information.

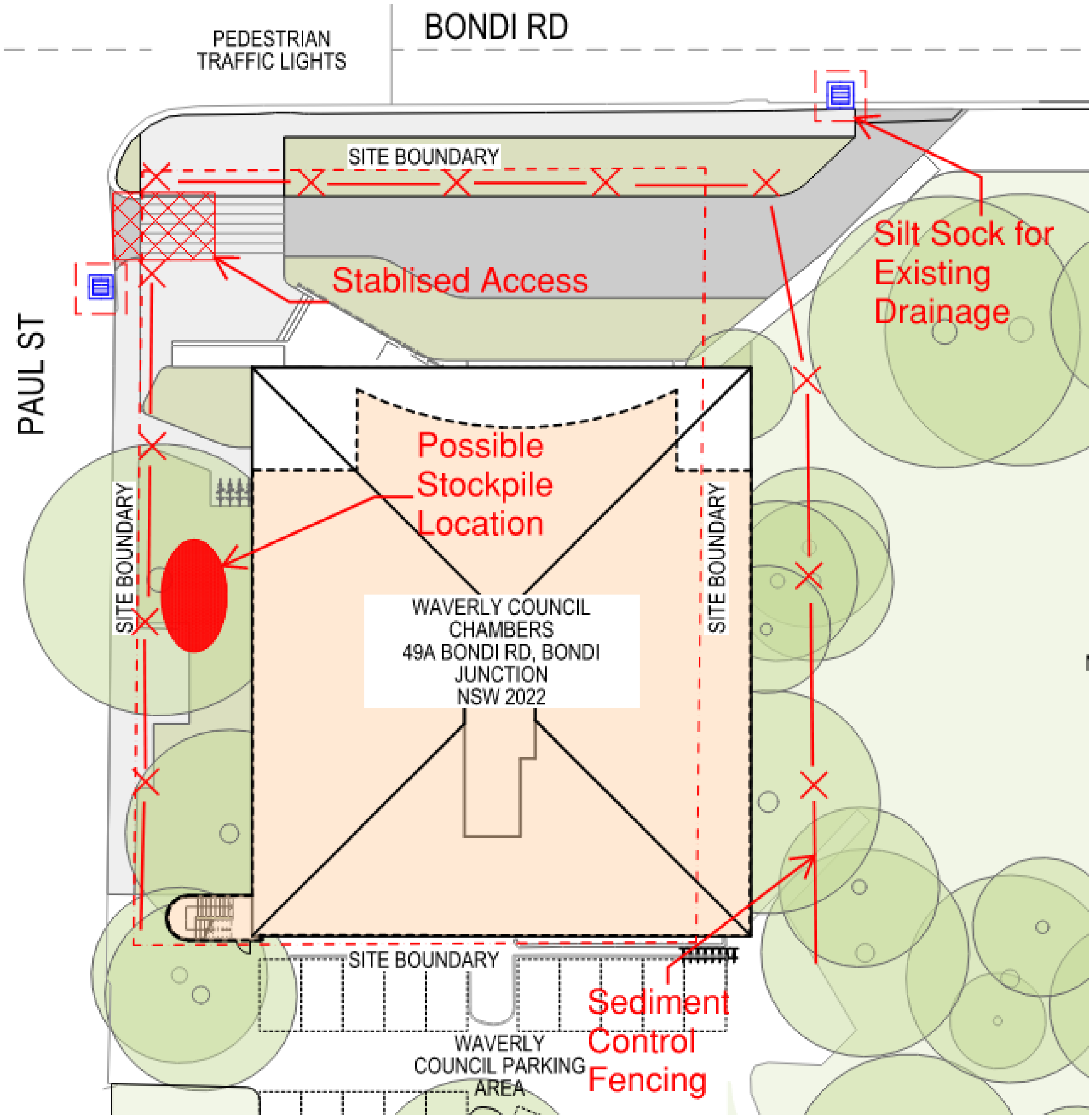


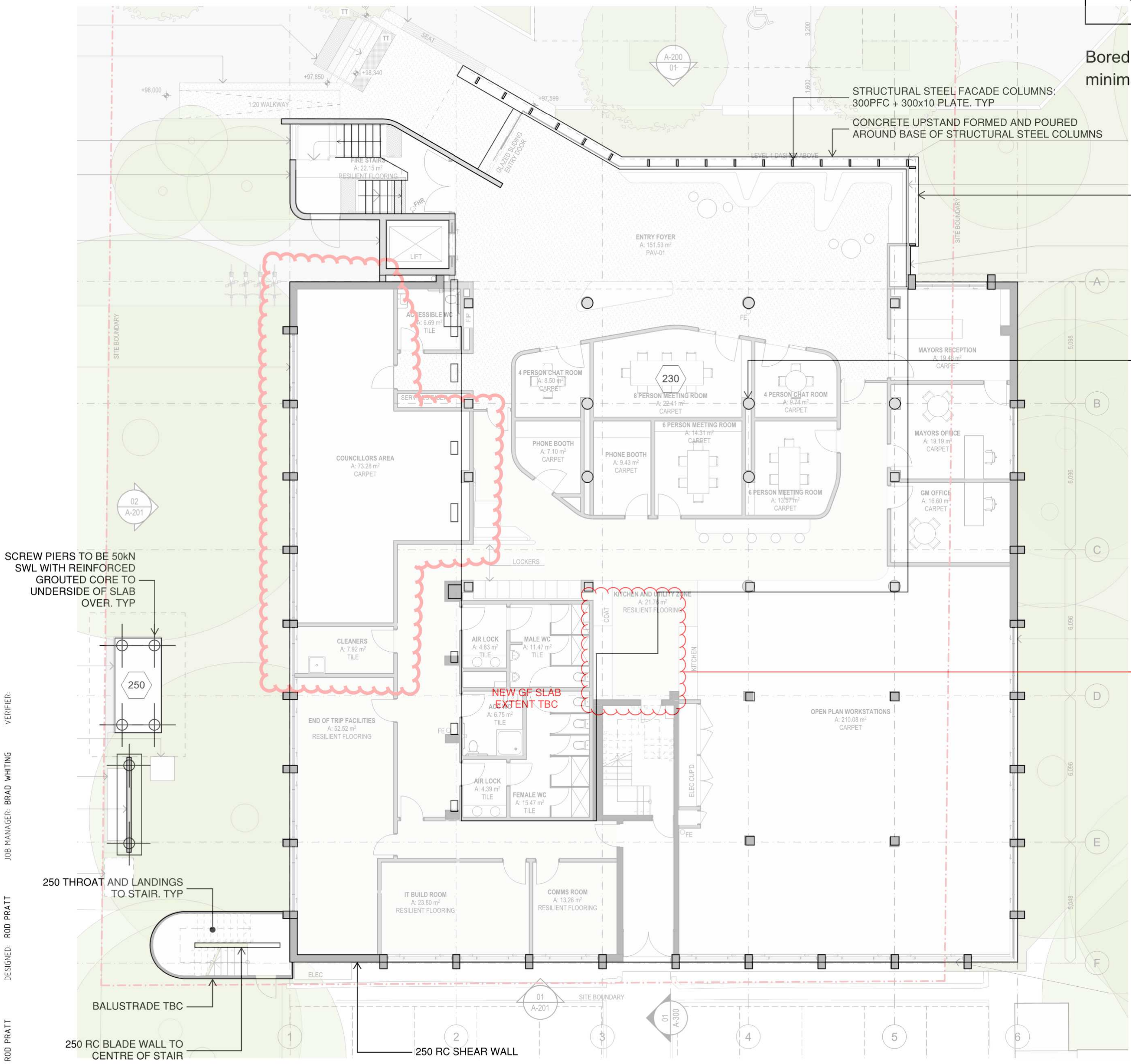

**Figure 7. Concept Erosion and Sediment Control Plan**

# Appendix A – Structural Sketches

**Table 2 - Geotechnical Design Parameters for Shallow Foundation**

| Description | Embedment Depth | Allowable Bearing Capacity | Elastic Modulus |
|---|---|---|---|
| | m | kPa | MPa |
| Highly weathered, very low strength sandstone | 0.5 | 800 | 100 |

Bored piers can be designed based on the parameters presented in Table 6. Piers should be socketed a minimum of 0.3m or one pier diameter into the underlying sandstone bedrock.

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PROJECT: WAVERLEY COUNCIL CHAMBERS

DRAWING TITLE: GROUND FLOOR PLAN

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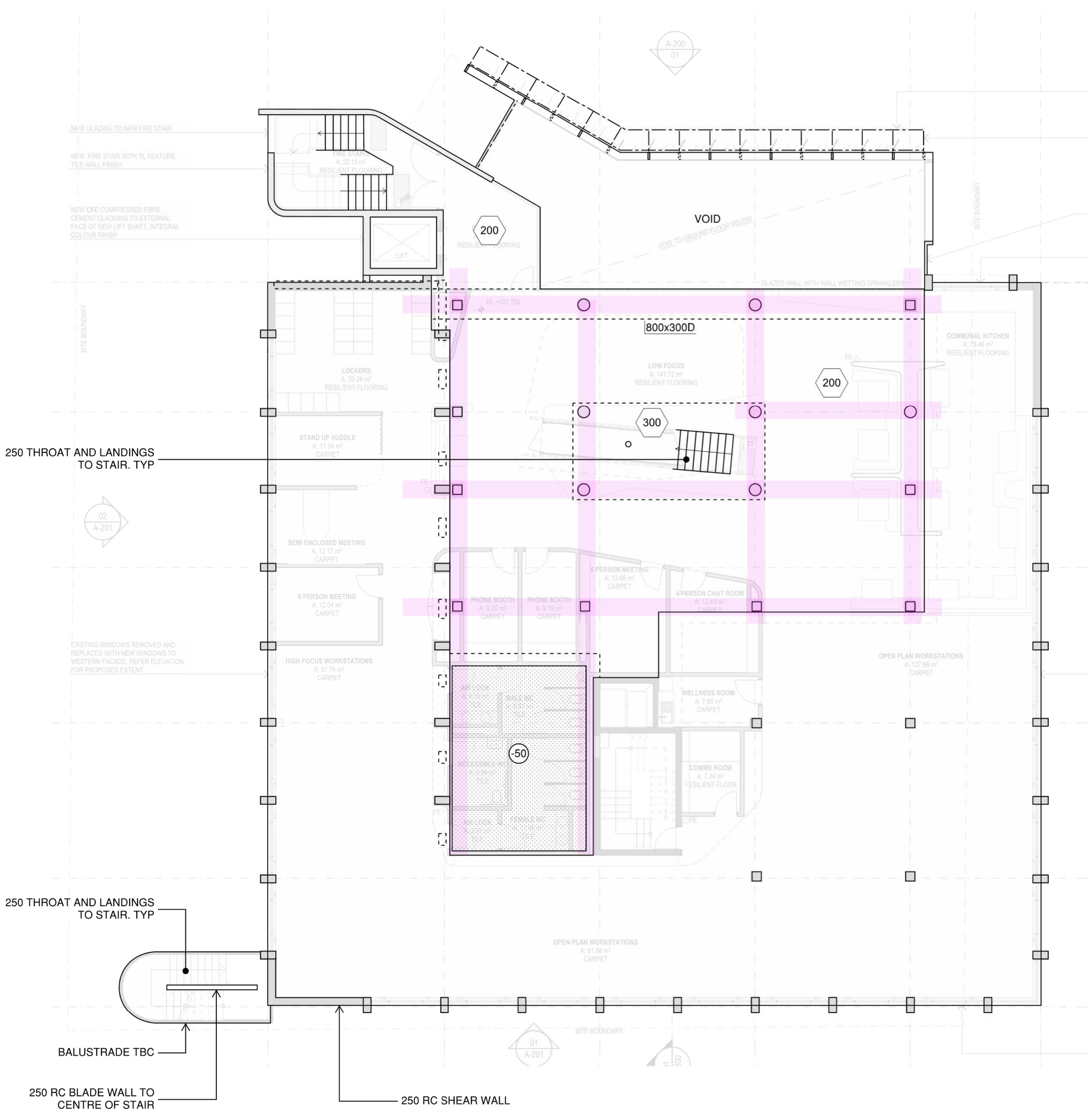


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LEVEL 1 PLAN

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203446

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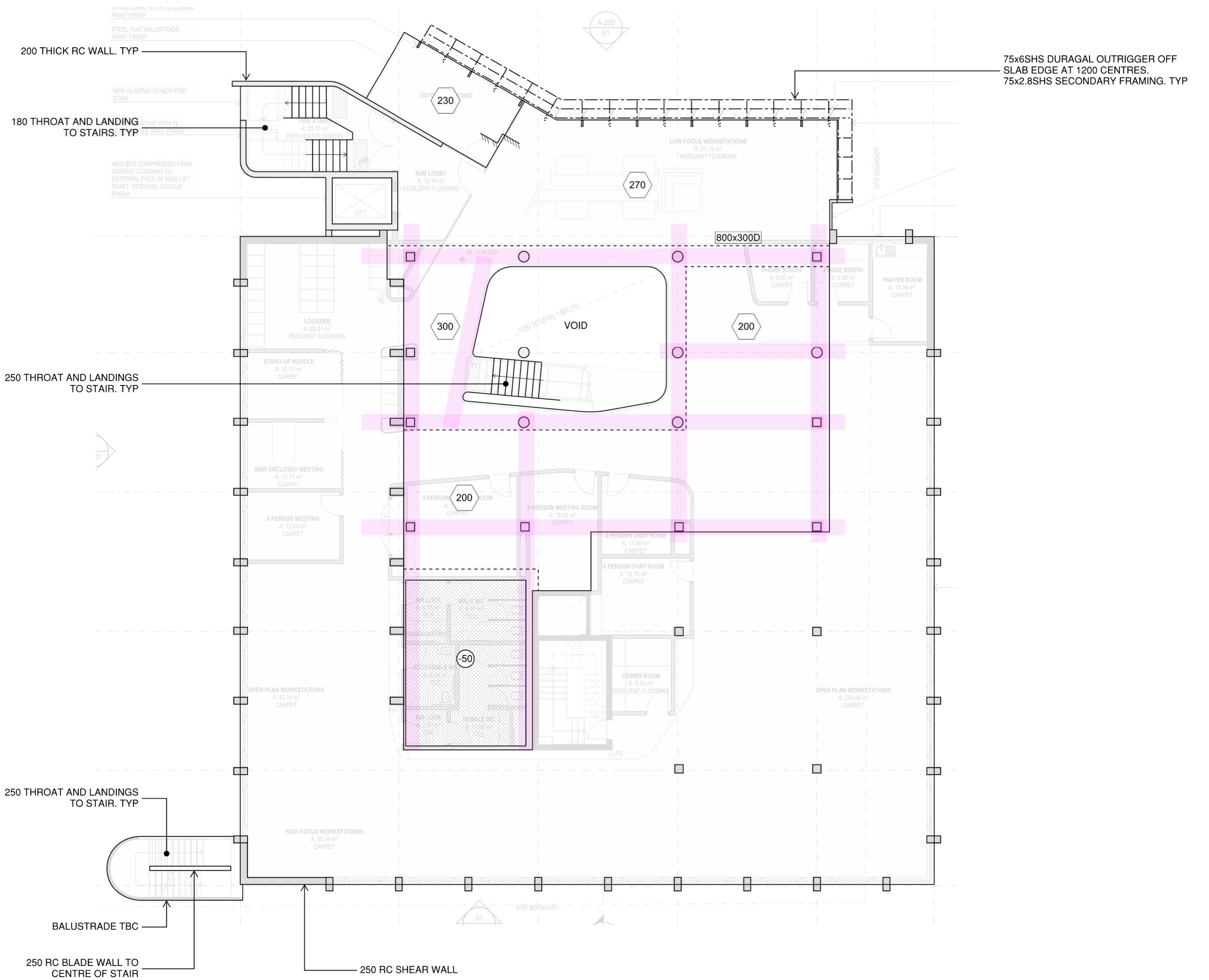


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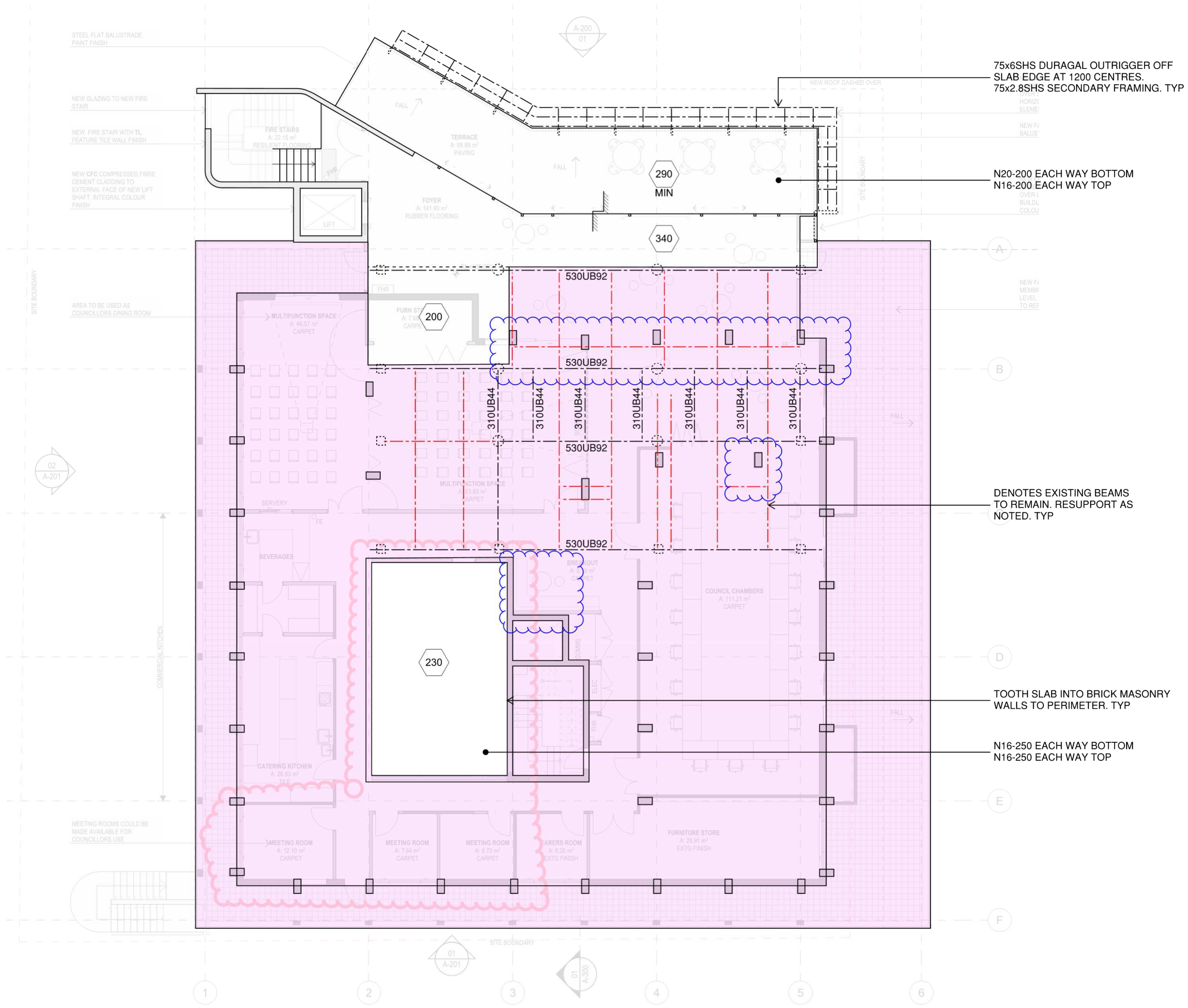


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DRAWING NUMBER
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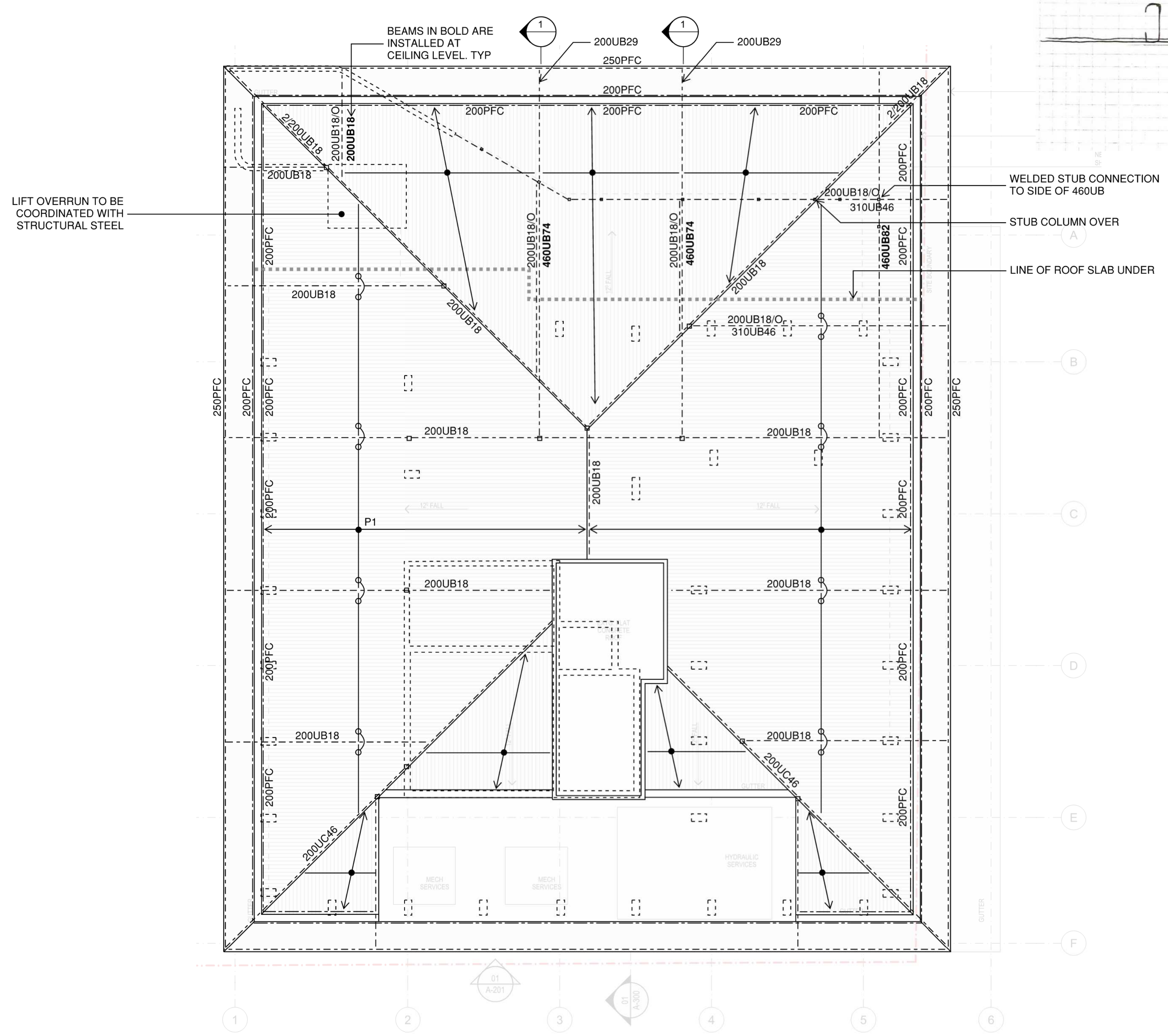


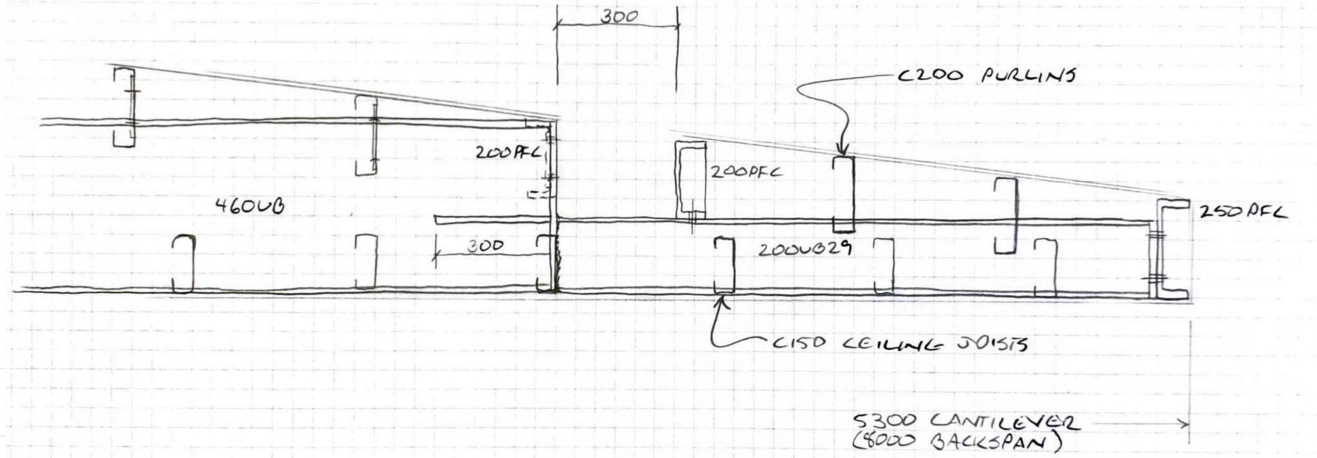


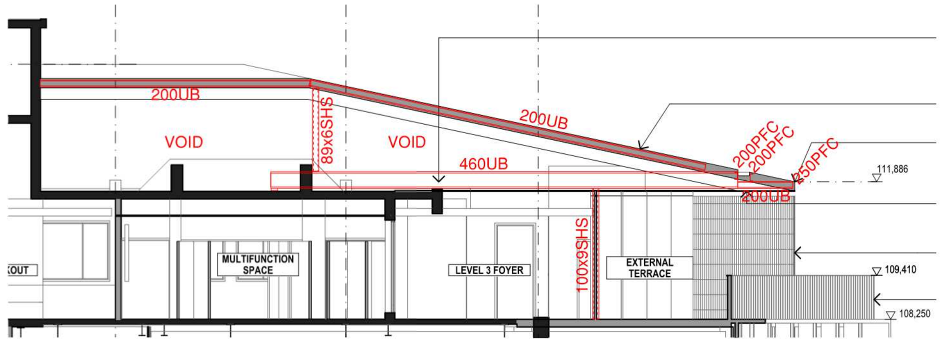


SECTION 1

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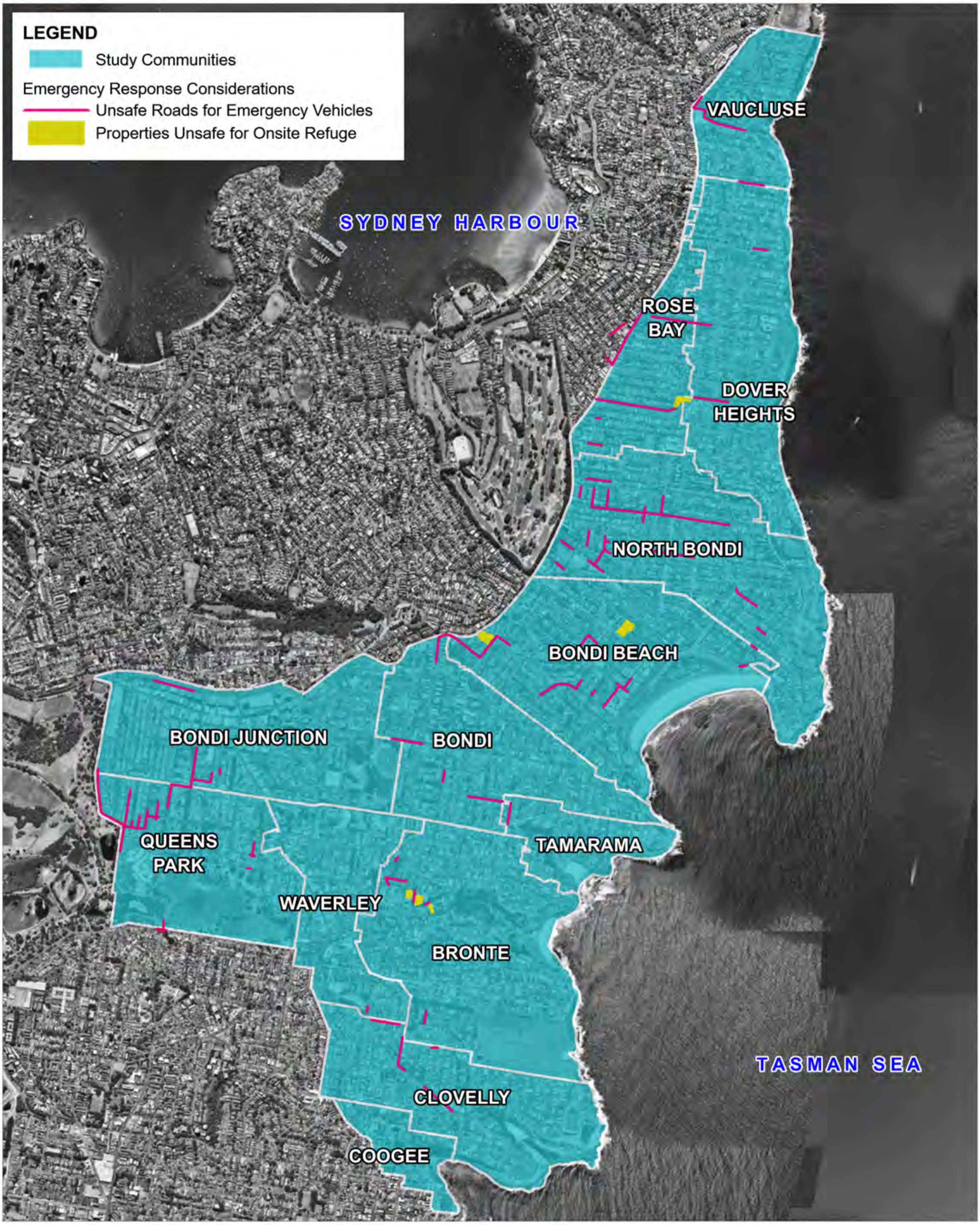
PROJECT
WAVERLEY COUNCIL CHAMBERS

DRAWING TITLE
ROOF FRAMING PLAN

JOB NUMBER 203446
DRAWING NUMBER SK17
REVISION 1
DRAWING SHEET SIZE = A1

# Appendix B – Flood Hazard Mapping




Title:
**Emergency Response Classification**
**1% AEP Event**

Figure: **X-X**

Rev: **-**

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N

0 0.5 1km
Approx. Scale

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Filepath: S:\WATER\PROJECTS\S20301_FS_Waverley_Council_Stormwater_Flood_Study\MI\Workspaces\Report_Figures\FigureX-X_ClassifcationofCommunities.wor


Title:

**Provisional Flood Hazard**
**5% AEP**

Figure: W-22_A

Rev: A

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N

0 250 500m
Approx. Scale

BMT
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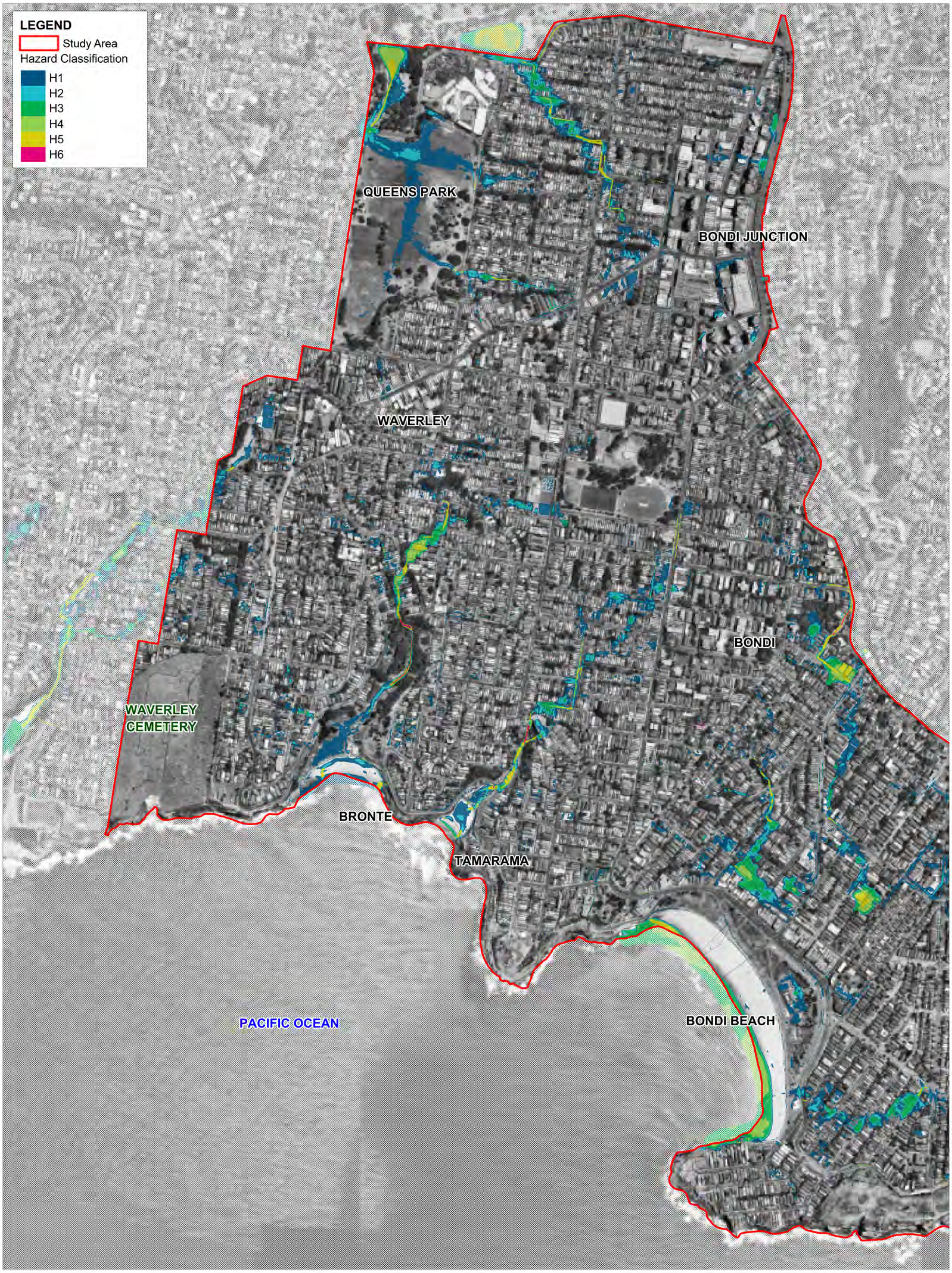


Title:

**Provisional Flood Hazard 5% AEP**

Figure: **W-22_B**

Rev: **A**

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N

0 250 500m

Approx. Scale

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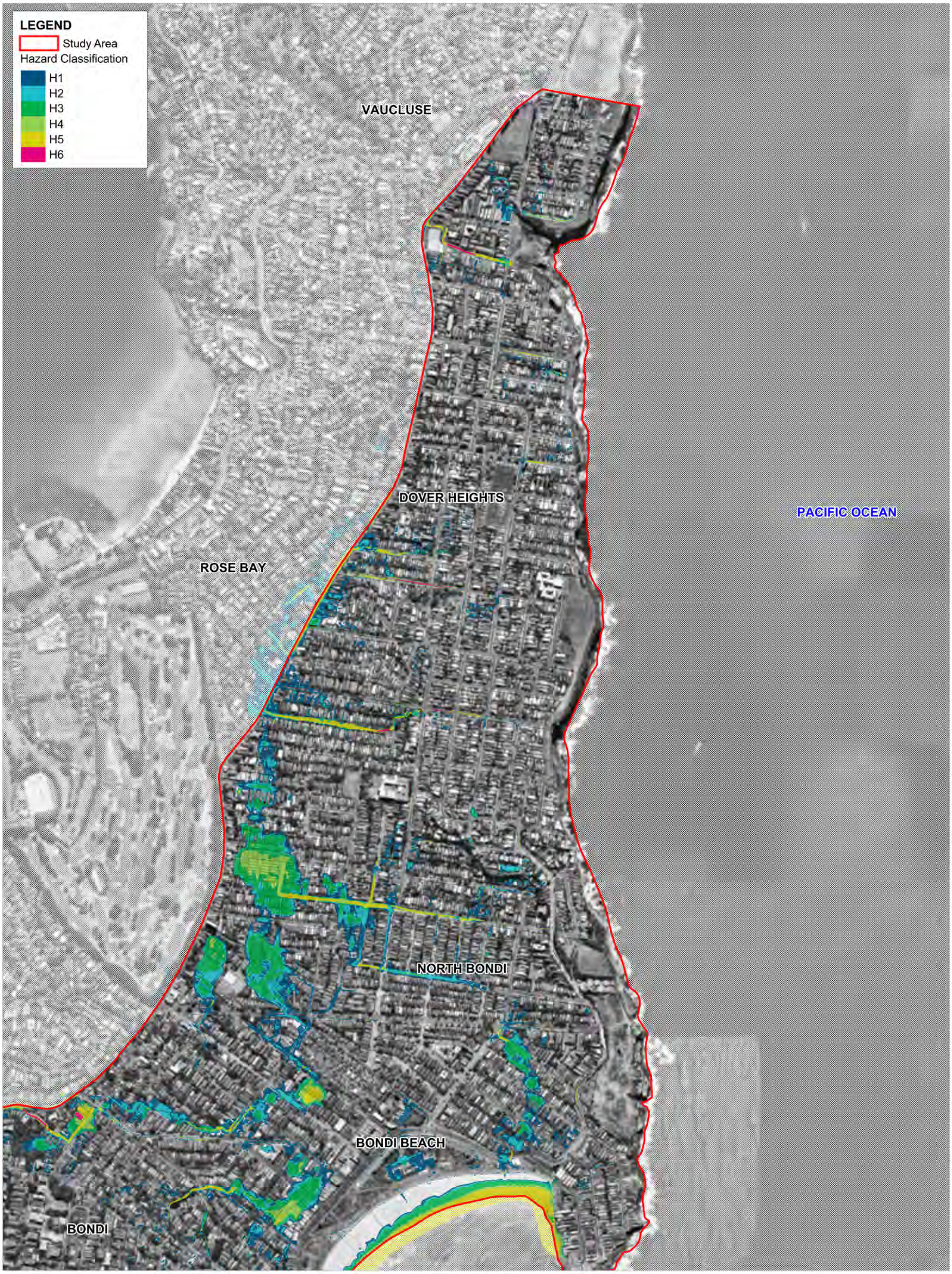


Title:

**Provisional Flood Hazard**
**1% AEP**

Figure: **W-23_A**

Rev: **A**

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N

0 250 500m
Approx. Scale

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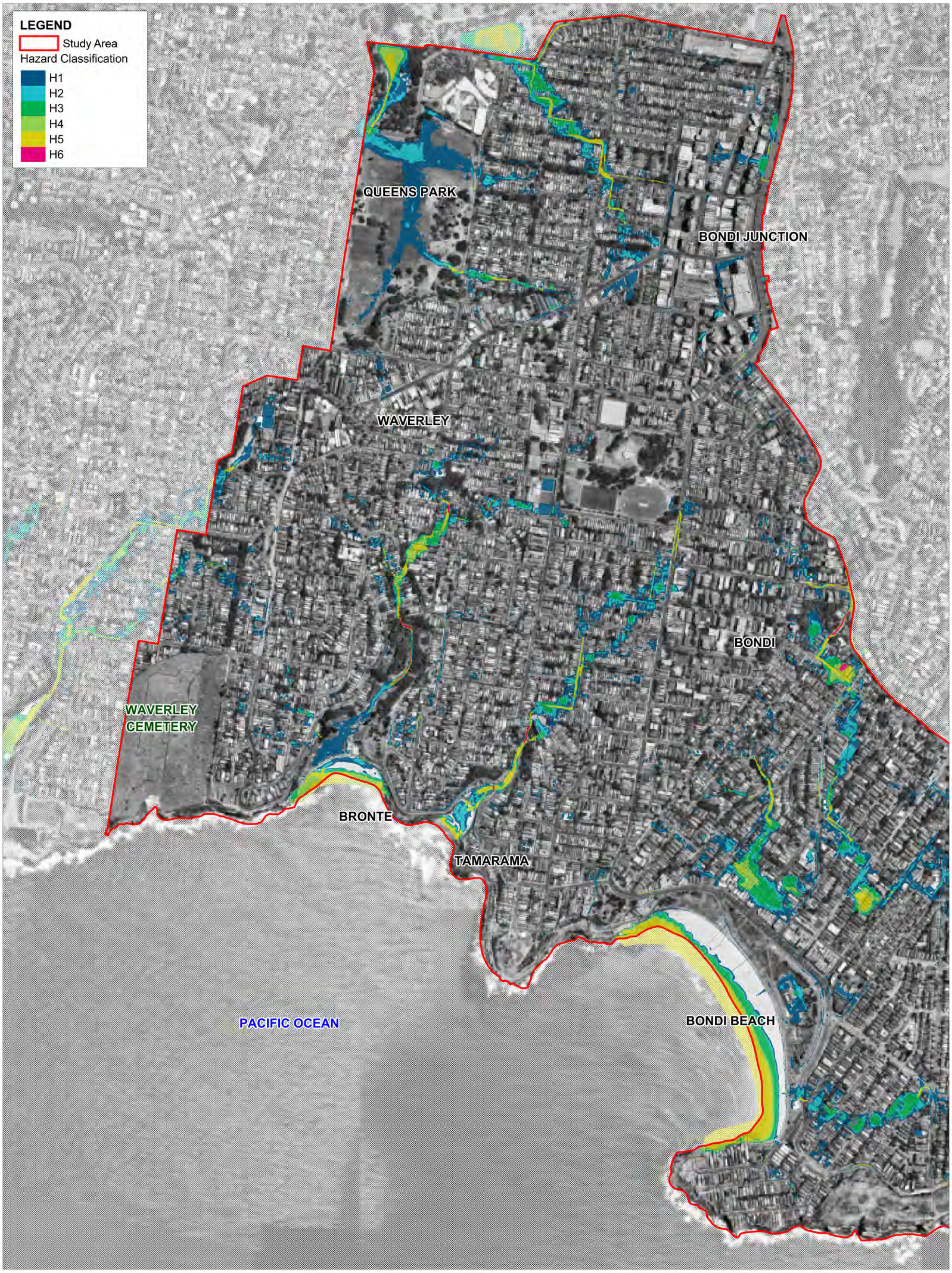


Title:
**Provisional Flood Hazard**
**1% AEP**

Figure: **W-23_B**

Rev: **A**



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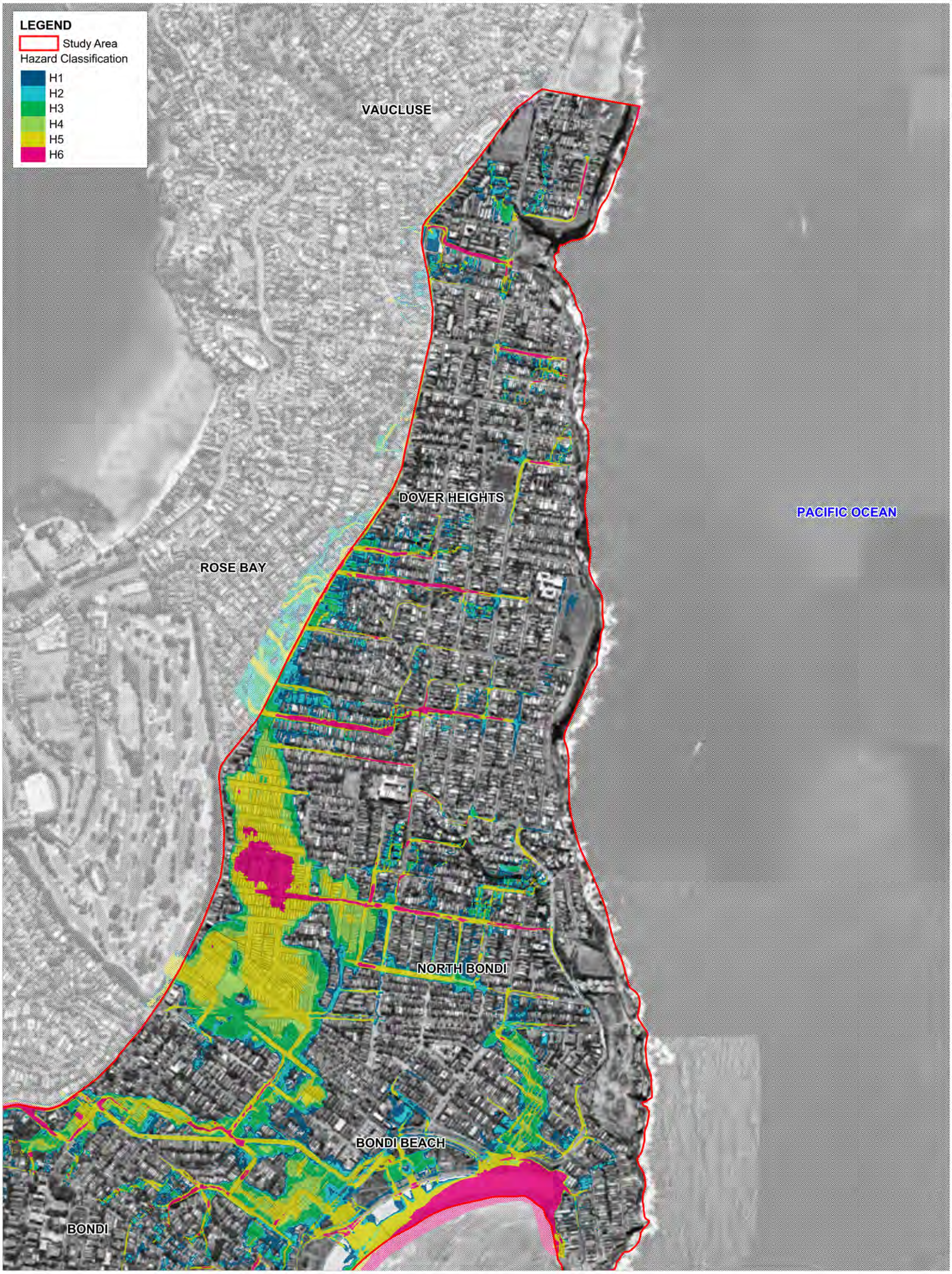


Title:

**Provisional Flood Hazard PMF**

Figure: **W-24_A**

Rev: **A**



N

0 250 500m
Approx. Scale

BMT
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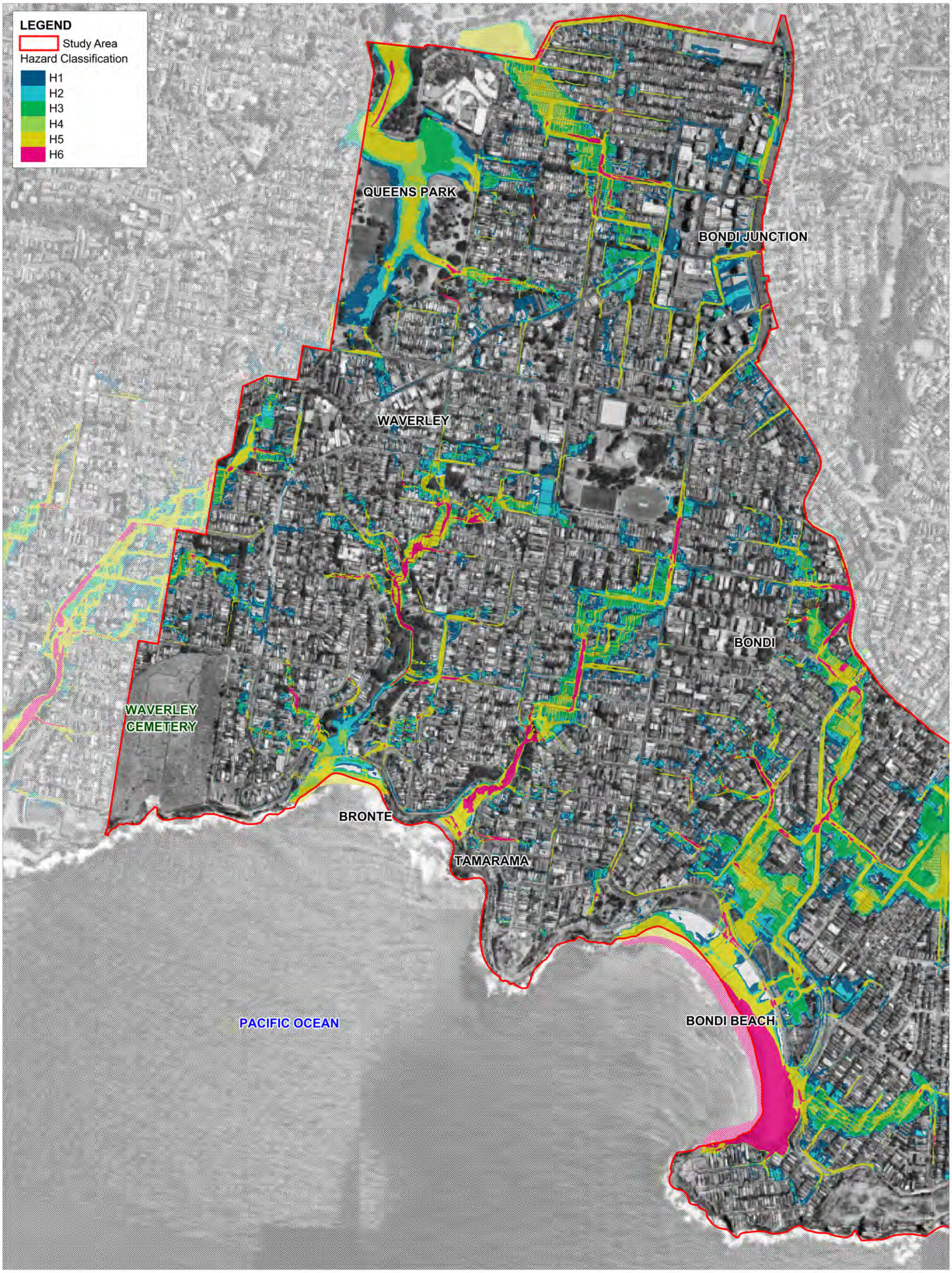


Title:
**Provisional Flood Hazard PMF**

Figure: W-24_B

Rev: A



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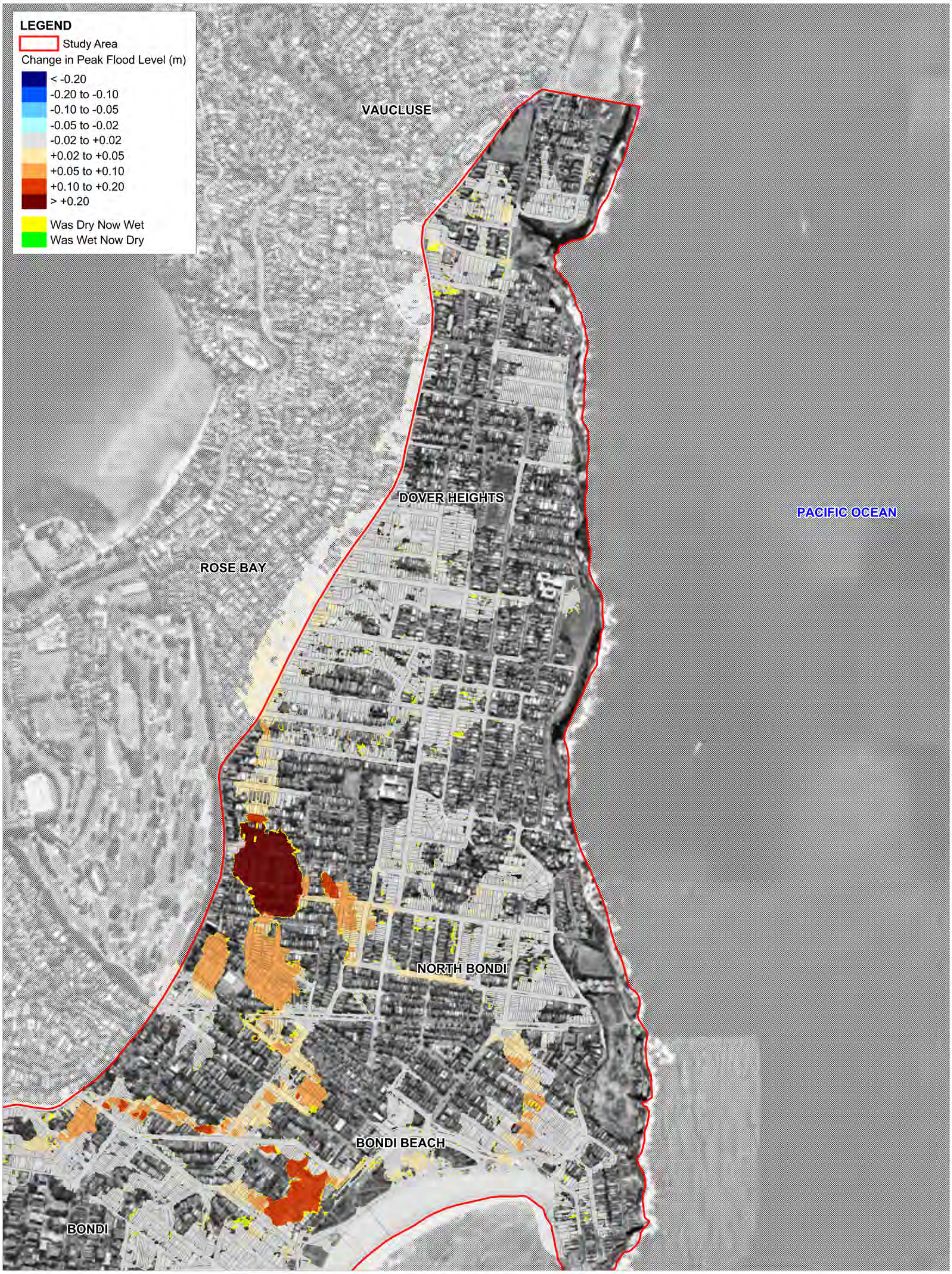


Title:

**Change in 1% AEP Peak Flood Level**
**10% Increase in Intensity Against Design Intensity**

Figure: **W-25_A**

Rev: **A**



N

0 250 500m

Approx. Scale

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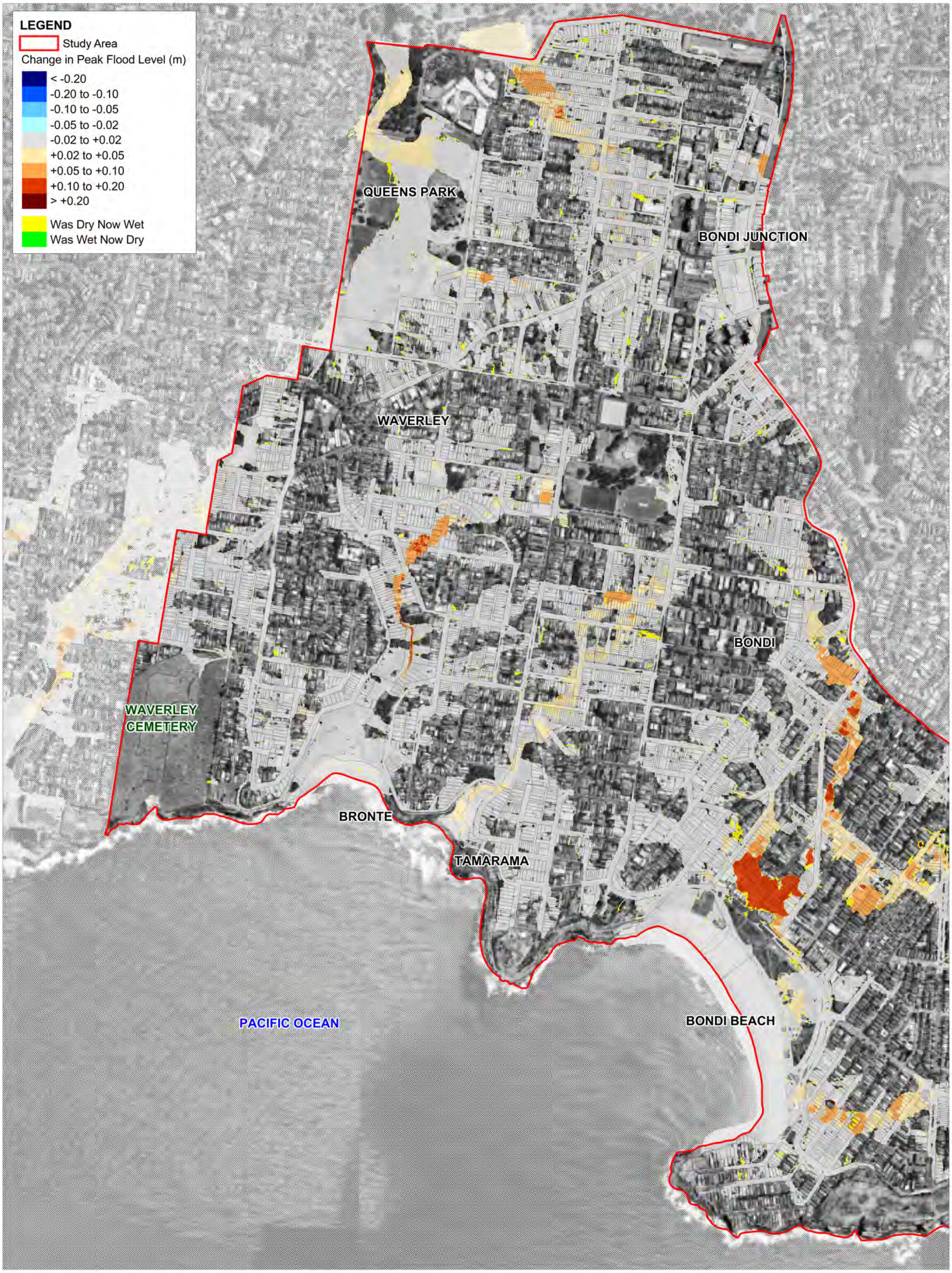
Filepath: S:\WATER\PROJECTS\S20301_FS_Waverley_Council_Stormwater_Flood_Study\MI\Workspaces\Report_Figures\Flood_Mapping_Compendium




Title:

**Change in 1% AEP Peak Flood Level**
**10% Increase in Intensity Against Design Intensity**

Figure: **W-25_B**

Rev: **A**

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N

0 250 500m
Approx. Scale

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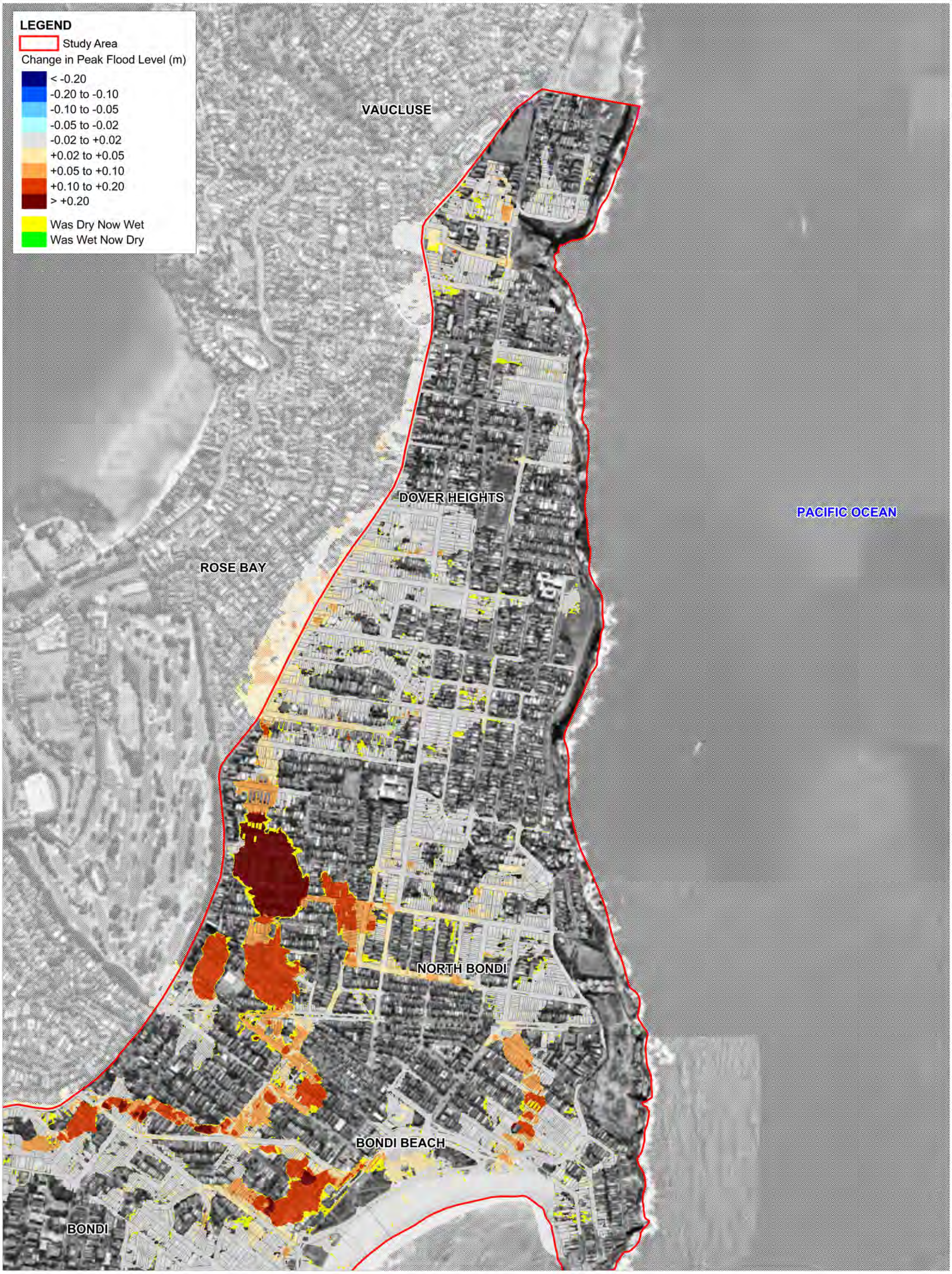


Title:

**Change in 1% AEP Peak Flood Level**
**20% Increase in Intensity Against Design Intensity**

Figure: **W-26_A**

Rev: **A**



N

0 250 500m
Approx. Scale

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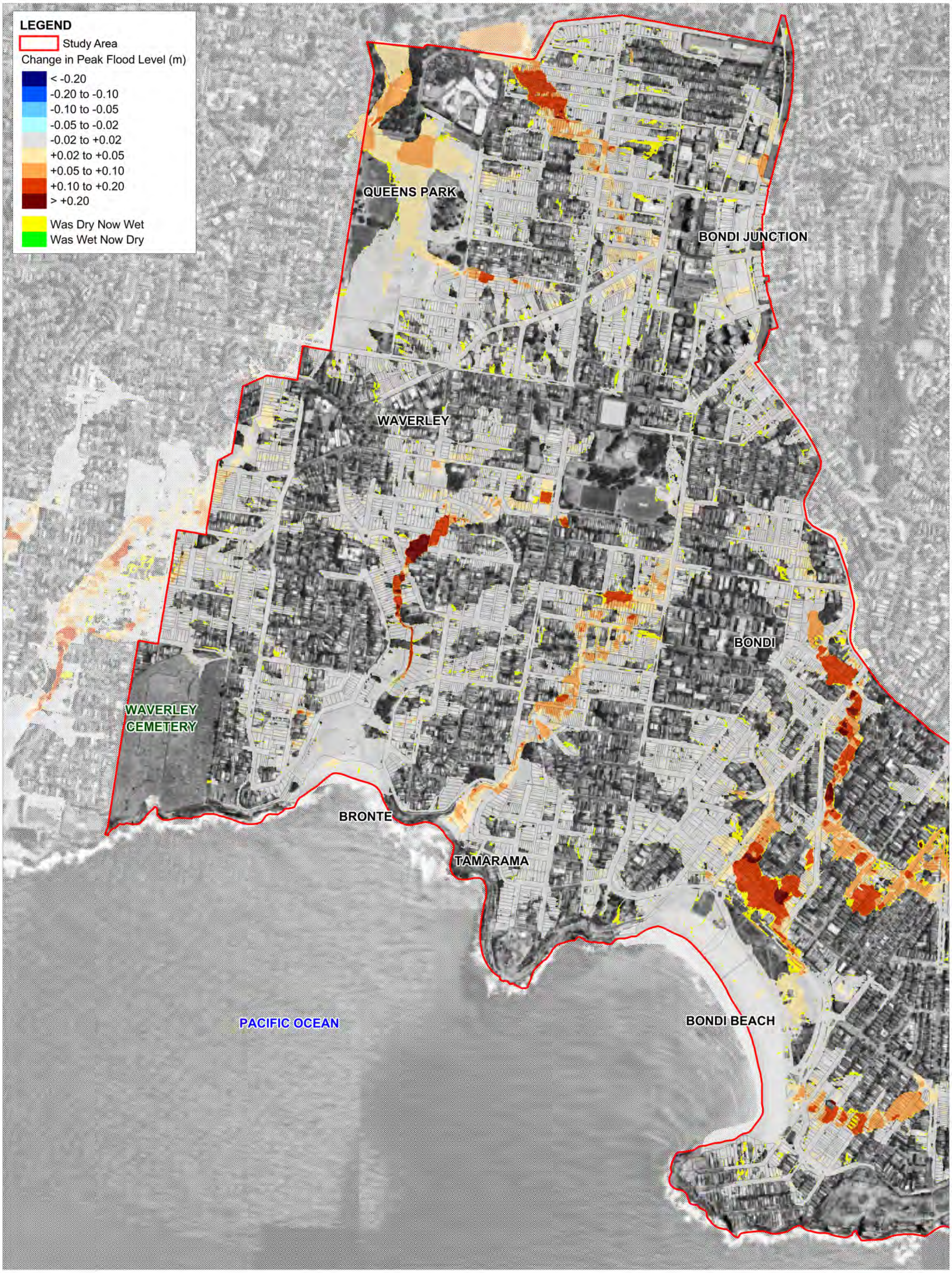


Title:

**Change in 1% AEP Peak Flood Level**
**20% Increase in Intensity Against Design Intensity**

Figure: **W-26_B**

Rev: **A**



N

0 250 500m
Approx. Scale

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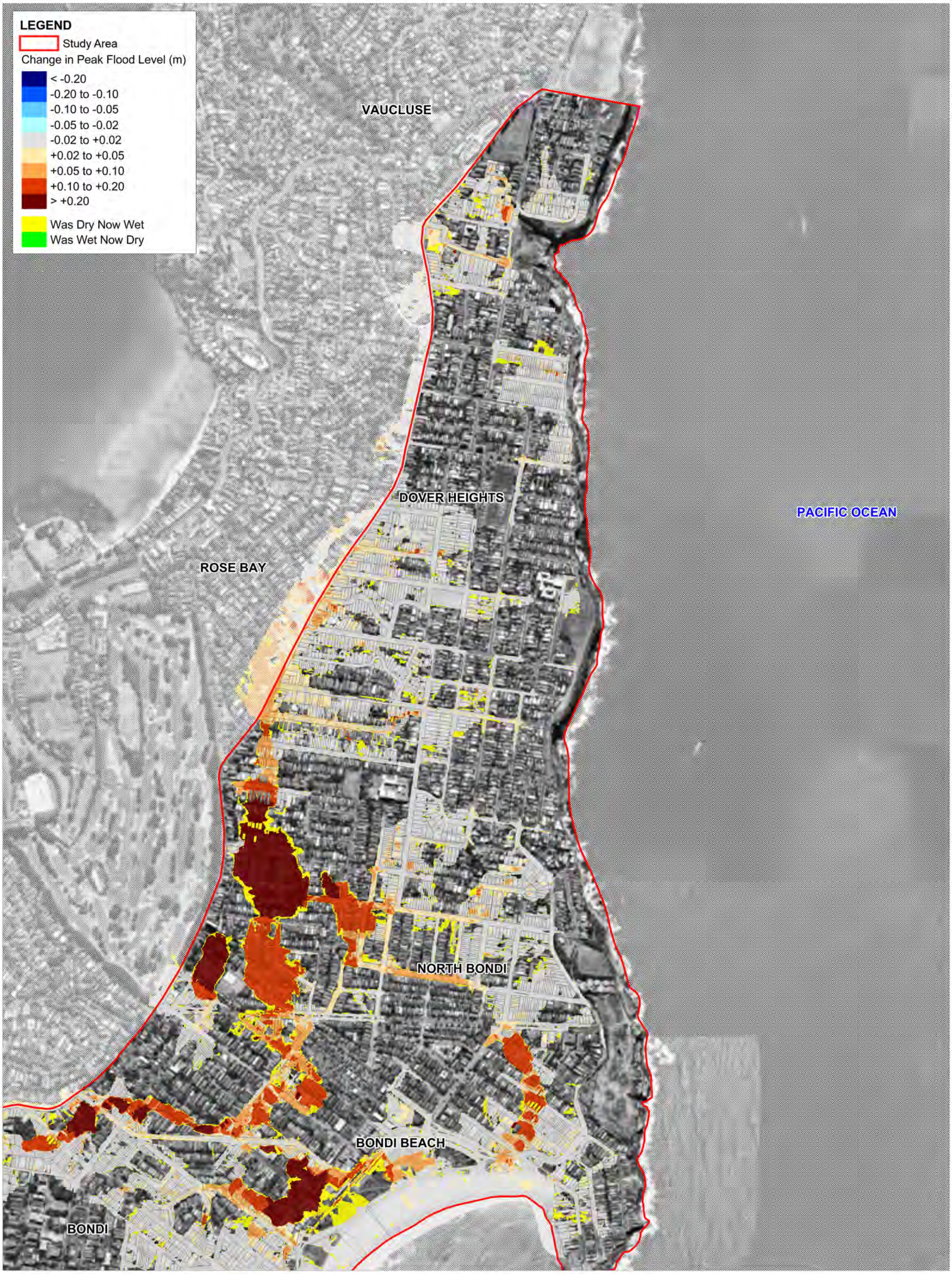


Title:

**Change in 1% AEP Peak Flood Level**
**30% Increase in Intensity Against Design Intensity**

Figure: **W-27_A**

Rev: **A**

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N

0 250 500m
Approx. Scale

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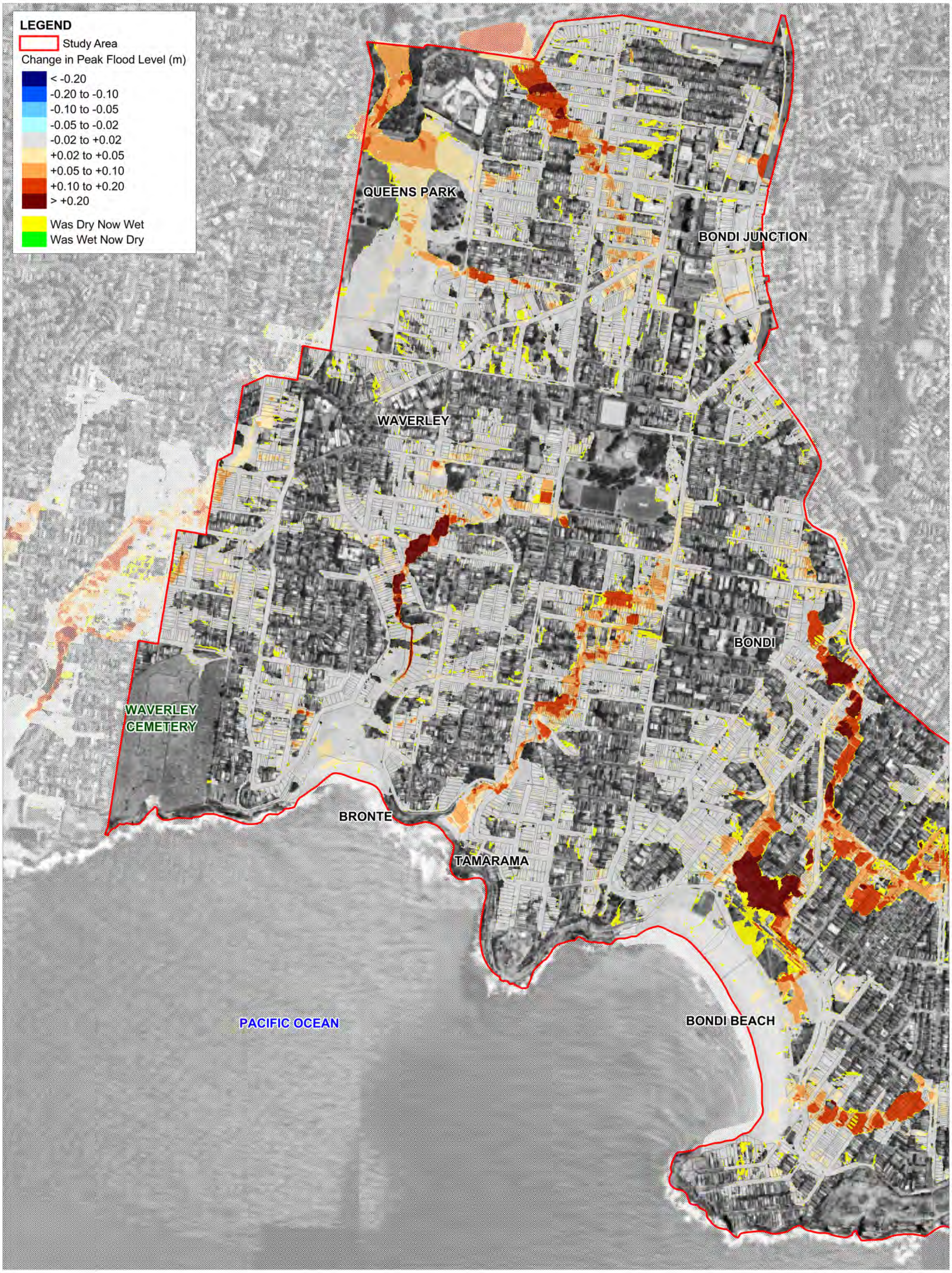


Title:
**Change in 1% AEP Peak Flood Level**
**30% Increase in Intensity Against Design Intensity**

Figure: **W-27_B**

Rev: **A**



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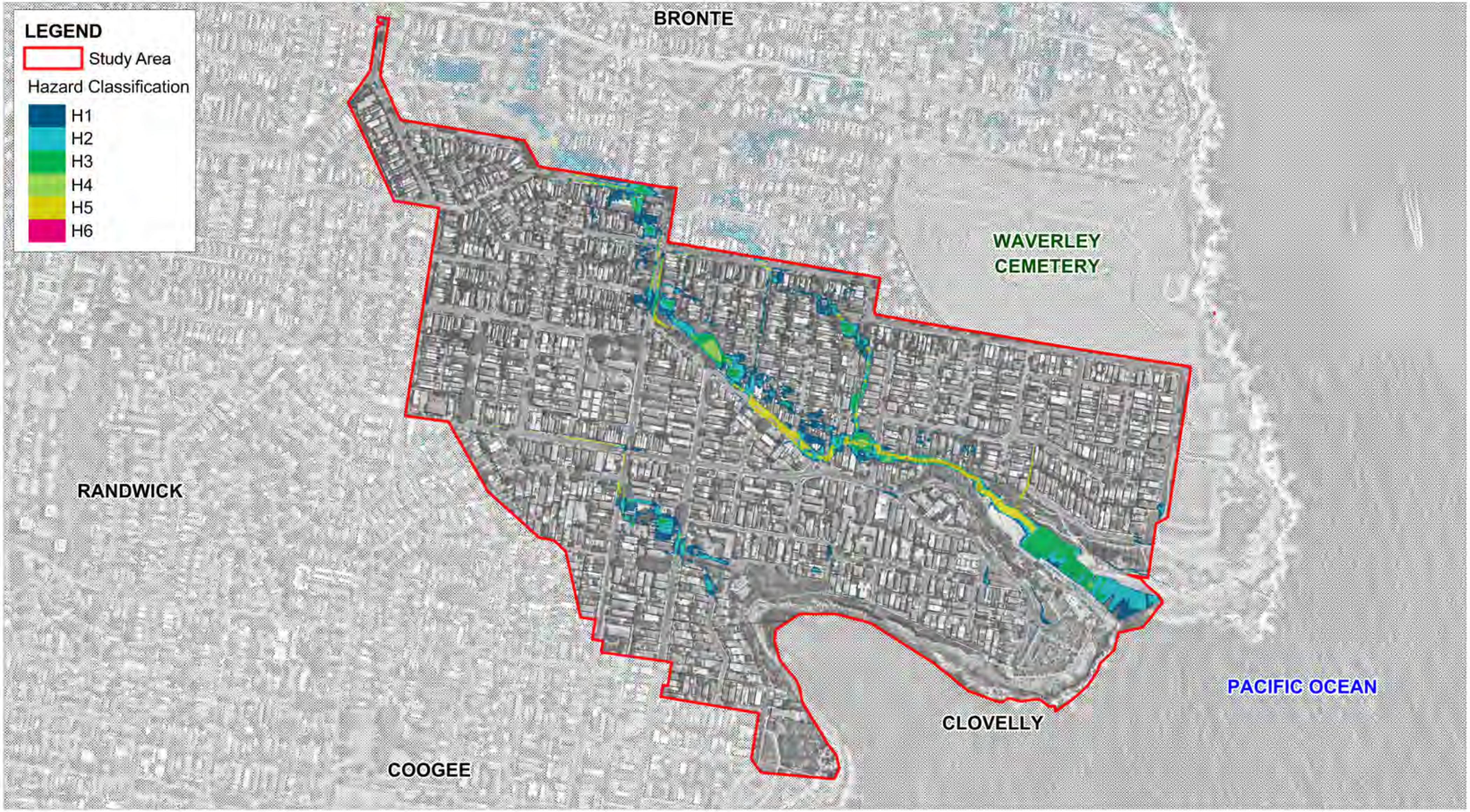


Title:

**Provisional Flood Hazard 5% AEP**

Figure: R-22

Rev: A

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N

0 200 400m

Approx. Scale

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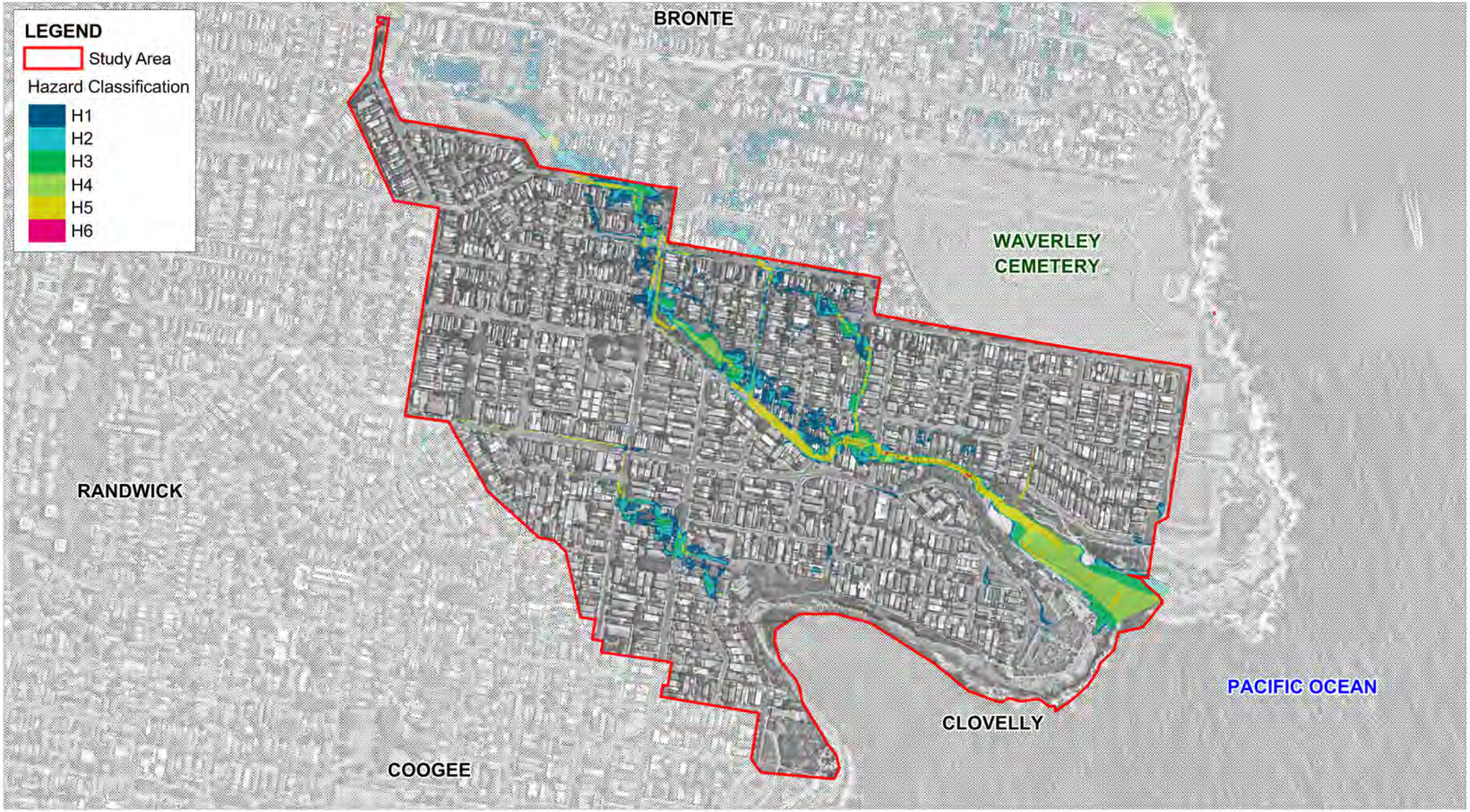


Title:

**Provisional Flood Hazard 1% AEP**

Figure: R-23

Rev: A



N

0 200 400m

Approx. Scale

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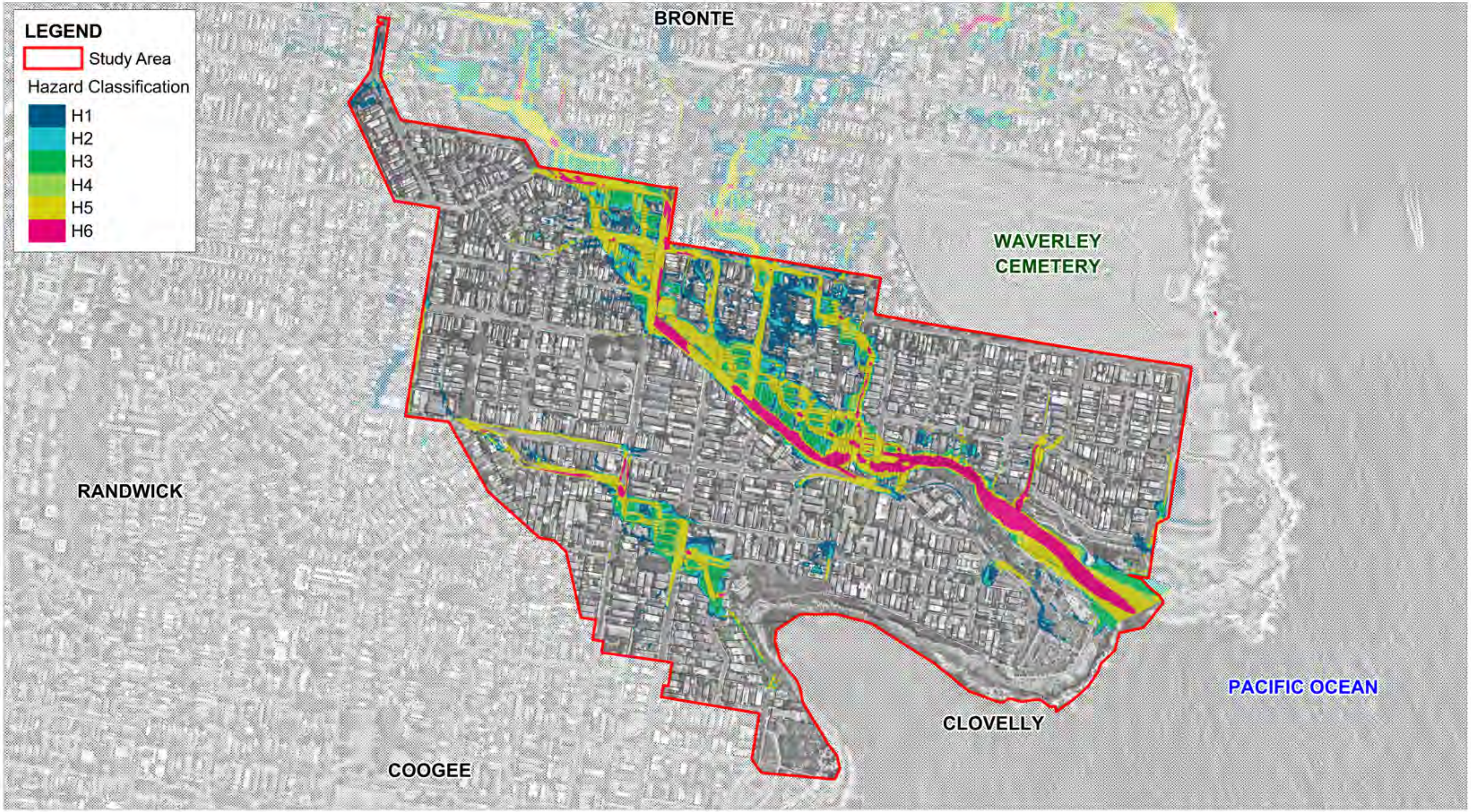


Title:

**Provisional Flood Hazard PMF**

Figure: **R-24**

Rev: **A**

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N

0 200 400m

Approx. Scale

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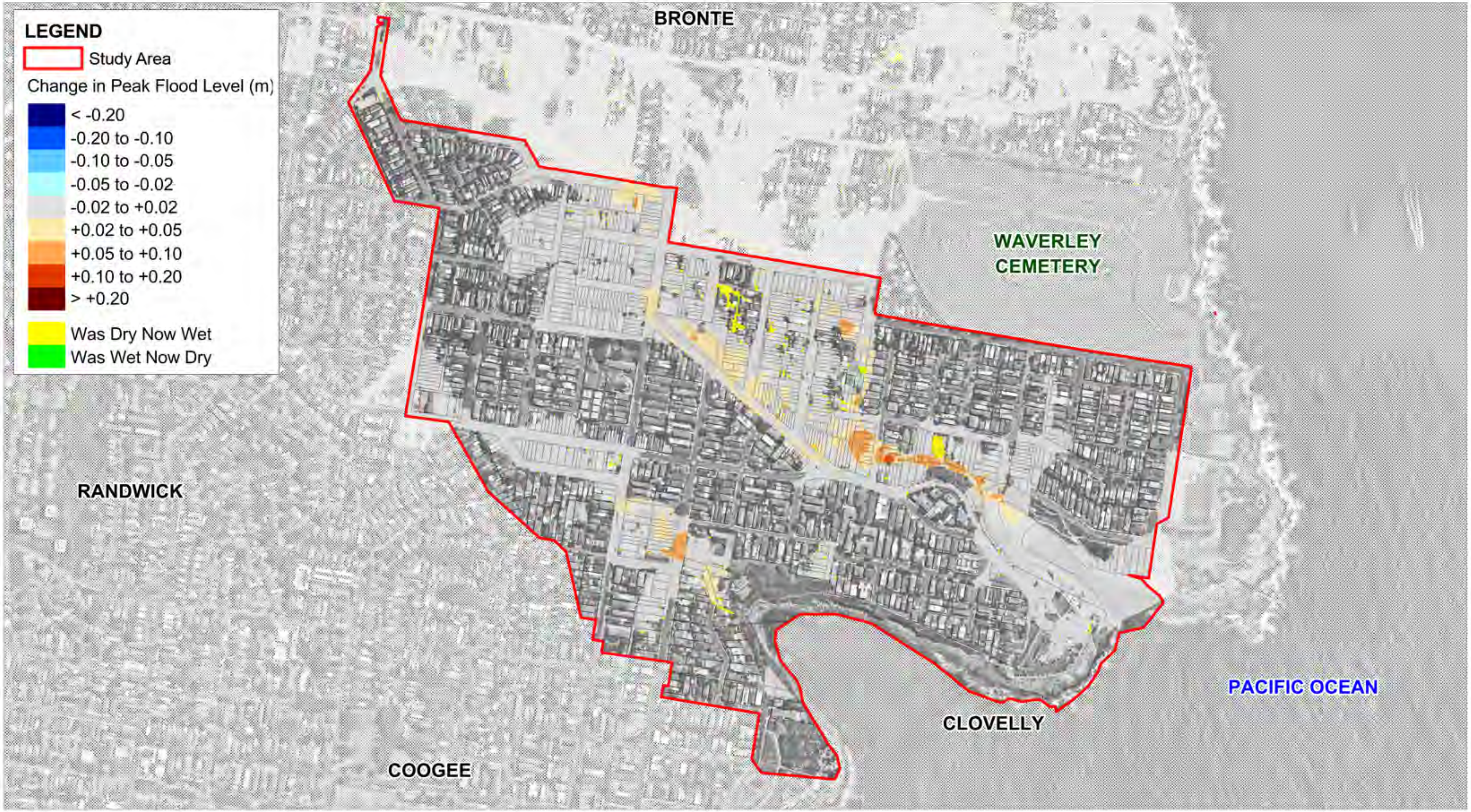


Title:

# Change in 1% AEP Peak Flood Level 10% Increase in Intensity Against Design Intensity

Figure: R-25

Rev: A



N

0 200 400m

Approx. Scale

BMT

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Filepath: S:\WATER\PROJECTS\S20301_FS_Waverley_Council_Stormwater_Flood_Study\MI\Workspaces\Report_Figures\Flood_Mapping_Compendium


Title:

**Change in 1% AEP Peak Flood Level 20% Increase in Intensity Against Design Intensity**

Figure: R-26

Rev: A

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N

0 200 400m

Approx. Scale

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Title:

**Change in 1% AEP Peak Flood Level**
**30% Increase in Intensity Against Design Intensity**

Figure: **R-27**

Rev: **A**

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N

0 200 400m

Approx. Scale

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