

FLOOD IMPACT AND RISK ASSESSMENT

Proposed Residential Flat Building with Basement Carpark

DIAN Rose Bay

2A & 2-6 Conway Avenue, 38-40 Carlisle Street, and 15-15A Fernleigh
Avenue, Rose Bay NSW

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EXECUTIVE SUMMARY

This Flood Impact and Risk Assessment (FIRA) supports a State Significant Development Application (SSD-101842729) for a residential flat building with basement levels at 2A & 2–6 Conway Avenue, 38–40 Carlisle Street and 15–15A Fernleigh Avenue, Rose Bay. The assessment has been undertaken in accordance with NSW Department of Planning and Environment, Woollahra LEP 2014, Woollahra DCP 2015 and the SEARs, using Council's adopted Rose Bay flood studies, ARR 2019 hydrology, detailed survey and a refined 2D TUFLOW model.

Flooding in the locality is driven by short, intense storms, with overland flow confined mainly to Fernleigh Avenue and Carlisle Street. Both Council mapping and refined modelling show flooding remaining within the public road reserve for the 5% AEP, 1% AEP and PMF events. The proposed development does not obstruct or divert the existing overland flow path and does not cause any measurable increase in flood levels, velocities, hazard or extent on neighbouring properties or the wider floodplain. Habitable and non-habitable floor levels can achieve freeboard requirements, with passive flood protection provided by continuous raised planters along Fernleigh Avenue and Carlisle Street, and by maintaining boundary levels at Conway Avenue basement entries.

Residual flood risk is considered low and can be safely managed through a shelter-in-place strategy, reliable vertical access to refuge areas above PMF and the implementation of basement flood-warning signage and a detailed Flood Risk Management Plan (FRMP) at Construction Certificate stage. Subject to these measures, the development is considered hydraulically compatible with the existing flood regime and acceptable from a flood impact and risk perspective, with compliance outcomes documented in Appendix A4 (Table 4).

**Flood Impact and Risk Assessment for DIAN, Rose Bay
Proposed Class 2 Residential Flat Building with Basement Carpark at
2A & 2-6 Conway Ave, 38-40 Carlisle St, and 15A-15 Fernleigh Ave, Rose Bay NSW
Job N° 251004 (SSD-101842729)**

1.0 INTRODUCTION

This Flood Impact and Risk Assessment (FIRA) has been prepared to support a State Significant Development Application (SSD-101842729) for the proposed development site at 2A & 2-6 Conway Avenue, 38-40 Carlisle Street, and 15A-15 Fernleigh Avenue, Rose Bay. The purpose of the assessment is to identify flood risks, confirm hydraulic compatibility and ensure the development does not increase flood impacts to life, property or neighbouring land.

1.1 PURPOSE OF FIRA

The purpose of this FIRA is to identify and characterise flood risks associated with the development site and to confirm that the development will not exacerbate flood risk to life, property or neighbouring land. The assessment determines how the proposed works interact with existing catchment-scale flood behaviour and whether post-development conditions remain hydraulically compatible.

The general site locality is illustrated in Figure 1. Site survey information and proposed development plans are provided in Appendix A7.

1.2 PROJECT CONTEXT

The subject land is located within a flood-affected precinct as identified in Woollahra Council's adopted floodplain risk management framework. The proposal involves infill affordable residential flat building with basement levels, ground-level shared facilities, landscaping, access and servicing infrastructure.

Regulating authorities require confirmation that the development will not adversely alter existing flood behaviour, that building immunity is appropriate, and that any residual flood risks are tolerable and manageable under accepted planning principles.

1.3 FIRA REQUIREMENTS

This assessment has been undertaken in accordance with Woollahra LEP 2014, Woollahra DCP 2015, the Secretary's Environmental Assessment Requirements (SEARs) and the NSW Flood Impact and Risk Assessment Guideline LU01 (DPE 2023). The scope includes pre- and post-development hydraulic modelling, hazard classification, residual risk evaluation and development recommendations suitable for SSD/SEARs consideration. Supporting datasets include:

- Architectural drawings prepared by MHNDU (Project No. 25-135 Drawings dated 01.05.2026)
- Preliminary Geotechnical Investigation prepared by EI Australia (E26891.G03 dated 25.11.2025)
- Topographical Survey prepared by Rygate Surveyors (Ref: 80854 Rev. C Sheets 1-3 dated 17.10.2025)

- Woollahra Local Environmental Plan 2014 (Woollahra LEP 2014)
- Woollahra Municipal Council Development Control Plan (Woollahra DCP 2015)
- Woollahra Council's adopted:
 - Rose Bay Catchment Flood Study – Final Report (WMA Water - 2010)
 - Rose Bay Floodplain Risk Management Study and Plan (WMA Water - 2014)
- Waverley LGA Flood Study – Final Report by BMT Commercial Australia Pty Ltd (2021)
- Applicable legislation, planning controls and emergency management guidance

These datasets provide the authoritative definition of catchment behaviour and form the baseline for hydraulic calibration and impact assessment.

A compliance assessment in accordance with the requirements under Woollahra DCP 2015, Woollahra LEP 2014 and the SEARs are consolidated in Appendix A4 (Table 4).



Figure 1.0 – Site Location and Surrounding Area (MHNDU)

2.0 BACKGROUND

This section summarises the development site conditions, study area characteristics and hydraulic behaviour relevant to this FIRA.

2.1 STUDY AREA

The site forms part of the Rose Bay upper catchment, draining toward the bay via Conway Avenue and Carlisle Street. These roadway corridors operate as the dominant overland flow paths during high-intensity rainfall events. Other than overland stormwater flow, the site does not experience any holding floodwater.

Refer to Appendix A1 for the adopted catchment mapping and predicted flood extents in relation to the site.

2.2 KNOWN FLOOD BEHAVIOUR

Flooding within the Conway Avenue and Carlisle Street precinct is characterised by short-duration, high-intensity rainfall and rapid hydrologic response from the surrounding urbanised catchment. Runoff is conveyed primarily within the kerb and gutter due to roadway grades, pit reliance and constrained on-lot sheet flow.

Ground levels on the subject land are elevated above adjoining kerb levels, and surface flows are expected to remain within the roadway except during temporary surcharge from pit blockage or exceedance of pipe capacity. For the 5% AEP, 1% AEP and PMF events, flood mapping shows inundation concentrated within the carriageway and bypassing habitable and communal building footprints when compliant driveway cresting and floor levels are provided.

The key flood behaviour characteristics are:

- Road reserve conveyance dominates over private-lot sheet flow
- Flood depths increase with event severity but remain low on site
- Peak levels are short-lived due to the flashy catchment response
- Inundation within building footprints is not expected under mapped design conditions, subject to compliant grading and minimum freeboard

These observations are consistent with Woollahra Council's adopted flood studies and the refined hydraulic modelling undertaken for this assessment.

2.3 FLOOD HISTORY

Historical flooding in the Rose Bay catchment has been recorded in Council documentation and community observations, with more notable events occurring in the 1980s–1990s. Impacts were typically concentrated at roadway low points and within the commercial foreshore precinct, where drainage constraints contributed to localised ponding and building inundation.

Within the Conway Avenue and Carlisle Street locality, reported flooding has involved roadway surcharge, driveway ponding and garage nuisance flooding rather than recurring internal building impact. A Council record for 14 Carlisle Street dated 20 June 2007 confirms surface flooding only, with no above-floor damage. No evidence of persistent internal inundation of the subject site under existing conditions has been discovered.

2.4 SITE DESCRIPTION

The consolidated development area includes multiple adjoining residential allotments, as listed below:

- 2 Conway Avenue (SP 81375) – Flood Planning Lot (Woollahra LEP 2014)
- 2A Conway Avenue (Lot 8 in DP 74055)
- 4 Conway Avenue (Lot 2 in DP 303984)
- 6 Conway Avenue (Lot 3 in DP 303984)
- 38 Carlisle Street (Lot B in DP 73175)
- 40 Carlisle Street (Lot 1 in DP 1201196) – Flood Planning Lot (Woollahra LEP 2014)
- 15A Fernleigh Avenue (Lot 2 in DP 1201196) – Flood Planning Lot (Woollahra LEP 2014)
- 15 Fernleigh Avenue (Lot 3 in DP 1201196) – Flood Planning Lot (Woollahra LEP 2014)

The total combined site area is approximately 3,105 m² based on the survey information and is located approximately 350 m east of Rose Bay beach. Below is a brief description of the subject land:

- The consolidated site area comprises of 9 dwellings existing in 2 storey single dwellings, three storey semi-detached dwellings, and a 2 storey apartment building. The properties contain a combination of pools, paved courtyards, gardens, small lawn areas, and basement or semi-basement garage structures.
- Ground levels generally range from approximately RL 46.8 to 40.0 m AHD along Fernleigh Avenue, RL 40.0 m to 37.0 m AHD along Carlisle Street, and RL 43.0 to 37.0 m AHD along Conway Avenue, falling toward the southern and eastern road corridors.
- Site access is provided via Conway Avenue, Carlisle Street and Fernleigh Avenue, each containing existing stormwater pits, utility services, street lighting and kerb infrastructure.
- Local circulation consists of driveway crossings, paving, pedestrian stairs and landscaped interfaces, with no natural watercourses or drainage channels located within private boundaries.
- Existing stormwater easements and rights-of-carriageway traverse portions of the consolidated land to support shared drainage, access and services, directing flows toward the public drainage network located within Conway Avenue and Carlisle Street.
- The surrounding roadway network provides the dominant overland flow path, with surface runoff directed toward kerb inlets and pits rather than across private lots, consistent with the urbanised catchment setting.

2.5 PROPOSED DEVELOPMENT

The proposed works involve demolition of existing dwellings and construction of a multi-unit residential building with basement parking, new driveway access, and upgraded drainage infrastructure. The proposed development extent is shown in Figure 2.0.

Based on the supplied information, we understand that the proposed development will comprise of:

- Demolition of existing dwellings.
- Construction of a multi-unit residential building with basement parking
- Driveway access via Conway Avenue, which is well suited away from overland stormwater flow.
- Two below ground basement levels with the lower ground floor level partially below ground.
- The ground floor level located at RL 44.70m and 40.50m AHD.
- The basement levels are accessed by the driveway entrance, internal lifts and staircases.

Finished floor levels and all sensitive uses are elevated above mapped flood levels and are not expected to experience direct inundation during design flood events, provided minimum freeboard is achieved in accordance with Council requirements.

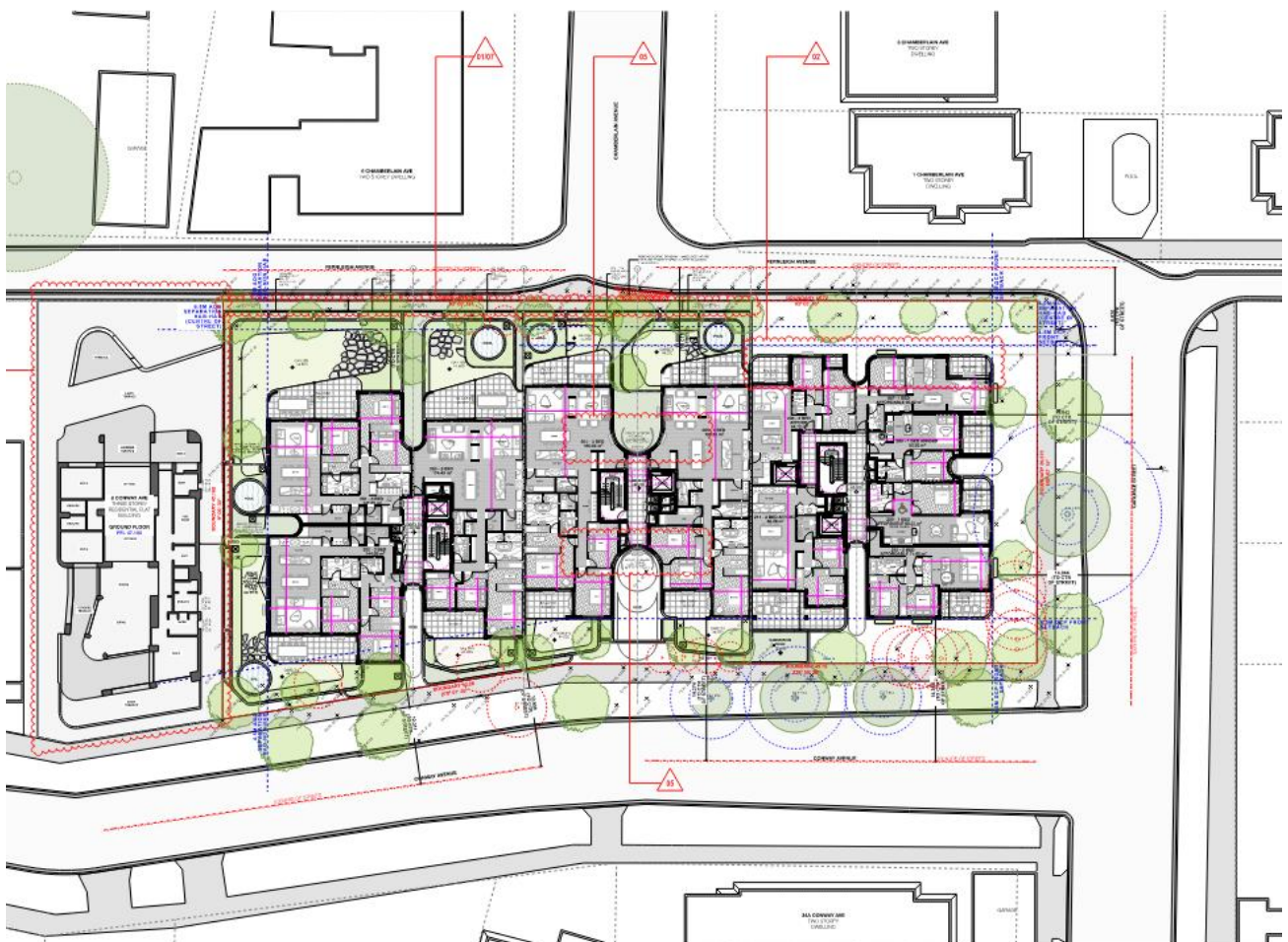


Figure 2.0 – Proposed Lower Ground Floor Plan (MHNDU)

2.6 EMERGENCY MANAGEMENT

Flood hazard in the Conway and Carlisle Street precinct is dominated by temporary roadway ponding and local surcharge during short-duration storms. Depths remain shallow and recede quickly, and building interiors are generally protected by elevated floor levels above kerb.

The rapid hydrologic response limits effective warning time, however, inundation duration is short (90-120 minutes), and vehicular or pedestrian movement can easily be avoided during peak rainfall periods. Emergency arrangements are primarily supported at a community level through established Council and State emergency systems, SES response, public information and general flood awareness programs.

For typical design events, the preferred response for residential occupation on this site is shelter-in-place, with evacuation or vehicle access not required in the short duration until roadway ponding dissipates. No specialised on-site flood equipment or operational deployment is required.

Refer to Appendix A4 (Table 4) for further emergency management requirements.

Consistent with the NSW SES advice (19 March 2026), residents and users of the development will be made aware of their flood risk and directed to the available NSW emergency-management tools, including the Hazards Near Me app (Australian Warning System), the NSW SES website, and HazardWatch. The Flood Emergency Response Plan (FERP) will be developed at Construction Certificate stage and will integrate with the NSW State Flood Plan (2024) Section 5.1.7 and the Waverley/Woollahra Flood Emergency Sub Plan (Endorsed December 2021) Section 5.8. A private flood management plan alone is not relied upon to address flood risk on this site; the site response is anchored in passive flood protection (refer Section 7.3) supported by community-level emergency arrangements coordinated by NSW SES.

3.0 AVAILABLE INFORMATION

This assessment adopts Woollahra Council's Rose Bay Catchment Flood Study (2010) and Floodplain Risk Management Study and Plan (2014) as the baseline definition of catchment behaviour, flood levels, dominant surface flow routes and hazard patterns. These studies provide the authoritative narrative for calibration and impact benchmarking.

To reflect current site conditions and support detailed modelling, additional datasets were incorporated, including:

- Demolition of existing dwellings.
- LiDAR terrain model validated against site-specific feature and level survey.
- ARR 2019 rainfall and temporal patterns consistent with contemporary design practice.
- Cadastral boundaries, zoning layers and aerial imagery to support realistic model surface and blockage representation.
- Site inspection observations, particularly around sag points and driveway grades.

Collectively, these datasets are comprehensive and fit for purpose, allowing the refined modelling to verify existing conditions and assess post-development hydraulic performance without redefining Council's accepted flood behaviour.

4.0 FLOOD RELATED REQUIREMENTS

This section summarises the applicable flood planning controls and confirms that the development can comply with those requirements. All detailed evaluation criteria, performance objectives and recommended mitigation measures under Woollahra DCP 2015, Woollahra LEP 2014 and the SEARs are consolidated in Appendix A4 (Table 4).

These controls ensure the development does not increase flood risk to neighbouring properties or to the surrounding public domain and that residual flood risk remains low and tolerable for a residential building. The post development scenario is not materially different to pre-development.

4.1 WOOLLAHRA MUNICIPAL COUNCIL DCP

Section E2.3 – Flood Risk Management Controls of Woollahra DCP sets flood-risk requirements for new development on or adjacent flood-affected land. Key applicable provisions include:

- Habitable floor areas: 1% AEP flood level plus 0.5 m freeboard
- Non-habitable floor areas: 1% AEP flood level plus 0.3 m freeboard
- Enclosed car parking spaces (> 3 vehicles): 1% AEP flood level plus 0.3 m freeboard
- Flood-compatible construction for all building elements located below the nominated protection level, consistent with Council requirements.
- Reliable flood-safe pedestrian access is maintained from the lowest habitable level to an internal refuge located above the PMF level.

All DCP compliance requirements and associated mitigation measures for this development are summarised in Appendix A4 (Table 4).

4.2 WOOLLAHRA MUNICIPAL COUNCIL LEP

Clause 5.21 – Flood Planning of Woollahra LEP 2014 applies to flood-affected development and requires assessment of hydraulic compatibility, building immunity and safety of occupants. These objectives are addressed through the same design controls established under the DCP. Clause 5.22 – Special Flood Considerations is not currently adopted.

All LEP requirements applicable to this development are identified and evaluated in Appendix A4 (Table 4).

4.3 SECRETARY'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS

Flood-related matters relevant to SSD assessment are addressed under the SEARs, including verification of post-development hydraulic compatibility, residual risk tolerance and emergency response feasibility. Where applicable, these objectives are satisfied through the same measures applied under the LEP and DCP. All SEAR-specific flood assessment items and recommended mitigation measures are consolidated in Appendix A4 (Table 4).

4.4 COMPLIANCE WITH SYDNEY PLAN APPENDIX I FLOOD PLANNING PRINCIPLES

The proposal has been assessed against the seven Flood Planning Principles in Appendix I (Flood Planning Principles), Department of Planning, Housing and Infrastructure, The Sydney Plan, December 2025 (draft for public exhibition). The principles apply to SSD assessment in areas not yet covered by a Disaster Adaptation Plan and are supplementary to the NSW Flood Prone Land Policy, Section 9.1 Ministerial Direction 4.1 Flooding, Standard Instrument LEP Clauses 5.21 and 5.22, the Flood Risk Management Manual (2023) and the Considering Flooding in Land Use Planning Guideline (2021). The instruments listed are addressed in Sections 4.1 to 4.3 and Appendix A6 of this report.

Table 4.4 – Sydney Plan Appendix I Flood Planning Principles Compliance

Principle	RTS Comment
1. Avoid adverse impacts of cut/fill or earthworks on flood behaviour	The site is not within a mapped floodway or flood storage area per the Rose Bay Catchment Flood Study (WMAwater 2010). The development does not introduce filling within floodway or flood storage land. Site grading is contained to the building footprint and landscape zones. Post-developed flood mapping (Appendix A3) demonstrates no adverse cumulative impact at adjoining or downstream properties relative to the existing case.
2. Reduce flood exposure on land below 1% AEP + freeboard + climate change	The site is overland-flow affected and the proposal increases residential density on flood-affected land. The principle's objective (reduced flood exposure) is met by design rather than by avoidance: Lower Ground and Ground Floor finished levels are set at or above the Flood Planning Level (1% AEP + 500 mm freeboard for habitable areas; +300 mm for car parking, per Annexure A draft condition D.6); basement openings are above the PMF. Climate change has been considered using the ARR 2019 climate change rainfall uplift, SSP5-8.5 to 2090 horizon, factor 1.77, consistent with the NSW Government Common Planning Assumptions.
3. Apply flood-related development controls per Standard Instrument Clause 5.21	A Clause 5.21(2)(a)
4. Apply controls between 1% AEP and PMF (evacuation, SIP, sensitive use)	All habitable floor levels and basement openings (ramp, vents, pedestrian entries) are set at or above the PMF or 1% AEP + freeboard, whichever is higher. Shelter-in-Place is the adopted emergency response strategy, with point-by-point compliance against the NSW Shelter-in-Place Guideline for Flash Flooding (DPHI, January 2025) provided in Table A6.3. The development is residential and is not a sensitive or vulnerable land use.
5. Consider flood-compatible building techniques	Building elements below the FPL adopt flood-compatible construction per the ABCB Standard for Construction of Buildings in Flood Hazard Areas and the NSW Reconstruction Authority Flood Resilient Design Guide. Subdivision design is not applicable to this SSD (single-site consolidated lot configuration).
6. Land use intensity matched to flood risk; cumulative impact on evacuation and emergency management	The development footprint sits predominantly within the Low-Risk floodplain category (Appendix A3). Higher-hazard zones (PMF) are confined to surrounding street kerbs and are not occupied by habitable building elements. The proposal is residential infill on an existing road network and does not reduce the evacuation capacity of Conway Avenue, Fernleigh

	Avenue or Carlisle Street. Emergency management complexity is addressed through Shelter-in-Place (Table A6.3) and the Flood Emergency Response Plan committed at Construction Certificate, consistent with the SES advice that off-site evacuation under PMF is not reliable on the local road network.
7. Balance development outcomes with flood risk management	Principle 7 is framed for development outcomes 'in centres' and is not directly applicable to this residential site. The proposal nonetheless adopts passive flood protection (no automatic, mechanical or tilting flood barriers). Refuge above the PMF is provided via the first residential level and all floors above. Off-site flood risk is not increased. The proposal achieves the affordable housing intent of the SSD while satisfying the flood risk management framework.

The proposal is consistent with the seven Flood Planning Principles. This narrative is supported by Appendix A6 (WLEP Cl 5.21 narrative and SIP compliance) and Section 7.3 (passive flood protection). Flood mapping is provided in Appendix A3.

5.0 PRE-DEVELOPED MODELLING AND ANALYSIS

The TUFLOW hydraulic model was used as the basis of this assessment and was refined to determine flood extents, levels, depths, velocities and hydraulic hazard during the critical 5% AEP, 1% AEP and PMF events for the site in existing and proposed conditions. The peak flood levels, depths, velocities and hazards in the critical duration of the storm events for existing site conditions are shown in Appendix A3.

5.1 EXISTING FLOOD MODELLING

A refined 2D TUFLOW hydraulic model was established using LiDAR terrain, site survey, ARR 2019 rainfall and adopted tailwater conditions. Predicted flood levels adjacent to the site are consistent with the Rose Bay Flood Study, and model behaviour and parameters were benchmarked against the Waverley LGA Flood Study to ensure alignment with current best-practice coastal flood modelling.

Consistent with the methodology of Council's adopted Rose Bay flood studies, residential lots were modelled as elevated barriers to preserve road-corridor surface flow dominance. Minor refinements were applied at major isolated sag points to permit realistic connectivity while maintaining catchment-scale flow behaviour.

Under existing conditions, overland flow floodwaters are conveyed predominantly along Fernleigh Avenue and Carlisle Street, within the roadway contained by the existing gutter, forming part of the major overland flow route that transfers runoff from the upper catchment toward Rose Bay.

It is acknowledged that the WMAwater (2010) approach of representing residential lots as raised barriers is a catchment-scale modelling convention adopted to preserve dominant road-corridor flow. To support this site-specific FIRA, on-lot ground levels have been verified against the Rygate Surveyors topographical survey (Ref 80854 Rev C, 17 October 2025), which confirms that the consolidated allotment ground levels are elevated above adjacent kerb levels along Fernleigh Avenue and Carlisle Street. Surface flows therefore naturally remain within the public road reserve, and the catchment-scale convention applied in the Rose Bay Flood Study is consistent with actual on-site behaviour.

Fence representation in the TUFLOW model has been reviewed in response to the DCCEEW CPHR observation regarding ponding against a permeable, slatted gate at the Fernleigh Avenue / Carlisle Street intersection. Boundary fences along the road frontages are modelled as permeable to overland flow consistent with the Rose Bay Catchment Flood Study assumption. The PMF depth concentration at the intersection reflects the natural sag-point ponding rather than blockage by the fence.

5.1.1 MODELLING PARAMETERS AND ASSUMPTIONS

Hydrological modelling parameters adopted are documented in Appendix A2, including the total modelled catchment area, sub-catchment delineation and ARR 2019 design rainfall depths and losses extracted from the AR&R Data Hub for the catchment centroid.

Hydraulic modelling parameters adopted in the refined TUFLOW model are documented in Appendix A2, including Manning's n values, the modelled stormwater network extent and the pit and pipe blockage

assumptions adopted (consistent with the Rose Bay Catchment Flood Study (WMAwater, 2010) blockage approach).

Verification of model levels against the Rose Bay Flood Study has been undertaken at the Conway Avenue, Fernleigh Avenue and Carlisle Street site frontages. Predicted levels at these locations agree with the Rose Bay Flood Study to within ± 0.02 – 0.03 m (refer Tables 1 and 2).

The critical storm duration adopted for the site has been determined via the AR&R 2019 ensemble approach (10 temporal patterns per duration). The critical duration is identified as the duration that produces the median peak flow at the site frontage monitoring point across the ensemble. The adopted critical duration is approximately 90 minutes for the 5% AEP, 1% AEP and PMF events, consistent with the short-duration overland-flow characterisation in the Rose Bay Catchment Flood Study (WMAwater, 2010).

Climate change has been considered through application of the Australian Rainfall and Runoff (ARR 2019) climate-change rainfall intensity uplift in addition to the sea-level-rise sensitivity testing carried in the Rose Bay Catchment Flood Study (WMAwater, 2010). The uplifted rainfall has been applied for the SSP5-8.5 scenario at the 2090 horizon (factor 1.77 per AR&R Book 1 Chapter 6 / NSW Government Common Planning Assumptions). Predicted 1% AEP and PMF flood depths at the site frontage under the climate-uplifted rainfall remain within the protective levels nominated in Tables 3a and 3b. The 77% rainfall intensity uplift produces a modest increase in predicted depths at the site frontage which remains within the freeboard provided in Tables 3a and 3b.

5.2 EXISTING FLOOD IMPACTS

Under existing conditions, floodwater is primarily conveyed along the Fernleigh Avenue and Carlisle Street road corridors adjacent to the site, with roadway capacity and pit function governing surface flow.

When applying the mitigation measures outlined in Section 7.0 of this FIRA, neither habitable nor non-habitable floor areas are inundated during the 5% AEP, 1% AEP or PMF events, confirming that building immunity can be maintained under existing and design storm conditions.

Flood hazard in proximity to the site typically ranges between H1 and H2, increasing to H2–H3 within the roadway in the 1% AEP event, and to H3–H4 at the Fernleigh/Carlisle eastern intersection in the PMF, due to depth and velocity concentration along the carriageway (refer Table A6.2). Importantly, safe and reliable access remains feasible via the Conway Avenue high point during the 1% AEP event, ensuring that emergency movement does not rely on traversing deeper roadway flow paths if required.

6.0 POST-DEVELOPMENT MODELLING AND ANALYSIS

The peak flood levels, depths, velocities and hazards in the critical duration of the storm events for existing site conditions are shown in Appendix A3.

6.1 PROPOSED DEVELOPMENT FLOOD MODELLING AND ASSESSMENT

The proposed development geometry was incorporated into the TUFLOW hydraulic model with negligible changes to upstream inflows, rainfall patterns, surface roughness or downstream tailwater conditions. The model indicates that the proposed development does not obstruct or divert the existing overland flow path, and no predicted significant changes to flood levels or velocities on adjoining properties, the public road corridor, or the broader floodplain.

Flood behaviour continues to be contained within roadway corridors, and no new overland flow pathways are generated across the site or toward neighbouring properties. The modelled peak flood depths and flow directions are consistent with existing condition behaviour, confirming that the proposed development does not increase flood risk to the public domain or adjacent assets.

6.2 FLOOD IMPACTS OF PROPOSED DEVELOPMENT

There is negligible redirection of flow, negligible increase in flood storage demand, negligible aggravation of hydraulic hazard, and no deterioration of emergency accessibility. The proposal is not anticipated to worsen flood risk within or beyond the development. TUFLOW-predicted overland flow levels adjacent to the site are summarised in Table 1, with accompanying flood mapping provided in Appendix A3.

For transparency, interpolated overland flow levels derived from Council's adopted Rose Bay Flood Study flood mapping are also provided in Table 2.

Table 1 – Table of TUFLOW Predicted Overland Flow Levels (Site-Specific Modelling)

Flood Event	Fernleigh Avenue Flood Levels (m AHD)		Carlisle Street Flood Levels (m AHD)	
	Minimum	Maximum	Minimum	Maximum
5% AEP	40.30*	44.02*	37.35*	40.30*
1% AEP	40.32	45.12	37.42	40.32
PMF	40.42	45.28	37.53	40.42

*Flood levels based on adjacent roadway flood extent at model edge where 5% AEP floodwaters do not reach the property boundary.

This dual-source comparison ensures transparency in reporting and mitigates uncertainty associated with interpolation tolerances along roadway corridors.

Table 2 – Table of Rose Bay Flood Study Interpolated Overland Flow Levels (Council Mapping)

Flood Event	Fernleigh Avenue Flood Levels (m AHD)		Carlisle Street Flood Levels (m AHD)	
	Minimum	Maximum	Minimum	Maximum
5% AEP	40.20*	45.05*	37.30*	40.20*
1% AEP	40.30	45.15	37.40	40.30
PMF	40.40	45.30	37.50	40.40

**Interpolated from Council's adopted Rose Bay Flood Study flood mapping (not modelled by RTS Civil).*

Comparison of the refined TUFLOW model results (Table 1) and the interpolated Rose Bay Flood Study levels (Table 2) indicate that predicted flood levels are generally consistent, with differences typically within about 0.02–0.03 m, some locations being marginally higher in the refined model and others marginally higher in the Council mapping. To ensure a conservative outcome consistent with Council's flood planning framework, the recommended design floor and basement protection levels have been based on the higher of the TUFLOW-predicted levels and the Council-mapped level at each location.

While the site is technically flood-affected due to elevated flood levels within the adjoining road corridor, the modelled flood behaviour is not anticipated to pose a material inundation risk to the building footprint provided appropriate overland flow and stormwater management measures are implemented. Finished floor levels and other sensitive areas are protected from predicted flood levels and are not expected to be impacted by direct inundation during extreme rainfall events, subject to the adoption of minimum freeboard requirements at detailed design stage.

7.0 FLOOD RISK MANAGEMENT PLAN (FRMP)

Woollahra DCP 2015, Woollahra LEP 2014 and the SEARs require a FRMP that includes evacuation strategy. The impact of flooding on the proposed development is minor and is not envisaged to result in any increased risk to human life. Appropriate risk-to-life controls for flood events up to the PMF have been considered.

Refer to Appendix A4 (Table 4) for recommendations.

7.1 FLOOD RISK PRECINCTS

The determined Flood Risk Precincts are:

- Flood Type: Overland Flow
- Floodplain Categorisation: High Hazard Floodway (Fernleigh Ave and Carlisle St roadway corridor)

7.2 FLOOD RISK MANAGEMENT

Flood effects within the surrounding road corridors can be safely managed as noted above. These measures, once integrated into detailed design documentation will ensure the development maintains a hydraulically neutral outcome in both existing and post-development conditions.

7.3 FLOOD PROTECTION

Flood protection at this site relies entirely on passive landscape and architectural elements. No automatic, mechanical, tilting or operable barrier is used or relied upon, consistent with the recommendations of DCCEEW CPHR (23 March 2026), NSW SES (19 March 2026) and DPHI Key Issues item 7 (24 March 2026).

Along the Fernleigh Avenue frontage and the affected portion of the Carlisle Street frontage, the development incorporates a continuous passive protection line comprising raised landscape crests, raised planter walls and raised pedestrian thresholds. These elements form an unbroken protective line between the road reserve and the lower ground floor of the building. Hydraulic modelling confirms that the minimum threshold height above the adjacent verge required to maintain freeboard to all protected entries is achievable through landscape and architectural means, without recourse to a mechanical device.

The threshold elements are set at or above the levels required for compliance with the 1% AEP flood level plus 500 mm freeboard for habitable areas, and PMF protection for basement openings. Continuity is maintained without low points, openings or operable elements; floodwaters remain confined to the road reserve and do not encroach upon the building footprint.

Along Conway Avenue, basement access is set above the PMF level. The Conway Avenue boundary levels achieve the required protection by virtue of the existing kerb and ground levels at the site frontage, without elevation of the basement slab and without any mechanical device.

Refer to Tables 3a and 3b for design protection levels, and Appendix A7 (MHNDU architectural plans) for the location of each passive threshold (PT 01–PT 06) and basement entry referenced in Tables 3a and 3b.

Table 3a – Passive Threshold Heights at Lower Ground Pedestrian Entries (PT 01–PT 06)

Passive Threshold	Predicted depth at threshold above adjacent ground (mm)		Minimum passive threshold height above adjacent ground (mm)	Freeboard above 1% AEP (mm)
	1% AEP depth (mm)	PMF depth (mm)		
PT 01	< 50	50	550	500
PT 02	< 50	50	550	500
PT 03	50	810	810	760
PT 04	< 50	370	550	500
PT 05	< 50	330	550	500
PT 06	< 50	97	550	500
Refer to Table 3b below for Conway Avenue basement entry levels (m AHD).				

Table 3b – Basement Access Protection Levels (Conway Avenue)

Location (refer Fig. A6.x)	Adjacent ground / kerb RL (m AHD)	1% AEP RL (m AHD)	PMF RL (m AHD)	Basement entry / ramp crest RL (m AHD)
Conway Ave Basement Entry / Ramp Crest	41.30	41.50	41.81	41.83

Notes: (1) PT 01–PT 06 locations are shown on the MHNDU architectural plans in Appendix A7. (2) The proposed basement entry RL of 41.83 m AHD exceeds both the 1% AEP RL and the PMF RL at the Conway Avenue boundary, providing passive PMF protection without elevation of the basement slab.

The proposed upper basement finished floor level is RL 40.50 m AHD. The basement entrance locations proposed along Conway Avenue where floodwaters are contained within road kerb, and PMF effects diminish at or lower than the property boundary. The basement entrances are located above the PMF and the 1% AEP flood levels plus freeboard consistent with Woollahra DCP intent.

These proposed external boundary levels provide compliant passive flood protection without elevating the slab or adopting mechanical devices. Operational responsibilities and maintenance requirements for flood protection elements are to be formalised at Construction Certificate stage.

8.0 CONCLUSIONS AND RECOMMENDATIONS, including Response to Submissions

This FIRA supports the State Significant Development Application (SSD-101842729) for the development at 2A & 2-6 Conway Avenue, 38-40 Carlisle Street, and 15A-15 Fernleigh Avenue, Rose Bay. The analysis confirms the proposal will not materially alter the established flood behaviour, with flooding remaining confined to the

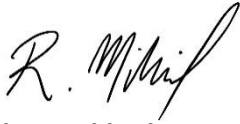
public road reserve. A compliance assessment under Woollahra DCP, Woollahra LEP, and the SEARs is provided in Appendix A4 (Table 4). Key recommendations are summarised below:

1. Finished Level Requirements (Architect) – currently adopted.
 - a. Passive flood protection has been integrated along Fernleigh Avenue and Carlisle Street frontages (raised landscape crests, raised planters and raised pedestrian thresholds) in accordance with Tables 3a and 3b, Appendix A4 (Table 4) and Appendix A6. Automatic flood barriers have been removed in response to DPHI Key Issues item 7, the DCCEEW CPHR submission (Issue 2), and the NSW SES submission.
2. Basement Flood Protection (Traffic / Architect / Civil) – currently adopted.
 - a. Basement entrances and service penetrations proposed must maintain existing boundary levels at Conway Avenue and must adopt the nominated passive threshold levels along Fernleigh Avenue and Carlisle Street. Essential services (power, pumps, switchboards, plant) must adopt the same protection levels. All basement openings (ramp crest, vents, pedestrian entries) are to be above the PMF or the 1% AEP plus freeboard, whichever is higher.
3. Flood-Compatible Construction (Architect / Structural / Builder) – Construction Certificate stage.
 - a. All building elements located below PMF levels must be flood-compatible and confirmed during CC.
4. Structural Resilience (Structural Engineer) – Construction Certificate stage.
 - a. Passive protection structures (raised landscape crests, planter walls and raised pedestrian thresholds) shall be certified by a structural engineer for flood and debris forces to the PMF level during CC.
5. Flood Warning and Emergency Management (Architect / Builder) – Construction Certificate stage.
 - a. Permanent flood awareness signage is to be installed within the basement carpark, and a Flood Risk Management Plan (including a shelter-in-place strategy) is to be incorporated into CC documentation.
6. Inconsistency with Council Draft Condition G.3(d) (Construction Certificate / Consent Stage).
 - a. RTS Civil notes that draft Council condition G.3(d) at Annexure A of the Woollahra Council submission of 2 March 2026 – requiring that the pedestrian entries from Fernleigh Avenue be protected by an automatic mechanical flood barrier – is inconsistent with the passive flood protection strategy adopted in this FIRA Rev 02 and with the agency advice from DCCEEW CPHR (23 March 2026, Issue 2), NSW SES (19 March 2026) and DPHI Key Issues item 7 (24 March 2026). RTS Civil recommends that DPHI amend draft condition G.3(d) prior to consent issue to remove reference to the automatic mechanical flood barrier and instead require continuity of passive landscape and architectural protection consistent with FIRA Rev 02

Section 7.3 and Tables 3a and 3b. This will align the consent conditions with current best-practice agency guidance and with the FIRA Rev 02 design response.

No adverse cumulative impacts are anticipated in combination with surrounding development. The development is therefore compatible with existing flood conditions, is acceptable from a flood risk perspective, and recommended for approval. Please contact the author should additional clarification be required.

RTS CIVIL CONSULTING ENGINEERS PTY LTD



Rhys Mikhail

Director | Principal Engineer (PRE0000266) | Design Practitioner (DEP0000285)
BEng (Civil) Hons MIEAust CPEng NER (2570082) RPEQ (17480) APEC IntPE(Aus)

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9.0 REFERENCES

Australian Building Codes Board (ABCB) – Standard for Construction of Buildings in Flood Hazard Areas. Australia.

Australian Government (ANEDF) – LiDAR and Elevation Information System, Australian National Elevation Data Framework.

Australian Rainfall and Runoff (ARR 2019) – A Guide to Flood Estimation. Commonwealth of Australia, Engineers Australia.

Australian Rainfall & Runoff Data Hub – Results ARR2019

<https://www.awmawatercontrol.com.au/flood-mitigation/>

Climate Change Rainfall Modifier – Watercom

Design Rainfall Data System (2016) – Australian Government Bureau of Meteorology

Department of Planning and Environment (NSW) (2023) – Flood Impact and Risk Assessment Guideline (LU01).

NSW Floodplain Management Manual (2005) – The Management of Flood Liable Land. NSW Government.

NSW Reconstruction Authority (2022) – Flood Resilient Design Guide.

RTS Civil (2025) – 2D Hydraulic Model Outputs and Flood Mapping.

WMA Water (2010) – Rose Bay Catchment Flood Study.

WMA Water (2014) – Rose Bay Catchment Floodplain Risk Management Study and Plan.

Waverley Council (2021) – Waverley Local Government Area Flood Study. Prepared by BMT Commercial Australia Pty Ltd.

Woollahra Municipal Council – Development Control Plan (DCP 2015) – Chapter E2: Stormwater, Flood and Geotechnical Risk Management.

Woollahra Municipal Council (2014) – Local Environmental Plan (LEP 2014).

NSW Government (2023) – NSW Flood Risk Management Manual (FRMM), ISBN 978-1-923076-17-4.

NSW Government (2023) – Support for Emergency Management Planning Guideline (FB02).

NSW Department of Planning, Housing and Infrastructure – Planning System Circular PS24-001 (Section 4.1 Flooding).

NSW Department of Planning, Housing and Infrastructure (2025) – Shelter-in-Place Guideline for Flash Flooding (January 2025).

Australian Disaster Resilience Handbook 7 (AIDR, 2017) – Managing the floodplain: a guide to best practice in flood risk management in Australia.

Australian Rainfall and Runoff (ARR 2019) – Book 6: Flood Hydraulics (Hazard Classification per Smith et al.).

NSW SES (2021, endorsed) – Waverley Council and Woollahra Council Flood Emergency Sub Plan.

NSW Government (2024) – NSW State Flood Plan.

NSW Department of Climate Change, Energy, the Environment and Water (DCCEEW) (2023) – Flood Risk Management Guideline FB03 (Hazard).

APPENDIX A1 – CATCHMENT INFORMATION

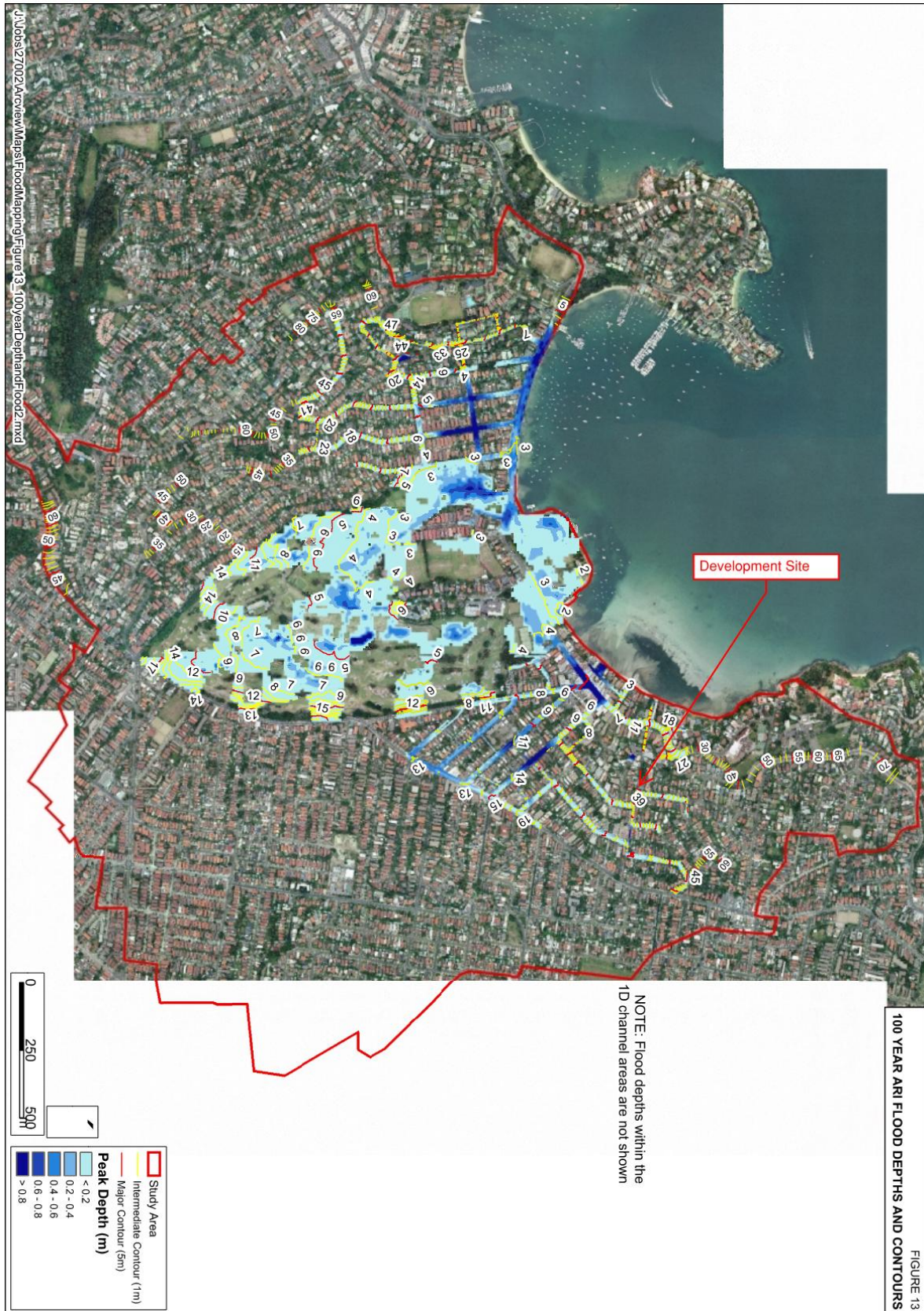


Figure A1 – 1% AEP Flood Extent from ‘The Rose Bay Flood Study’ (Global Catchment)



Figure A2 – 1% AEP Flood Extent from 'The Rose Bay Flood Study' (Upstream Catchment)

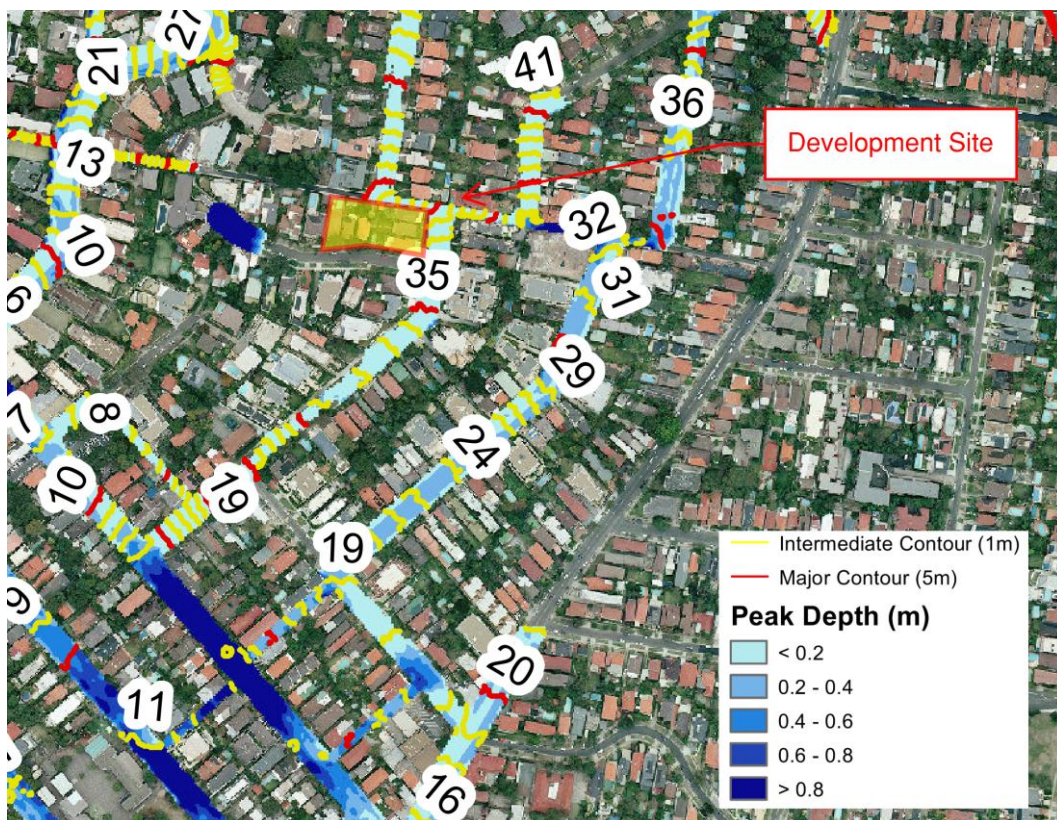


Figure A3 – PMF Flood Extent from 'The Rose Bay Flood Study' (Upstream Catchment)

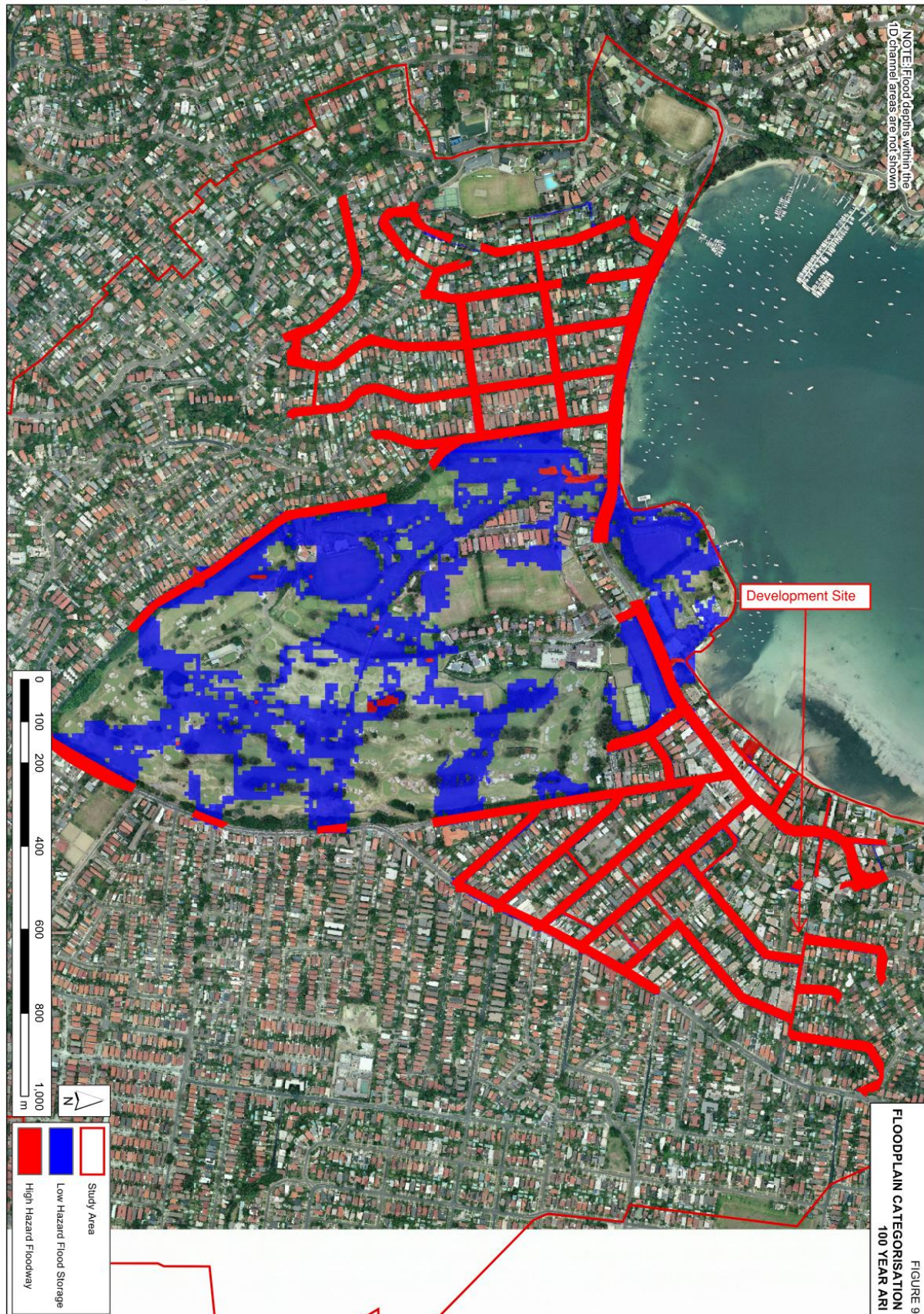


Figure A4 – 1% AEP Flood Hazard Category from ‘The Rose Bay Flood Study’



Figure A5 – RTS Civil Refined 1% AEP TUFLOW Model (NTS)

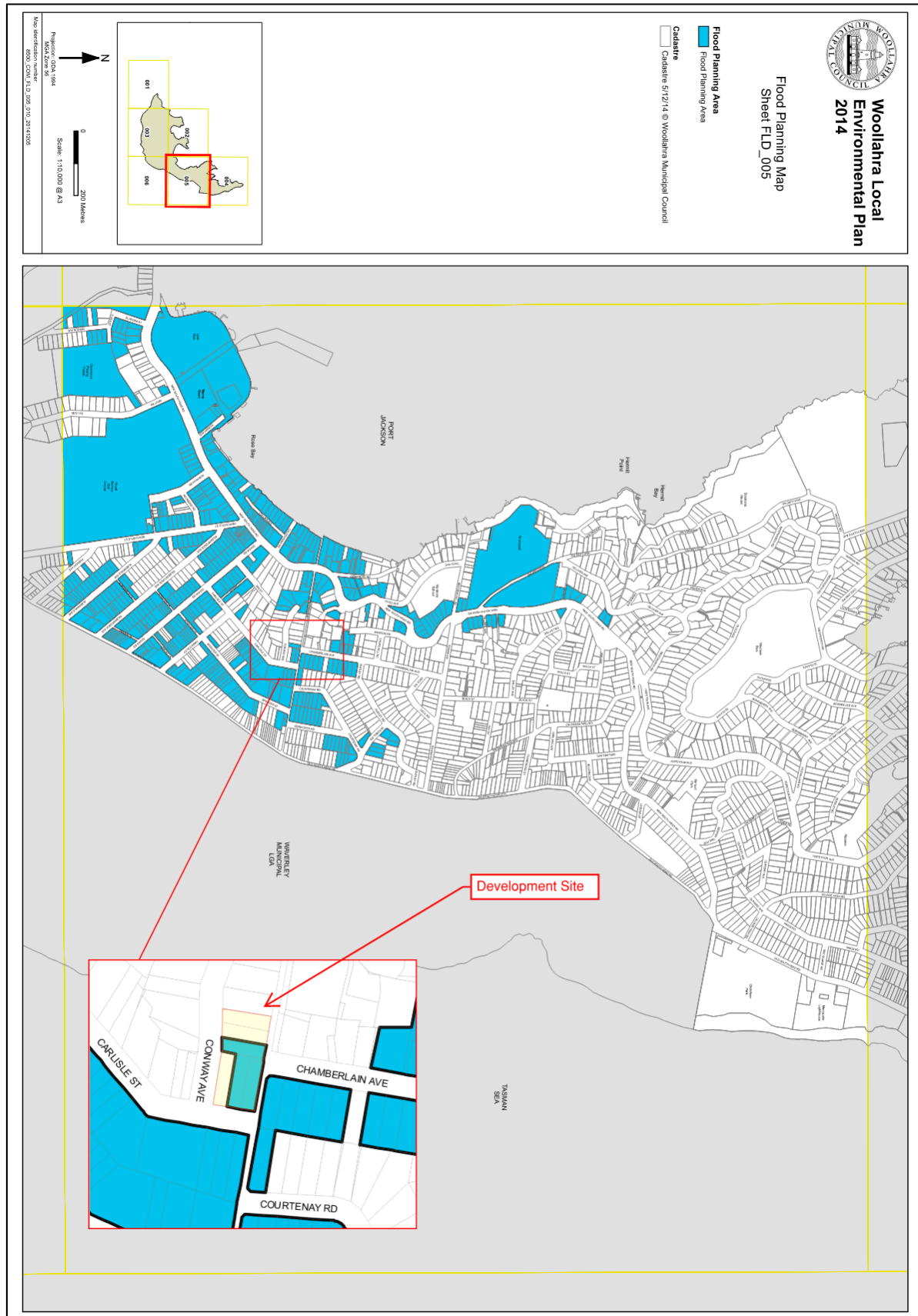


Figure A6 – RTS Flood Planning Map – Woollahra LEP 2014 (NTS)

APPENDIX A2 – MODEL DATA AND INFORMATION

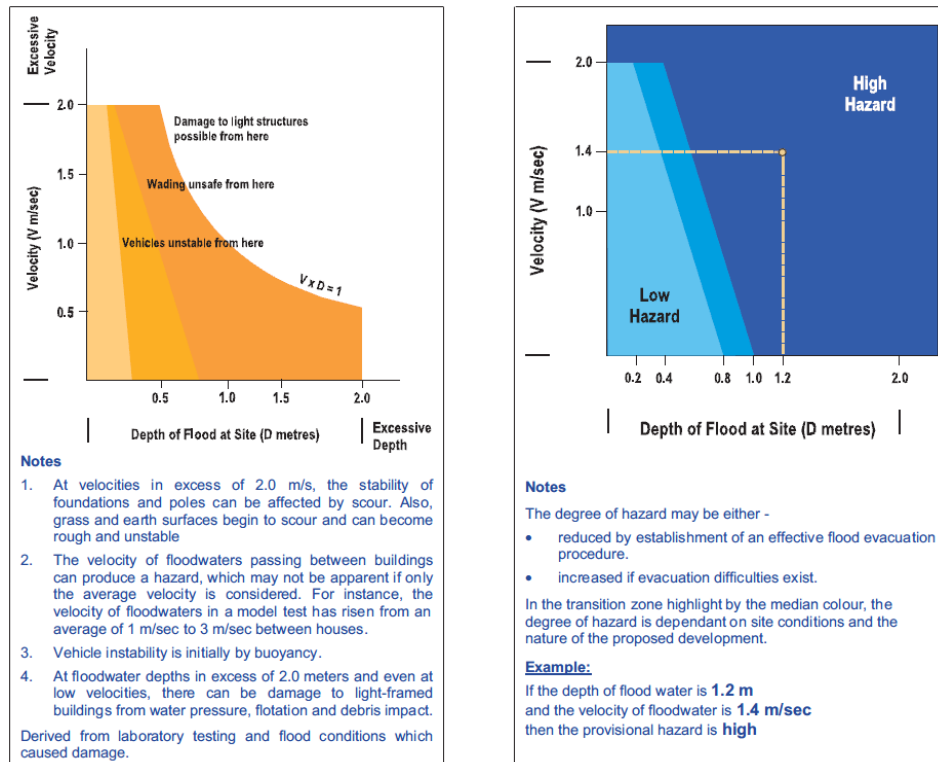


Figure A4 – Flood Hazard Curve Risk Level for the Development

Note: This information is based on the NSW Government Floodplain Management Manual (2005)

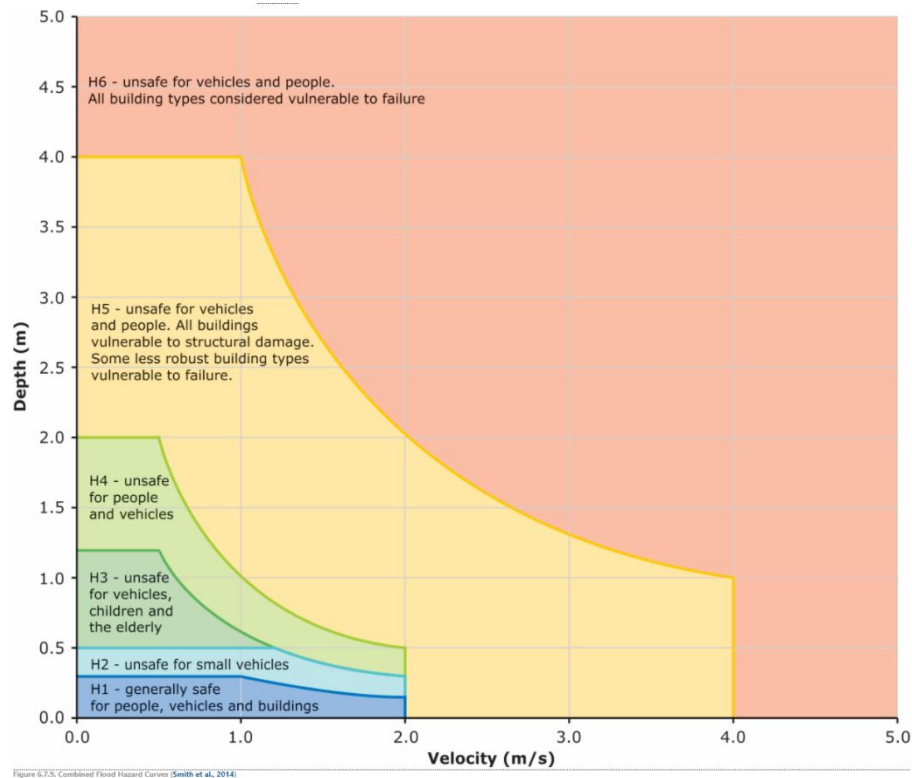


Figure A5 – Combined Flood Hazard Curves



Location

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IFD Design Rainfall Depth (mm)

Issued: 07 December 2025

Rainfall depth for Durations, Exceedance per Year (EY), and Annual Exceedance Probabilities (AEP).
[FAQ for New ARR probability terminology](#)

Unit: mm

	Annual Exceedance Probability (AEP)						
Duration	63.2%	50%#	20%*	10%	5%	2%	1%
1 min	2.48	2.78	3.72	4.37	5.01	5.86	6.52
2 min	4.17	4.65	6.14	7.15	8.15	9.53	10.6
3 min	5.77	6.43	8.52	9.95	11.3	13.3	14.8
4 min	7.20	8.04	10.7	12.5	14.3	16.7	18.6
5 min	8.48	9.49	12.7	14.8	17.0	19.9	22.1
10 min	13.3	15.0	20.1	23.6	27.1	31.7	35.3
15 min	16.6	18.7	25.1	29.6	33.9	39.7	44.1
20 min	19.1	21.5	28.9	33.9	38.9	45.5	50.6
25 min	21.1	23.7	31.9	37.4	42.9	50.2	55.8
30 min	22.8	25.6	34.3	40.3	46.2	54.0	60.1
45 min	26.8	30.0	40.0	46.9	53.8	63.0	70.1
1 hour	29.8	33.3	44.3	51.9	59.5	69.7	77.7
1.5 hour	34.4	38.3	50.9	59.7	68.4	80.3	89.8
2 hour	38.0	42.4	56.2	65.9	75.7	89.0	99.6
3 hour	44.0	48.9	64.9	76.3	87.8	104	116
4.5 hour	51.0	56.7	75.6	89.1	103	122	137
6 hour	56.8	63.3	84.6	100	116	138	156
9 hour	66.5	74.2	100.0	119	138	165	187
12 hour	74.4	83.2	113	135	157	188	213
18 hour	87.1	97.9	134	161	188	226	257
24 hour	97.1	110	151	182	213	257	291
30 hour	105	119	165	199	234	281	319
36 hour	112	127	177	214	251	302	342
48 hour	124	141	196	237	278	335	378
72 hour	140	159	223	269	315	376	424
96 hour	151	172	241	289	337	401	450
120 hour	159	181	253	302	351	416	466

144 hour	165	188	261	312	361	426	475
168 hour	171	194	268	319	368	433	480

Note:
The 50% AEP IFD **does not** correspond to the 2 year Average Recurrence Interval (ARI) IFD.
Rather it corresponds to the 1.44 ARI.
* The 20% AEP IFD **does not** correspond to the 5 year Average Recurrence Interval (ARI) IFD.
Rather it corresponds to the 4.48 ARI.

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IFD Design Rainfall Intensity (mm/h)

Issued: 07 December 2025

Rainfall intensity for Durations, Exceedance per Year (EY), and Annual Exceedance Probabilities (AEP).

[FAQ for New ARR probability terminology](#)

Unit: mm/h ▼

Duration	Annual Exceedance Probability (AEP)						
	63.2%	50%#	20%*	10%	5%	2%	1%
1 min	149	167	223	262	301	352	391
2 min	125	139	184	215	244	286	319
3 min	115	129	170	199	227	266	296
4 min	108	121	160	188	215	251	280
5 min	102	114	152	178	204	239	265
10 min	79.9	89.7	121	142	163	190	212
15 min	66.5	74.7	101	118	136	159	176
20 min	57.4	64.4	86.6	102	117	137	152
25 min	50.7	56.9	76.4	89.8	103	120	134
30 min	45.7	51.2	68.7	80.6	92.4	108	120
45 min	35.7	39.9	53.4	62.6	71.7	83.9	93.5
1 hour	29.8	33.3	44.3	51.9	59.5	69.7	77.7
1.5 hour	22.9	25.6	34.0	39.8	45.6	53.6	59.8
2 hour	19.0	21.2	28.1	33.0	37.8	44.5	49.8
3 hour	14.7	16.3	21.6	25.4	29.3	34.6	38.8
4.5 hour	11.3	12.6	16.8	19.8	22.9	27.1	30.5
6 hour	9.47	10.5	14.1	16.7	19.3	23.0	25.9
9 hour	7.39	8.25	11.1	13.2	15.4	18.4	20.8
12 hour	6.20	6.94	9.41	11.2	13.1	15.7	17.8
18 hour	4.84	5.44	7.45	8.93	10.5	12.6	14.3
24 hour	4.05	4.56	6.29	7.57	8.89	10.7	12.1
30 hour	3.51	3.97	5.51	6.63	7.80	9.38	10.6
36 hour	3.12	3.54	4.92	5.93	6.98	8.39	9.51
48 hour	2.58	2.93	4.09	4.94	5.80	6.97	7.88
72 hour	1.94	2.21	3.10	3.73	4.37	5.23	5.89
96 hour	1.57	1.79	2.51	3.01	3.51	4.18	4.69
120 hour	1.32	1.51	2.10	2.52	2.93	3.47	3.88

144 hour	1.15	1.31	1.81	2.16	2.51	2.96	3.30
168 hour	1.02	1.16	1.60	1.90	2.19	2.57	2.86

Note:
The 50% AEP IFD **does not** correspond to the 2 year Average Recurrence Interval (ARI) IFD.
Rather it corresponds to the 1.44 ARI.
* The 20% AEP IFD **does not** correspond to the 5 year Average Recurrence Interval (ARI) IFD.
Rather it corresponds to the 4.48 ARI.

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Rare Design Rainfall Intensity (mm/h)

Issued: 07 December 2025

Rainfall intensity for Durations, Exceedance per Year (EY), and Annual Exceedance Probabilities (AEP).

[FAQ for New ARR probability terminology](#)

Duration	Annual Exceedance Probability (1 in x)				
	1 in 100	1 in 200	1 in 500	1 in 1000	1 in 2000
1 min	391	424	480	523	567
2 min	319	350	399	435	473
3 min	296	324	368	402	436
4 min	280	305	346	377	409
5 min	265	288	327	356	386
10 min	212	229	259	282	305
15 min	176	191	216	235	255
20 min	152	164	186	203	220
25 min	134	145	164	179	194
30 min	120	130	148	161	175
45 min	93.5	102	115	126	136
1 hour	77.7	84.6	96.0	105	113
1.5 hour	59.8	65.1	73.8	80.5	87.2
2 hour	49.8	54.1	61.3	66.8	72.4
3 hour	38.8	42.0	47.5	51.7	56.0
4.5 hour	30.5	32.9	37.2	40.5	43.8
6 hour	25.9	27.9	31.5	34.3	37.0
9 hour	20.8	22.3	25.1	27.4	29.6
12 hour	17.8	19.1	21.5	23.4	25.3
18 hour	14.3	15.4	17.4	18.9	20.5
24 hour	12.1	13.1	14.9	16.2	17.6
30 hour	10.6	11.9	13.6	15.0	16.4
36 hour	9.51	10.7	12.4	13.7	15.1
48 hour	7.88	8.95	10.3	11.4	12.6
72 hour	5.89	6.61	7.57	8.30	9.06
96 hour	4.69	5.20	5.90	6.43	6.97
120 hour	3.88	4.28	4.81	5.24	5.66

144 hour	3.30	3.62	4.06	4.43	4.78
168 hour	2.86	3.14	3.51	3.85	4.17

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Rare Design Rainfall Depth (mm)

Issued: 07 December 2025

Rainfall depth for Durations, Exceedance per Year (EY), and Annual Exceedance Probabilities (AEP).

[FAQ for New ARR probability terminology](#)

Duration	Annual Exceedance Probability (1 in x)				
	1 in 100	1 in 200	1 in 500	1 in 1000	1 in 2000
1 min	6.52	7.07	8.00	8.72	9.45
2 min	10.6	11.7	13.3	14.5	15.8
3 min	14.8	16.2	18.4	20.1	21.8
4 min	18.6	20.3	23.1	25.1	27.3
5 min	22.1	24.0	27.2	29.7	32.2
10 min	35.3	38.1	43.1	47.0	50.9
15 min	44.1	47.7	53.9	58.8	63.6
20 min	50.6	54.8	62.0	67.6	73.3
25 min	55.8	60.5	68.5	74.7	80.9
30 min	60.1	65.2	73.9	80.6	87.4
45 min	70.1	76.2	86.5	94.3	102
1 hour	77.7	84.6	96.0	105	113
1.5 hour	89.8	97.6	111	121	131
2 hour	99.6	108	123	134	145
3 hour	116	126	143	155	168
4.5 hour	137	148	167	182	197
6 hour	156	167	189	206	222
9 hour	187	201	226	246	266
12 hour	213	229	258	281	304
18 hour	257	277	313	341	368
24 hour	291	315	357	389	422
30 hour	319	356	408	450	493
36 hour	342	387	445	494	543
48 hour	378	429	495	548	604
72 hour	424	476	545	598	652
96 hour	450	500	566	617	669
120 hour	466	513	578	629	679

144 hour	475	522	585	638	689
168 hour	480	528	590	647	700

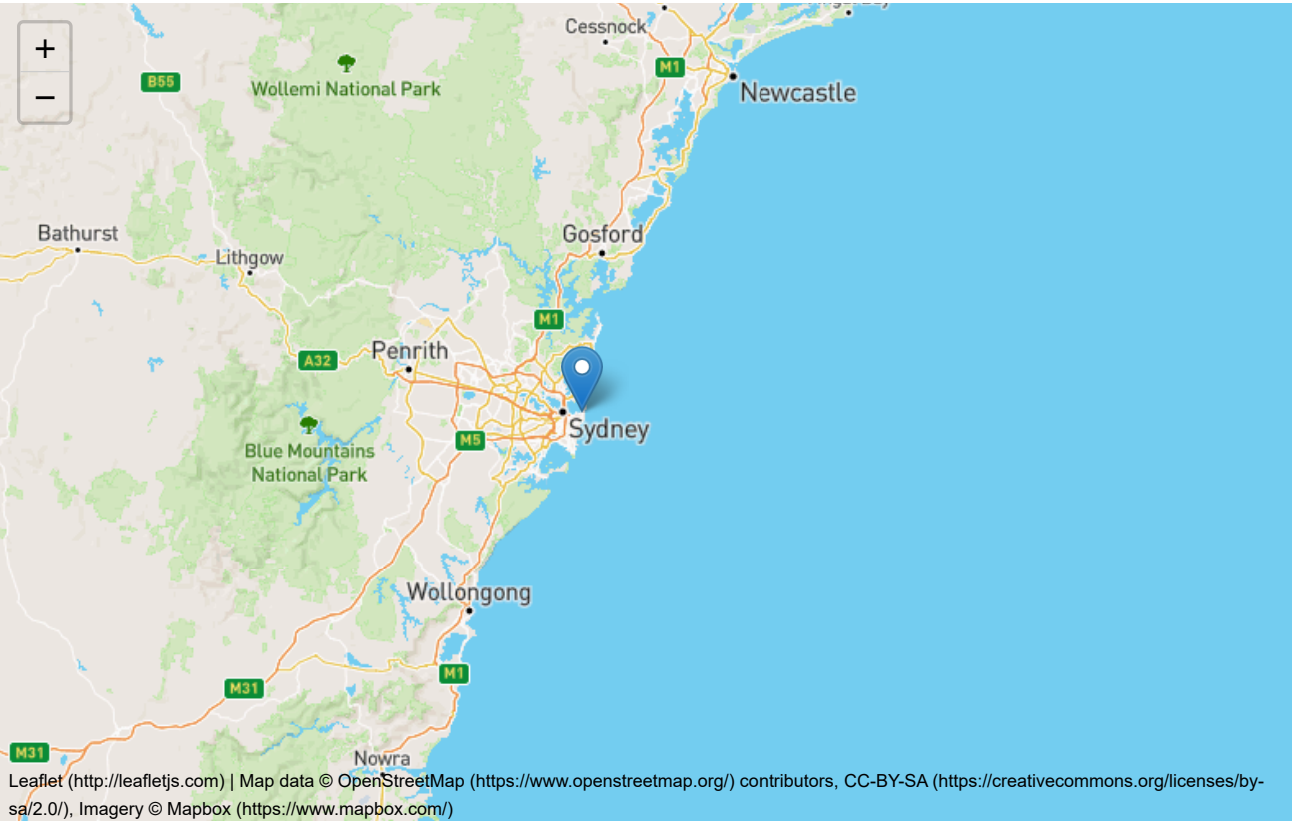
This page was created at **12:04 on Sunday 07 December 2025 (AEDT)**

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Australian Rainfall & Runoff Data Hub - Results

Input Data

Longitude	151.273
Latitude	-33.869
Selected Regions (clear)	
River Region	show
ARF Parameters	show
Storm Losses	show
Temporal Patterns	show
Areal Temporal Patterns	show
BOM IFDs	show
Median Preburst Depths and Ratios	show
10% Preburst Depths	show
25% Preburst Depths	show
75% Preburst Depths	show
90% Preburst Depths	show
Climate Change Factors	show
Probability Neutral Burst Initial Loss (/nsw_specific)	show



Data

River Region

Division	South East Coast (NSW)
River Number	13
River Name	Sydney Coast-Georges River

Layer Info

Time Accessed	07 December 2025 12:00PM
Version	2016_v1

ARF Parameters

$$ARF = Min \left\{ 1, \left[1 - a \left(Area^b - c \log_{10} Duration \right) Duration^{-d} + e Area^f Duration^g (0.3 + \log_{10} AEP) + h 10^{i Area \frac{Duration}{1440}} (0.3 + \log_{10} AEP) \right] \right\}$$

Zone	a	b	c	d	e	f	g	h	i
SE Coast	0.06	0.361	0.0	0.317	8.11e-05	0.651	0.0	0.0	0.0

Short Duration ARF

$$ARF = Min \left[1, 1 - 0.287 \left(Area^{0.265} - 0.439 \log_{10}(Duration) \right) . Duration^{-0.36} + 2.26 \times 10^{-3} \times Area^{0.226} . Duration^{0.125} (0.3 + \log_{10}(AEP)) + 0.0141 \times Area^{0.213} \times 10^{-0.021 \frac{(Duration-180)^2}{1440}} (0.3 + \log_{10}(AEP)) \right]$$

Layer Info

Time Accessed	07 December 2025 12:00PM
Version	2016_v1

Storm Losses

Note: Burst Loss = Storm Loss - Preburst

Note: These losses are only for rural use and are **NOT FOR DIRECT USE** in urban areas

Note: As this point is in NSW the advice provided on losses and pre-burst on the NSW Specific Tab of the ARR Data Hub (.nsw_specific) is to be considered. In NSW losses are derived considering a hierarchy of approaches depending on the available loss information. The continuing storm loss information from the ARR Datahub provided below should only be used where relevant under the loss hierarchy (level 5) and where used is to be multiplied by the factor of 0.4.

ID	17135.0
Storm Initial Losses (mm)	28.0
Storm Continuing Losses (mm/h)	1.6

Layer Info

Time Accessed	07 December 2025 12:00PM
Version	2016_v1

Temporal Patterns | Download (.zip) (static/temporal_patterns/TP/ECsouth.zip)

code	ECsouth
Label	East Coast South

Layer Info

Time Accessed	07 December 2025 12:00PM
Version	2016_v2

Areal Temporal Patterns | Download (.zip) (./static/temporal_patterns/Areal/Areal_ECsouth.zip)

code	ECsouth
arealabel	East Coast South

Layer Info

Time Accessed	07 December 2025 12:00PM
Version	2016_v2

BOM IFDs

Click here (http://www.bom.gov.au/water/designRainfalls/revised-ifd/?year=2016&coordinate_type=dd&latitude=-33.8687285278&longitude=151.273319979&sadmin=true&sdhr=true&sdday=true&user_label=) to obtain the IFD depths for catchment centroid from the BoM website

Layer Info

Time Accessed	07 December 2025 12:00PM
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Median Preburst Depths and Ratios

Values are of the format depth (ratio) with depth in mm

min (h)\AEP(%)	50	20	10	5	2	1
60 (1.0)	12.0 (0.362)	8.3 (0.188)	5.9 (0.113)	3.5 (0.059)	2.1 (0.030)	1.1 (0.014)
90 (1.5)	13.4 (0.350)	9.8 (0.192)	7.4 (0.123)	5.0 (0.074)	2.7 (0.034)	1.0 (0.011)
120 (2.0)	9.3 (0.219)	8.4 (0.150)	7.9 (0.119)	7.3 (0.097)	4.3 (0.048)	2.0 (0.020)
180 (3.0)	8.0 (0.163)	7.1 (0.110)	6.6 (0.086)	6.1 (0.069)	7.2 (0.069)	8.1 (0.069)
360 (6.0)	11.8 (0.186)	21.4 (0.253)	27.8 (0.278)	33.9 (0.293)	25.2 (0.183)	18.6 (0.120)
720 (12.0)	3.5 (0.042)	10.0 (0.089)	14.4 (0.107)	18.5 (0.118)	26.3 (0.140)	32.2 (0.151)
1080 (18.0)	3.9 (0.040)	9.3 (0.070)	12.9 (0.080)	16.4 (0.087)	26.4 (0.116)	33.8 (0.132)
1440 (24.0)	1.0 (0.009)	5.4 (0.036)	8.3 (0.046)	11.1 (0.052)	20.7 (0.081)	27.9 (0.096)
2160 (36.0)	0.0 (0.000)	2.6 (0.015)	4.3 (0.020)	6.0 (0.024)	9.2 (0.030)	11.6 (0.034)
2880 (48.0)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	1.8 (0.005)	3.2 (0.008)
4320 (72.0)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.9 (0.002)	1.5 (0.004)

Layer Info

Time Accessed	07 December 2025 12:00PM
Version	2018_v1
Note	Preburst interpolation methods for catchment wide preburst has been slightly altered. Point values remain unchanged.

10% Preburst Depths

Values are of the format depth (ratio) with depth in mm

min (h)\AEP(%)	50	20	10	5	2	1
60 (1.0)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)
90 (1.5)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)
120 (2.0)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)
180 (3.0)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)
360 (6.0)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)
720 (12.0)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)
1080 (18.0)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)
1440 (24.0)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)
2160 (36.0)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)
2880 (48.0)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)
4320 (72.0)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)

Layer Info

Time Accessed	07 December 2025 12:00PM
Version	2018_v1
Note	Preburst interpolation methods for catchment wide preburst has been slightly altered. Point values remain unchanged.

25% Preburst Depths

Values are of the format depth (ratio) with depth in mm

min (h)\AEP(%)	50	20	10	5	2	1
60 (1.0)	0.5 (0.015)	0.3 (0.006)	0.1 (0.003)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)
90 (1.5)	0.4 (0.010)	0.2 (0.004)	0.1 (0.002)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)
120 (2.0)	0.2 (0.004)	0.1 (0.002)	0.0 (0.001)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)
180 (3.0)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)
360 (6.0)	0.5 (0.008)	0.8 (0.009)	1.0 (0.010)	1.2 (0.010)	0.5 (0.004)	0.0 (0.000)
720 (12.0)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.1 (0.001)	0.2 (0.001)
1080 (18.0)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	2.3 (0.010)	4.0 (0.015)
1440 (24.0)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	1.3 (0.005)	2.3 (0.008)
2160 (36.0)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)
2880 (48.0)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)
4320 (72.0)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)	0.0 (0.000)

Layer Info

Time Accessed	07 December 2025 12:00PM
Version	2018_v1
Note	Preburst interpolation methods for catchment wide preburst has been slightly altered. Point values remain unchanged.

75% Preburst Depths

Values are of the format depth (ratio) with depth in mm

min (h)\AEP(%)	50	20	10	5	2	1
60 (1.0)	46.5 (1.397)	41.4 (0.934)	38.0 (0.732)	34.8 (0.585)	28.1 (0.403)	23.1 (0.298)
90 (1.5)	47.8 (1.246)	41.3 (0.812)	37.1 (0.621)	33.0 (0.482)	28.8 (0.358)	25.6 (0.286)
120 (2.0)	42.0 (0.992)	41.5 (0.737)	41.1 (0.623)	40.7 (0.538)	40.4 (0.454)	40.2 (0.403)
180 (3.0)	52.2 (1.067)	48.9 (0.754)	46.8 (0.613)	44.8 (0.510)	57.3 (0.553)	66.7 (0.573)
360 (6.0)	43.8 (0.692)	61.2 (0.723)	72.8 (0.727)	83.9 (0.723)	93.3 (0.676)	100.4 (0.645)
720 (12.0)	22.5 (0.270)	37.6 (0.333)	47.7 (0.354)	57.3 (0.364)	72.4 (0.384)	83.7 (0.393)
1080 (18.0)	23.8 (0.243)	39.7 (0.296)	50.3 (0.313)	60.4 (0.321)	74.0 (0.327)	84.2 (0.328)
1440 (24.0)	11.9 (0.109)	28.6 (0.189)	39.6 (0.218)	50.2 (0.235)	62.0 (0.242)	70.8 (0.243)
2160 (36.0)	8.0 (0.063)	21.2 (0.119)	29.9 (0.140)	38.2 (0.152)	51.8 (0.171)	62.0 (0.181)
2880 (48.0)	2.5 (0.018)	7.4 (0.038)	10.7 (0.045)	13.8 (0.050)	22.7 (0.068)	29.4 (0.078)
4320 (72.0)	0.0 (0.000)	0.9 (0.004)	1.6 (0.006)	2.2 (0.007)	20.2 (0.054)	33.7 (0.079)

Layer Info

Time Accessed	07 December 2025 12:00PM
Version	2018_v1
Note	Prebust interpolation methods for catchment wide preburst has been slightly altered. Point values remain unchanged.

90% Preburst Depths

Values are of the format depth (ratio) with depth in mm

min (h)\AEP(%)	50	20	10	5	2	1
60 (1.0)	98.8 (2.972)	98.7 (2.228)	98.7 (1.899)	98.6 (1.657)	105.6 (1.514)	110.8 (1.426)
90 (1.5)	107.9 (2.816)	116.2 (2.281)	121.7 (2.038)	126.9 (1.855)	124.4 (1.549)	122.6 (1.365)
120 (2.0)	90.6 (2.139)	102.9 (1.830)	111.0 (1.684)	118.8 (1.571)	118.8 (1.335)	118.8 (1.193)
180 (3.0)	90.5 (1.851)	123.2 (1.897)	144.8 (1.899)	165.6 (1.886)	149.7 (1.444)	137.7 (1.184)
360 (6.0)	80.6 (1.273)	107.1 (1.265)	124.7 (1.245)	141.5 (1.220)	164.3 (1.191)	181.3 (1.165)
720 (12.0)	45.1 (0.542)	77.8 (0.689)	99.3 (0.738)	120.1 (0.763)	138.4 (0.735)	152.2 (0.714)
1080 (18.0)	53.4 (0.546)	82.4 (0.615)	101.6 (0.633)	120.1 (0.637)	144.6 (0.639)	163.0 (0.635)
1440 (24.0)	46.4 (0.424)	75.8 (0.502)	95.2 (0.524)	113.8 (0.533)	121.8 (0.475)	127.8 (0.439)
2160 (36.0)	28.5 (0.224)	49.6 (0.280)	63.6 (0.298)	77.0 (0.307)	100.5 (0.333)	118.2 (0.345)
2880 (48.0)	15.8 (0.112)	40.1 (0.204)	56.2 (0.237)	71.7 (0.257)	90.2 (0.270)	104.1 (0.275)
4320 (72.0)	10.0 (0.063)	21.7 (0.097)	29.4 (0.109)	36.8 (0.117)	62.5 (0.166)	81.7 (0.193)

Layer Info

Time Accessed	07 December 2025 12:00PM
Version	2018_v1
Note	Preburst interpolation methods for catchment wide preburst has been slightly altered. Point values remain unchanged.

Climate Change Factors

Rainfall Factors

SSP1-2.6

Year	<1 hour	1.5 Hours	2 Hours	3 Hours	4.5 Hours	6 Hours	9 Hours	12 Hours	18 Hours	>24 Hours
2030	1.18	1.17	1.16	1.14	1.13	1.12	1.12	1.11	1.1	1.1
2040	1.21	1.19	1.17	1.16	1.15	1.14	1.13	1.12	1.11	1.11
2050	1.22	1.2	1.18	1.17	1.15	1.15	1.14	1.13	1.12	1.11
2060	1.23	1.21	1.2	1.18	1.17	1.16	1.15	1.14	1.13	1.12
2070	1.24	1.22	1.2	1.18	1.17	1.16	1.15	1.14	1.13	1.12
2080	1.23	1.21	1.2	1.18	1.17	1.16	1.15	1.14	1.13	1.12
2090	1.23	1.21	1.2	1.18	1.17	1.16	1.15	1.14	1.13	1.12
2100	1.22	1.2	1.19	1.17	1.16	1.15	1.14	1.13	1.12	1.12

SSP2-4.5

Year	<1 hour	1.5 Hours	2 Hours	3 Hours	4.5 Hours	6 Hours	9 Hours	12 Hours	18 Hours	>24 Hours
2030	1.18	1.17	1.16	1.14	1.13	1.12	1.12	1.11	1.1	1.1
2040	1.22	1.2	1.19	1.17	1.16	1.15	1.14	1.13	1.12	1.12
2050	1.27	1.24	1.23	1.21	1.19	1.18	1.17	1.16	1.15	1.14
2060	1.3	1.27	1.25	1.23	1.21	1.2	1.19	1.18	1.16	1.16
2070	1.33	1.3	1.28	1.26	1.24	1.22	1.21	1.19	1.18	1.17
2080	1.37	1.33	1.31	1.28	1.26	1.24	1.22	1.21	1.2	1.19
2090	1.4	1.36	1.34	1.31	1.28	1.26	1.24	1.23	1.21	1.2
2100	1.41	1.37	1.35	1.32	1.29	1.27	1.25	1.24	1.22	1.21

SSP3-7.0

Year	<1 hour	1.5 Hours	2 Hours	3 Hours	4.5 Hours	6 Hours	9 Hours	12 Hours	18 Hours	>24 Hours
2030	1.18	1.17	1.16	1.14	1.13	1.12	1.12	1.11	1.1	1.1
2040	1.23	1.21	1.2	1.18	1.17	1.16	1.15	1.14	1.13	1.12
2050	1.29	1.26	1.24	1.22	1.2	1.19	1.18	1.17	1.16	1.15
2060	1.35	1.32	1.3	1.27	1.25	1.23	1.22	1.2	1.19	1.18
2070	1.42	1.38	1.35	1.32	1.29	1.28	1.26	1.24	1.22	1.21
2080	1.5	1.45	1.42	1.38	1.35	1.33	1.3	1.28	1.26	1.25
2090	1.59	1.53	1.49	1.44	1.4	1.38	1.35	1.33	1.3	1.29
2100	1.66	1.59	1.55	1.5	1.45	1.42	1.39	1.37	1.34	1.32

SSP5-8.5

Year	<1 hour	1.5 Hours	2 Hours	3 Hours	4.5 Hours	6 Hours	9 Hours	12 Hours	18 Hours	>24 Hours
2030	1.2	1.18	1.17	1.16	1.14	1.13	1.13	1.12	1.11	1.11
2040	1.26	1.24	1.22	1.2	1.18	1.17	1.16	1.15	1.14	1.14
2050	1.34	1.31	1.29	1.26	1.24	1.23	1.21	1.2	1.18	1.18
2060	1.42	1.38	1.35	1.32	1.29	1.28	1.26	1.24	1.22	1.21
2070	1.52	1.47	1.43	1.4	1.36	1.34	1.31	1.29	1.27	1.26
2080	1.63	1.57	1.52	1.48	1.43	1.4	1.37	1.35	1.33	1.31
2090	1.77	1.69	1.64	1.58	1.52	1.49	1.45	1.42	1.39	1.37
2100	1.86	1.77	1.71	1.64	1.58	1.54	1.5	1.47	1.43	1.41

Loss Factors

Initial Loss (Adjustment Factors)

	Losses SSP1-2.6	Losses SSP2-4.5	Losses SSP3-7.0	Losses SSP5-8.5
2030	1.02	1.02	1.02	1.03
2040	1.03	1.03	1.03	1.03
2050	1.03	1.03	1.04	1.04
2060	1.03	1.04	1.04	1.05
2070	1.03	1.04	1.05	1.06
2080	1.03	1.05	1.06	1.07
2090	1.03	1.05	1.07	1.08
2100	1.03	1.05	1.07	1.09

Continuing Loss (Adjustment Factors)

	Losses SSP1-2.6	Losses SSP2-4.5	Losses SSP3-7.0	Losses SSP5-8.5
2030	1.04	1.05	1.05	1.05
2040	1.05	1.05	1.06	1.06
2050	1.06	1.06	1.07	1.08
2060	1.06	1.07	1.08	1.1
2070	1.06	1.08	1.1	1.12
2080	1.06	1.09	1.11	1.14
2090	1.06	1.09	1.13	1.16
2100	1.06	1.1	1.14	1.18

Temperature Changes (Degrees, Relative to 1961-1990 Baseline)

Year	SSP1-2.6	SSP2-4.5	SSP3-7.0	SSP5-8.5
2030	1.2	1.2	1.2	1.3
2040	1.3	1.4	1.5	1.6

Year	SSP1-2.6	SSP2-4.5	SSP3-7.0	SSP5-8.5
2050	1.4	1.7	1.8	2.1
2060	1.5	1.9	2.2	2.5
2070	1.5	2.1	2.5	3
2080	1.5	2.2	2.9	3.5
2090	1.5	2.4	3.3	4.1
2100	1.4	2.5	3.6	4.5

Layer Info

Time Accessed	07 December 2025 12:00PM
Version	2024_v1
Note	Updated climate change factors for IFD Initial loss and continuing loss based on IPCC AR6 temperature increases from the updated Climate Change Considerations (Book 1: Chapter 6) in ARR (Version 4.2). ARR recommends the use of Current and near-term (2030 midpoint). Medium-term (2050 midpoint) and Long-term (2090 midpoint)

Probability Neutral Burst Initial Loss

min (h)AEP(%)	50.0	20.0	10.0	5.0	2.0	1.0
60 (1.0)	11.6	7.8	8.9	8.5	8.2	6.4
90 (1.5)	11.9	8.3	9.5	9.5	9.4	6.5
120 (2.0)	13.3	8.9	9.9	9.7	9.4	5.7
180 (3.0)	13.3	9.7	10.7	10.2	8.8	4.5
360 (6.0)	13.0	8.8	8.6	7.9	9.0	3.0
720 (12.0)	18.3	13.0	12.7	10.9	12.1	3.2
1080 (18.0)	18.6	13.6	14.4	12.0	12.4	3.9
1440 (24.0)	21.6	16.4	16.5	14.2	14.9	4.4
2160 (36.0)	24.7	19.0	18.6	15.8	16.7	6.3
2880 (48.0)	27.7	22.4	21.7	23.1	19.9	9.5
4320 (72.0)	29.6	25.7	25.8	26.5	22.3	10.4

Layer Info

Time Accessed	07 December 2025 12:00PM
Version	2018_v1
Note	As this point is in NSW the advice provided on losses and pre-burst on the NSW Specific Tab of the ARR Data Hub (./nsw_specific) is to be considered. In NSW losses are derived considering a hierarchy of approaches depending on the available loss information. Probability neutral burst initial loss values for NSW are to be used in place of the standard initial loss and pre-burst as per the losses hierarchy.

Download TXT (downloads/4bf8e3c9-6b86-4989-b09e-9248097e6be1.txt)

Download JSON (downloads/03af5faa-18f1-4fe1-9238-ebb5f740be52.json)

Generating PDF... (downloads/b09e1a66-24fd-4c95-848c-3a6b8496c911.pdf)



ARRv4.2 Climate Change Factors

Inputs

Selected SSP: SSP3-7.0

Target/Design Year: 2090

Initial Losses

Input Initial Loss: 28.0 mm

Initial Loss Multiplier: 1.07

New Initial Loss: 29.96 mm

Continuing Losses

Input Cont. Loss: 1.6 mm/hr

Cont. Loss Multiplier: 1.13

New Cont. Loss: 1.808 mm/hr

3.3°C

of warming from a 1990 baseline.

Burst Duration	Duration in Mins	Depth Factor	α %/°C	Total % Increase
≤1 hour	60	1.59	15.1%	59.0%
1.5 Hours	90	1.53	13.8%	53.0%
2 Hours	120	1.49	12.8%	49.0%
3 Hours	180	1.44	11.7%	44.0%
4.5 Hours	270	1.4	10.7%	40.0%
6 Hours	360	1.38	10.3%	38.0%
9 Hours	540	1.35	9.5%	35.0%
12 Hours	720	1.33	9.0%	33.0%
18 Hours	1080	1.3	8.3%	30.0%
≥24 Hours	1440	1.29	8.0%	29.0%

Modified BOM File

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*** DATA MODIFIED ON 2025-12-07 WITH CLIMATE CHANGE FACTORS FOR SS

All Design Rainfall Depth (mm)

Issued:,31 October 2025

Location Label:,

Requested coordinate:,Latitude,-33.8687285278,Longitude,151.2733199

Nearest grid cell:,Latitude,33.8625 (S),Longitude,151.2625 (E)

*** DATA MODIFIED ON 2025-12-07 WITH CLIMATE CHANGE FACTORS FOR SS

,,Exceedances per Year (EY),Annual Exceedance Probability (AEP)

Duration,Duration in min,12EY,6EY,4EY,3EY,2EY,63.2%,50%,0.5EY,20%,0

1 min,1,1.7967,2.0193,2.4168,2.7189,3.1482,3.9432,4.4202,4.8972,5.9

2 min,2,3.2118,3.5934,4.2612,4.7382,5.4219,6.6303,7.3935,8.2044,9.7

3 min,3,4.3725,4.9131,5.8512,6.5349,7.4889,9.1743,10.2237,11.3526,1

4 min,4,5.3424,6.0261,7.2345,8.0931,9.3174,11.448,12.7836,14.1828,1

5 min,5,6.1851,6.996,8.4429,9.4605,10.9233,13.4832,15.0891,16.695,2

10 min,10,9.2061,10.5099,12.8313,14.5008,16.854,21.147,23.85,26.394

15 min,15,11.2095,12.8472,15.7569,17.808,20.988,26.394,29.733,32.91

20 min,20,12.72,14.6121,17.967,20.352,24.009,30.369,34.185,37.842,4

25 min,25,13.9602,16.059,19.716,22.419,26.394,33.549,37.683,41.817,

30 min,30,14.9937,17.172,21.306,24.168,28.461,36.252,40.704,45.156,

45 min,45,17.49,20.034,24.645,28.143,33.231,42.612,47.7,52.947,63.6

1 hour,60,19.239,22.101,27.348,31.164,36.888,47.382,52.947,58.671,7

1.5 hour,90.0,21.267,24.48,30.294,34.578,40.851,52.632,58.599,65.02

2 hour,120,22.946,26.373,32.482,37.101,43.955,56.62,63.176,70.03,83

3 hour,180,25.344,29.232,36.144,41.328,49.104,63.36,70.416,78.192,9
4.5 hour,270.0,28.28,32.62,40.6,46.48,55.16,71.4,79.38,88.2,105.84,
6 hour,360,30.774,35.604,44.298,50.922,60.582,78.384,87.354,97.014,
9 hour,540,34.56,40.23,50.355,57.915,69.12,89.775,100.17,111.24,135
12 hour,720,37.506,43.89,55.195,63.574,76.076,98.952,110.656,122.89
18 hour,1080,42.12,49.4,62.53,72.28,86.71,113.23,127.27,141.7,174.2
24 hour,1440,45.795,53.922,68.628,79.593,95.718,125.259,141.9,157.3
30 hour,1800,49.02,57.921,74.046,86.043,103.587,135.45,153.51,170.2
36 hour,2160,51.729,61.275,78.561,91.332,110.295,144.48,163.83,181.
48 hour,2880,55.857,66.564,85.785,99.975,121.002,159.96,181.89,201.
72 hour,4320,61.146,73.401,95.589,111.972,135.45,180.6,205.11,228.3
96 hour,5760,64.242,77.658,101.91,119.841,145.77,194.79,221.88,246.
120 hour,7200,65.919,80.496,106.425,125.517,153.51,205.11,233.49,251.
144 hour,8640,66.822,82.173,109.65,130.29,159.96,212.85,242.52,269.
168 hour,10080,67.338,83.334,112.101,132.87,163.83,220.59,250.26,27

Modified ARR Datahub Text File

[Copy](#)[Download .txt](#)

Results - ARR Data Hub

[STARTTEXT]

Input Data Information

[INPUTDATA]

Latitude,-33.868729

Longitude,151.273320

[END_INPUTDATA]

River Region

[RIVREG]

Division,South East Coast (NSW)

River Number,13

River Name,Sydney Coast-Georges River

[RIVREG_META]

Time Accessed,28 October 2025 04:13PM

Version,2016_v1

[END_RIVREG]

ARF Parameters

[LONGARF]

Zone,SE Coast

a,0.06

b,0.361

c,0.0

d,0.317

e,8.11e-05

f,0.651

g,0.0
h,0.0
i,0.0
[LONGARF_META]
Time Accessed,28 October 2025 04:13PM
Version,2016_v1
[END_LONGARF]

Storm Losses
[LOSSES]
ID,17135.0
Storm Initial Losses (mm),29.96
Storm Continuing Losses (mm/h),1.808
[LOSSES_META]
*** DATA MODIFIED ON 2025-12-07 WITH CLIMATE CHANGE FACTORS FOR SSP
Time Accessed,28 October 2025 04:13PM
Version,2016_v1
[END_LOSSES]

Temporal Patterns
[TP]
code,ECsouth
Label,East Coast South
[TP_META]
Time Accessed,28 October 2025 04:13PM
Version,2016_v2
[END_TP]

Areal Temporal Patterns
[ATP]
code,ECsouth
arealabel,East Coast South
[ATP_META]
Time Accessed,28 October 2025 04:13PM
Version,2016_v2
[END_ATP]

Median Preburst Depths and Ratios
[PREBURST]
min (h)\AEP(%),50,20,10,5,2,1
60 (1.0),19.08 (0.362),13.197 (0.188),9.381 (0.113),5.565 (0.059),3
90 (1.5),20.502 (0.350),14.994 (0.192),11.322 (0.123),7.65 (0.074),
120 (2.0),13.857 (0.219),12.516 (0.150),11.771 (0.119),10.877 (0.09
180 (3.0),11.52 (0.163),10.224 (0.110),9.504 (0.086),8.784 (0.069),
360 (6.0),16.284 (0.186),29.532 (0.253),38.364 (0.278),46.782 (0.29
720 (12.0),4.655 (0.042),13.3 (0.089),19.152 (0.107),24.605 (0.118)
1080 (18.0),5.07 (0.040),12.09 (0.070),16.77 (0.080),21.32 (0.087),
1440 (24.0),1.29 (0.009),6.966 (0.036),10.707 (0.046),14.319 (0.052
2160 (36.0),0.0 (0.000),3.354 (0.015),5.547 (0.020),7.74 (0.024),11

2880 (48.0),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),2.322 (1
4320 (72.0),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),1.161 (1
[PREBURST_META]

*** DATA MODIFIED ON 2025-12-07 WITH CLIMATE CHANGE FACTORS FOR SSP
Time Accessed,28 October 2025 04:13PM

Version,2018_v1

Note,Preburst interpolation methods for catchment wide preburst has
[END_PREBURST]From preburst class

10% Preburst Depths

[PREBURST10]

min (h)\AEP(%),50,20,10,5,2,1

60 (1.0),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000)
90 (1.5),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000)
120 (2.0),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000)
180 (3.0),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000)
360 (6.0),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000)
720 (12.0),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000)
1080 (18.0),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000)
1440 (24.0),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000)
2160 (36.0),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000)
2880 (48.0),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000)
4320 (72.0),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000)

[PREBURST10_META]

*** DATA MODIFIED ON 2025-12-07 WITH CLIMATE CHANGE FACTORS FOR SSP
Time Accessed,28 October 2025 04:13PM

Version,2018_v1

Note,Preburst interpolation methods for catchment wide preburst has
[END_PREBURST10]From preburst class

25% Preburst Depths

[PREBURST25]

min (h)\AEP(%),50,20,10,5,2,1

60 (1.0),0.795 (0.015),0.477 (0.006),0.159 (0.003),0.0 (0.000),0.0 (0.000)
90 (1.5),0.612 (0.010),0.306 (0.004),0.153 (0.002),0.0 (0.000),0.0 (0.000)
120 (2.0),0.298 (0.004),0.149 (0.002),0.0 (0.001),0.0 (0.000),0.0 (0.000)
180 (3.0),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000)
360 (6.0),0.69 (0.008),1.104 (0.009),1.38 (0.010),1.656 (0.010),0.612 (0.005)
720 (12.0),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.133 (0.001)
1080 (18.0),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),2.99 (0.001)
1440 (24.0),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),1.677 (0.001)
2160 (36.0),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000)
2880 (48.0),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000)
4320 (72.0),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000),0.0 (0.000)

[PREBURST25_META]

*** DATA MODIFIED ON 2025-12-07 WITH CLIMATE CHANGE FACTORS FOR SSP
Time Accessed,28 October 2025 04:13PM

Version,2018_v1

Note,Preburst interpolation methods for catchment wide preburst has

[END_PREBURST25]From preburst class

75% Preburst Depths

[PREBURST75]

min (h)\AEP(%),50,20,10,5,2,1

60 (1.0),73.935 (1.397),65.826 (0.934),60.42 (0.732),55.332 (0.585)

90 (1.5),73.134 (1.246),63.189 (0.812),56.763 (0.621),50.49 (0.482)

120 (2.0),62.58 (0.992),61.835 (0.737),61.239 (0.623),60.643 (0.538)

180 (3.0),75.168 (1.067),70.416 (0.754),67.392 (0.613),64.512 (0.511)

360 (6.0),60.444 (0.692),84.456 (0.723),100.464 (0.727),115.782 (0.727)

720 (12.0),29.925 (0.270),50.008 (0.333),63.441 (0.354),76.209 (0.354)

1080 (18.0),30.94 (0.243),51.61 (0.296),65.39 (0.313),78.52 (0.321)

1440 (24.0),15.351 (0.109),36.894 (0.189),51.084 (0.218),64.758 (0.218)

2160 (36.0),10.32 (0.063),27.348 (0.119),38.571 (0.140),49.278 (0.140)

2880 (48.0),3.225 (0.018),9.546 (0.038),13.803 (0.045),17.802 (0.051)

4320 (72.0),0.0 (0.000),1.161 (0.004),2.064 (0.006),2.838 (0.007),2.838 (0.007)

[PREBURST75_META]

*** DATA MODIFIED ON 2025-12-07 WITH CLIMATE CHANGE FACTORS FOR SSP

Time Accessed,28 October 2025 04:13PM

Version,2018_v1

Note,Preburst interpolation methods for catchment wide preburst has

[END_PREBURST75]From preburst class

90% Preburst Depths

[PREBURST90]

min (h)\AEP(%),50,20,10,5,2,1

60 (1.0),157.092 (2.972),156.933 (2.228),156.933 (1.899),156.774 (1.899)

90 (1.5),165.087 (2.816),177.786 (2.281),186.201 (2.038),194.157 (2.038)

120 (2.0),134.994 (2.139),153.321 (1.830),165.39 (1.684),177.012 (1.684)

180 (3.0),130.32 (1.851),177.408 (1.897),208.512 (1.899),238.464 (1.899)

360 (6.0),111.228 (1.273),147.798 (1.265),172.086 (1.245),195.27 (1.245)

720 (12.0),59.983 (0.542),103.474 (0.689),132.069 (0.738),159.733 (0.738)

1080 (18.0),69.42 (0.546),107.12 (0.615),132.08 (0.633),156.13 (0.633)

1440 (24.0),59.856 (0.424),97.782 (0.502),122.808 (0.524),146.802 (0.524)

2160 (36.0),36.765 (0.224),63.984 (0.280),82.044 (0.298),99.33 (0.313)

2880 (48.0),20.382 (0.112),51.729 (0.204),72.498 (0.237),92.493 (0.237)

4320 (72.0),12.9 (0.063),27.993 (0.097),37.926 (0.109),47.472 (0.112)

[PREBURST90_META]

*** DATA MODIFIED ON 2025-12-07 WITH CLIMATE CHANGE FACTORS FOR SSP

Time Accessed,28 October 2025 04:13PM

Version,2018_v1

Note,Preburst interpolation methods for catchment wide preburst has

[END_PREBURST90]From preburst class

Climate Change Factors

[CCF]

[SSP1-2.6]

,<1 hour,1.5 Hours,2 Hours,3 Hours,4.5 Hours,6 Hours,9 Hours,12 Hours

2030,1.18,1.17,1.16,1.14,1.13,1.12,1.12,1.11,1.1,1.1

2040,1.21,1.19,1.17,1.16,1.15,1.14,1.13,1.12,1.11,1.11
 2050,1.22,1.2,1.18,1.17,1.15,1.15,1.14,1.13,1.12,1.11
 2060,1.23,1.21,1.2,1.18,1.17,1.16,1.15,1.14,1.13,1.12
 2070,1.24,1.22,1.2,1.18,1.17,1.16,1.15,1.14,1.13,1.12
 2080,1.23,1.21,1.2,1.18,1.17,1.16,1.15,1.14,1.13,1.12
 2090,1.23,1.21,1.2,1.18,1.17,1.16,1.15,1.14,1.13,1.12
 2100,1.22,1.2,1.19,1.17,1.16,1.15,1.14,1.13,1.12,1.12

[END_SSP1-2.6]

[SSP2-4.5]

,<1 hour,1.5 Hours,2 Hours,3 Hours,4.5 Hours,6 Hours,9 Hours,12 Hou

2030,1.18,1.17,1.16,1.14,1.13,1.12,1.12,1.11,1.1,1.1
 2040,1.22,1.2,1.19,1.17,1.16,1.15,1.14,1.13,1.12,1.12
 2050,1.27,1.24,1.23,1.21,1.19,1.18,1.17,1.16,1.15,1.14
 2060,1.3,1.27,1.25,1.23,1.21,1.2,1.19,1.18,1.16,1.16
 2070,1.33,1.3,1.28,1.26,1.24,1.22,1.21,1.19,1.18,1.17
 2080,1.37,1.33,1.31,1.28,1.26,1.24,1.22,1.21,1.2,1.19
 2090,1.4,1.36,1.34,1.31,1.28,1.26,1.24,1.23,1.21,1.2
 2100,1.41,1.37,1.35,1.32,1.29,1.27,1.25,1.24,1.22,1.21

[END_SSP2-4.5]

[SSP3-7.0]

,<1 hour,1.5 Hours,2 Hours,3 Hours,4.5 Hours,6 Hours,9 Hours,12 Hou

2030,1.18,1.17,1.16,1.14,1.13,1.12,1.12,1.11,1.1,1.1
 2040,1.23,1.21,1.2,1.18,1.17,1.16,1.15,1.14,1.13,1.12
 2050,1.29,1.26,1.24,1.22,1.2,1.19,1.18,1.17,1.16,1.15
 2060,1.35,1.32,1.3,1.27,1.25,1.23,1.22,1.2,1.19,1.18
 2070,1.42,1.38,1.35,1.32,1.29,1.28,1.26,1.24,1.22,1.21
 2080,1.5,1.45,1.42,1.38,1.35,1.33,1.3,1.28,1.26,1.25
 2090,1.59,1.53,1.49,1.44,1.4,1.38,1.35,1.33,1.3,1.29
 2100,1.66,1.59,1.55,1.5,1.45,1.42,1.39,1.37,1.34,1.32

[END_SSP3-7.0]

[SSP5-8.5]

,<1 hour,1.5 Hours,2 Hours,3 Hours,4.5 Hours,6 Hours,9 Hours,12 Hou

2030,1.2,1.18,1.17,1.16,1.14,1.13,1.13,1.12,1.11,1.11
 2040,1.26,1.24,1.22,1.2,1.18,1.17,1.16,1.15,1.14,1.14
 2050,1.34,1.31,1.29,1.26,1.24,1.23,1.21,1.2,1.18,1.18
 2060,1.42,1.38,1.35,1.32,1.29,1.28,1.26,1.24,1.22,1.21
 2070,1.52,1.47,1.43,1.4,1.36,1.34,1.31,1.29,1.27,1.26
 2080,1.63,1.57,1.52,1.48,1.43,1.4,1.37,1.35,1.33,1.31
 2090,1.77,1.69,1.64,1.58,1.52,1.49,1.45,1.42,1.39,1.37
 2100,1.86,1.77,1.71,1.64,1.58,1.54,1.5,1.47,1.43,1.41

[END_SSP5-8.5]

[Climate_Change_INITIAL_LOSS]

,Losses SSP1-2.6,Losses SSP2-4.5,Losses SSP3-7.0,Losses SSP5-8.5

2030,1.02,1.02,1.02,1.03
 2040,1.03,1.03,1.03,1.03
 2050,1.03,1.03,1.04,1.04
 2060,1.03,1.04,1.04,1.05
 2070,1.03,1.04,1.05,1.06
 2080,1.03,1.05,1.06,1.07

2090,1.03,1.05,1.07,1.08

2100,1.03,1.05,1.07,1.09

[END_Climate_Change_INITIAL_LOSS]

[Climate_Change_CONTINUING_LOSS]

, Losses SSP1-2.6, Losses SSP2-4.5, Losses SSP3-7.0, Losses SSP5-8.5

2030,1.04,1.05,1.05,1.05

2040,1.05,1.05,1.06,1.06

2050,1.06,1.06,1.07,1.08

2060,1.06,1.07,1.08,1.1

2070,1.06,1.08,1.1,1.12

2080,1.06,1.09,1.11,1.14

2090,1.06,1.09,1.13,1.16

2100,1.06,1.1,1.14,1.18

[END_Climate_Change_CONTINUING_LOSS]

[TEMPERATURE_CHANGES]

, SSP1-2.6, SSP2-4.5, SSP3-7.0, SSP5-8.5

2030,1.2,1.2,1.2,1.3

2040,1.3,1.4,1.5,1.6

2050,1.4,1.7,1.8,2.1

2060,1.5,1.9,2.2,2.5

2070,1.5,2.1,2.5,3.0

2080,1.5,2.2,2.9,3.5

2090,1.5,2.4,3.3,4.1

2100,1.4,2.5,3.6,4.5

[END_TEMPERATURE_CHANGES]

[CCF_META]

Time Accessed, 28 October 2025 04:13PM

Version, 2024_v1

Note, Updated climate change factors for IFD Initial loss and contin

[END_CCF]

Probability Neutral Burst Initial Loss

[BURSTIL]

min (h)\AEP(%), 50.0, 20.0, 10.0, 5.0, 2.0, 1.0

60 (1.0), 12.412, 8.346, 9.523, 9.095, 8.774, 6.848

90 (1.5), 12.733, 8.881, 10.165, 10.165, 10.058, 6.955

120 (2.0), 14.231, 9.523, 10.593, 10.379, 10.058, 6.099

180 (3.0), 14.231, 10.379, 11.449, 10.914, 9.416, 4.815

360 (6.0), 13.91, 9.416, 9.202, 8.453, 9.63, 3.21

720 (12.0), 19.581, 13.91, 13.589, 11.663, 12.947, 3.424

1080 (18.0), 19.902, 14.552, 15.408, 12.84, 13.268, 4.173

1440 (24.0), 23.112, 17.548, 17.655, 15.194, 15.943, 4.708

2160 (36.0), 26.429, 20.33, 19.902, 16.906, 17.869, 6.741

2880 (48.0), 29.639, 23.968, 23.219, 24.717, 21.293, 10.165

4320 (72.0), 31.672, 27.499, 27.606, 28.355, 23.861, 11.128

[BURSTIL_META]

*** DATA MODIFIED ON 2025-12-07 WITH CLIMATE CHANGE FACTORS FOR SSP

Time Accessed, 28 October 2025 04:13PM

Version,2018_v1

Note,As this point is in NSW the advice provided on losses and pre-

[END_BURSTIL]

Transformational Pre-burst Rainfall

[PREBURST_TRANS]

min (h)\AEP(%),50.0,20.0,10.0,5.0,2.0,1.0

60 (1.0),26.553,32.595,30.846,31.482,31.959,34.821

90 (1.5),25.092,30.6,28.764,28.764,28.917,33.354

120 (2.0),22.35,28.906,27.416,27.714,28.161,33.674

180 (3.0),21.6,26.784,25.344,26.064,28.08,34.272

360 (6.0),21.114,26.91,27.186,28.152,26.634,34.914

720 (12.0),13.3,20.349,20.748,23.142,21.546,33.383

1080 (18.0),12.61,19.11,18.07,21.19,20.67,31.72

1440 (24.0),8.643,15.351,15.222,18.189,17.286,30.831

2160 (36.0),4.644,11.997,12.513,16.125,14.964,28.38

2880 (48.0),0.774,7.611,8.514,6.708,10.836,24.252

4320 (72.0),0.0,3.354,3.225,2.322,7.74,23.091

[PREBURST_TRANS_META]

*** DATA MODIFIED ON 2025-12-07 WITH CLIMATE CHANGE FACTORS FOR SSP

The tranformational pre-burst is intended for software suppliers in

[END_PREBURST_TRANS]

[ENDTXT]

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APPENDIX A3 – PRE AND POST DEVELOPMENT MODEL OUTPUTS

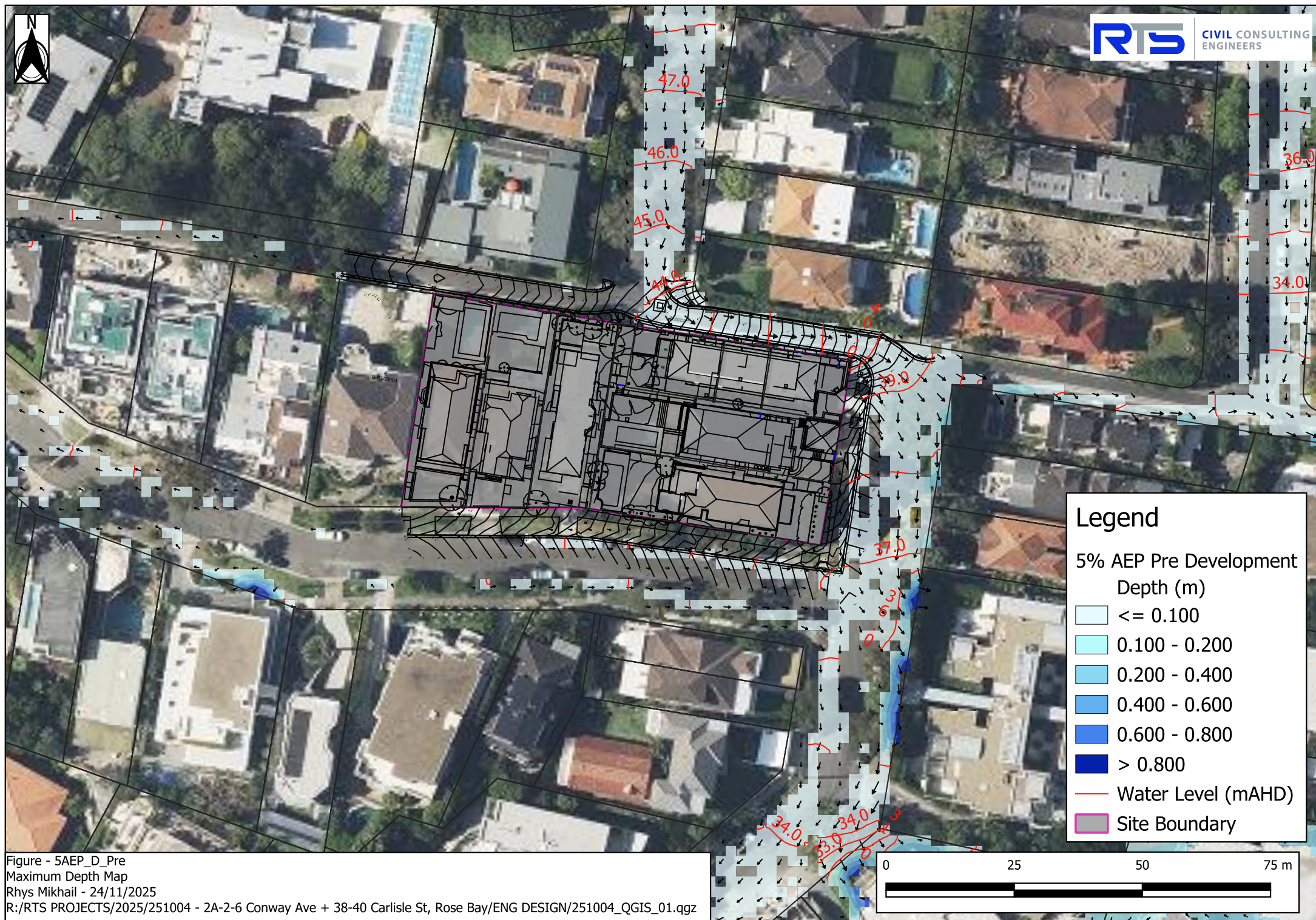


Figure - 5AEP_D_Pre
Maximum Depth Map
Rhys Mikhail - 24/11/2025
R:/RTS PROJECTS/2025/251004 - 2A-2-6 Conway Ave + 38-40 Carlisle St, Rose Bay/ENG DESIGN/251004_QGIS_01.qgz

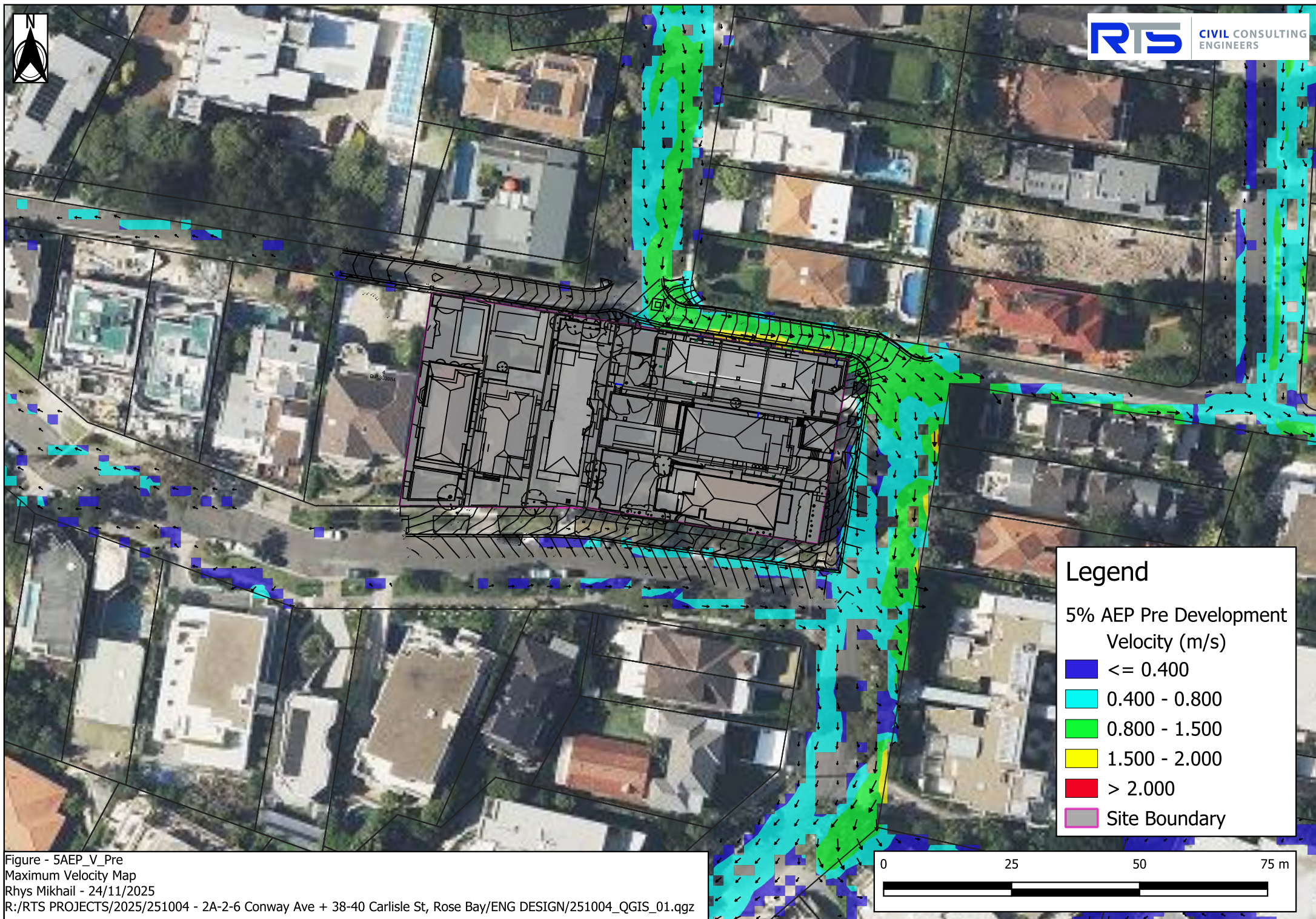


Figure - 5AEP_V_Pre
Maximum Velocity Map
Rhys Mikhail - 24/11/2025
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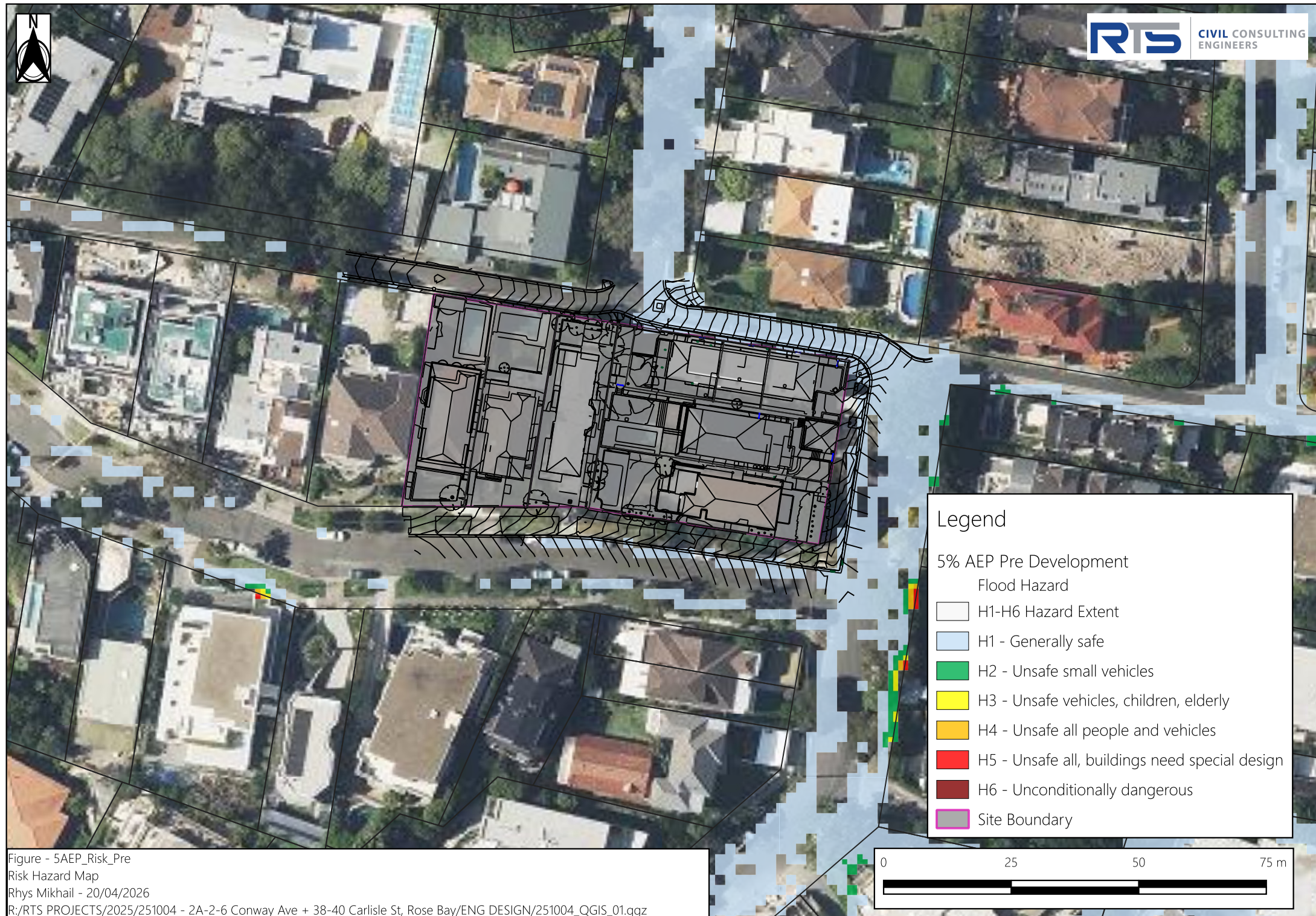


Figure - 5AEP_Risk_Pre

Risk Hazard Map

Rhys Mikhail - 20/04/2026

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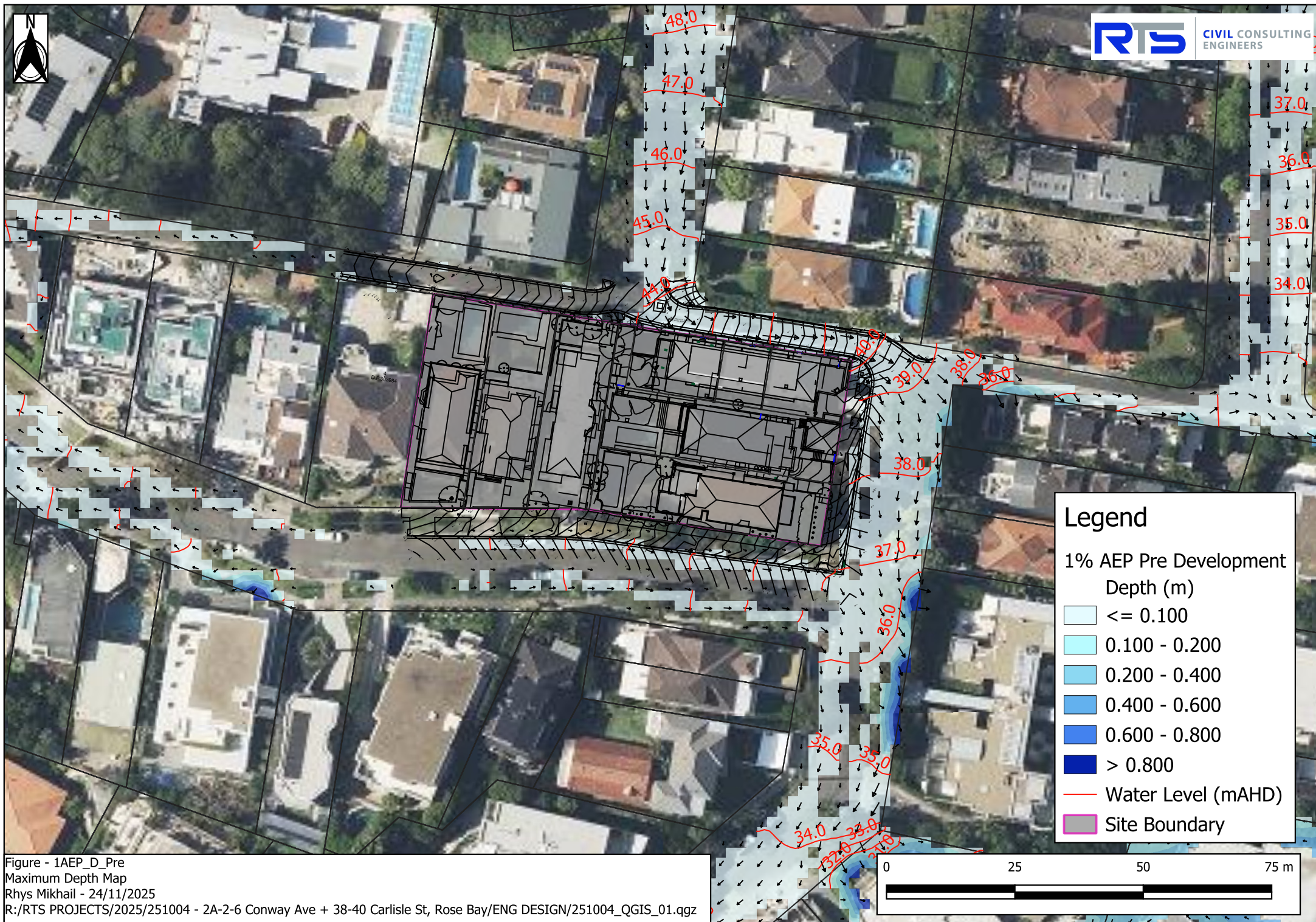


Figure - 1AEP_D_Pre
Maximum Depth Map
Rhys Mikhail - 24/11/2025
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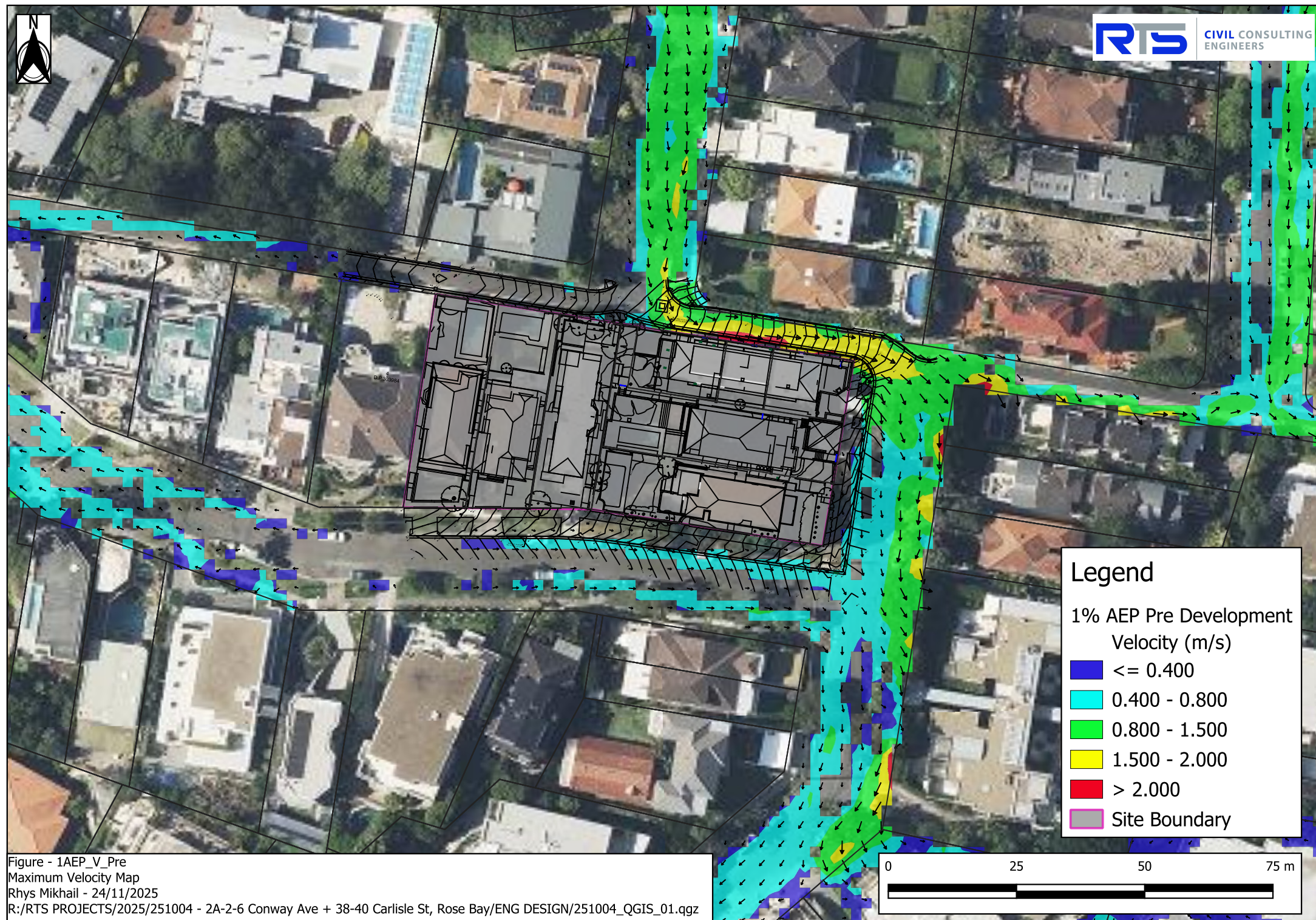
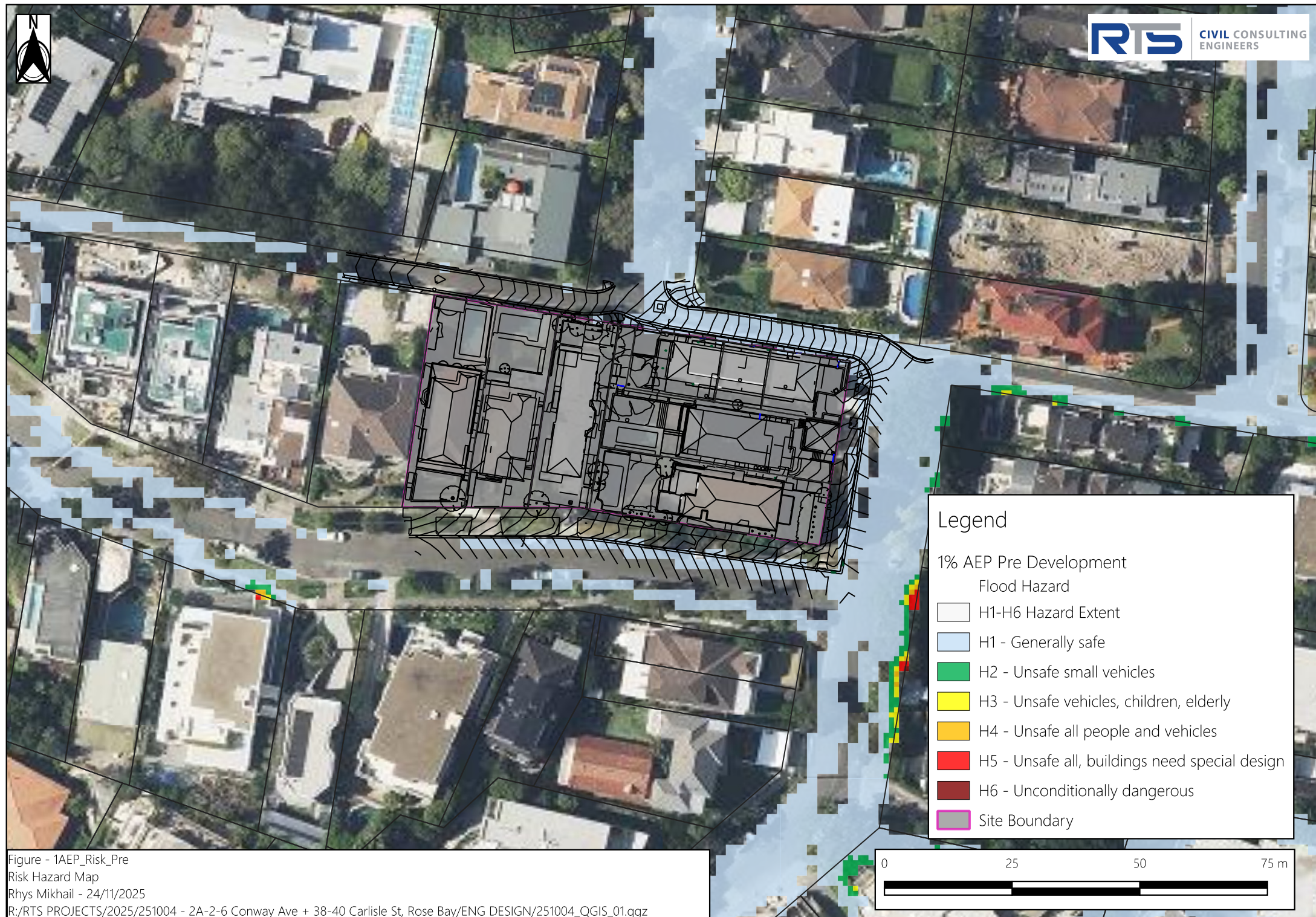


Figure - 1AEP_V_Pre
Maximum Velocity Map
Rhys Mikhail - 24/11/2025
R:/RTS PROJECTS/2025/251004 - 2A-2-6 Conway Ave + 38-40 Carlisle St, Rose Bay/ENG DESIGN/251004_QGIS_01.qgz



Legend

1% AEP Pre Development
Flood Hazard

H1-H6 Hazard Extent

H1 - Generally safe

H2 - Unsafe small vehicles

H3 - Unsafe vehicles, children, elderly

H4 - Unsafe all people and vehicles

H5 - Unsafe all, buildings need special design

H6 - Unconditionally dangerous

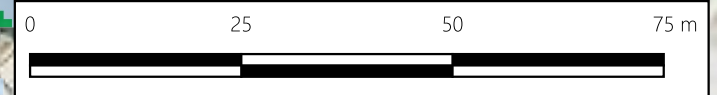
Site Boundary

Figure - 1AEP_Risk_Pre

Risk Hazard Map

Rhys Mikhail - 24/11/2025

R:/RTS PROJECTS/2025/251004 - 2A-2-6 Conway Ave + 38-40 Carlisle St, Rose Bay/ENG DESIGN/251004_QGIS_01.qgz



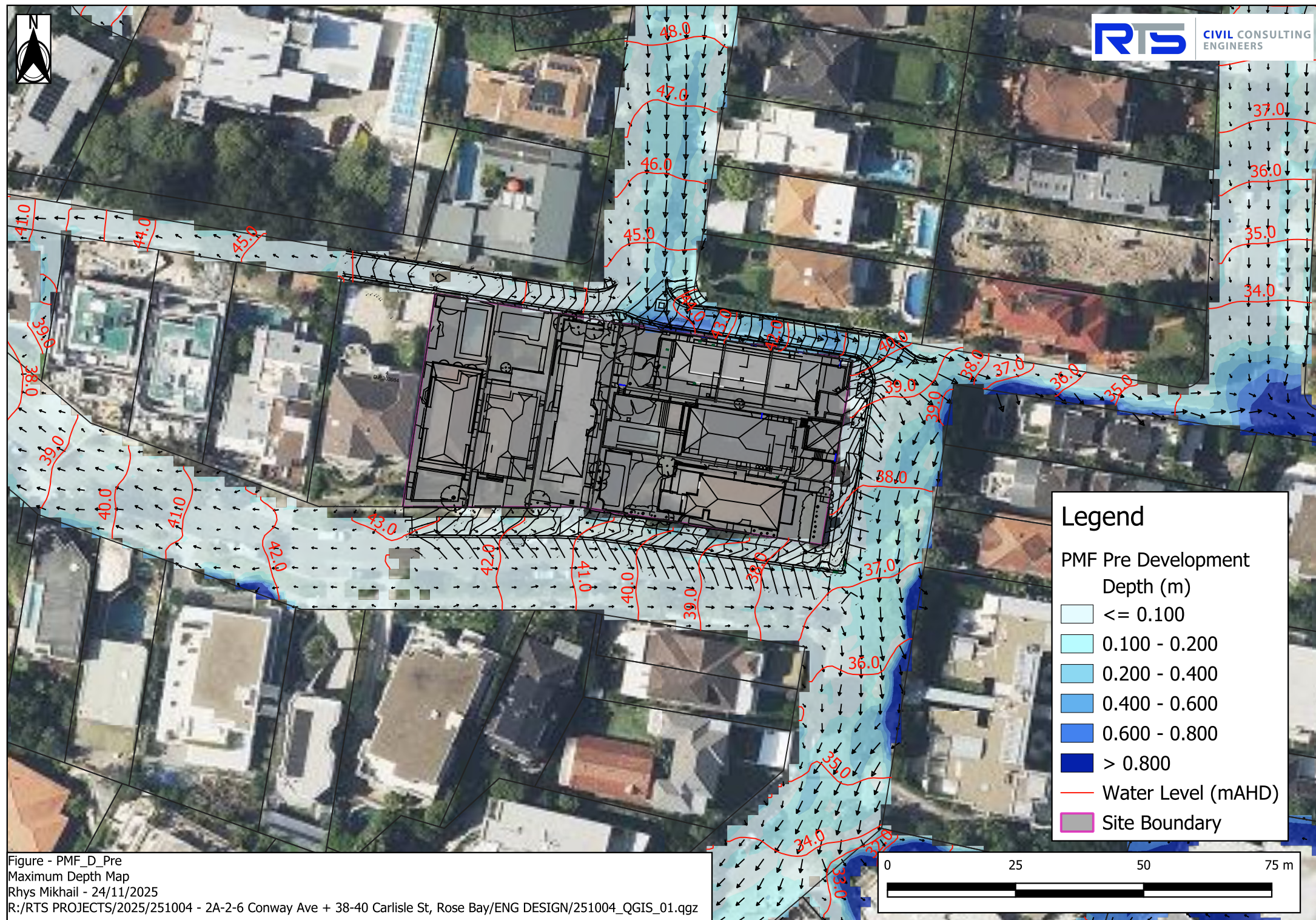
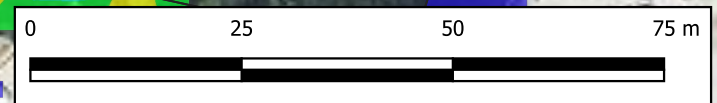


Figure - PMF_D_Pre
Maximum Depth Map
Rhys Mikhail - 24/11/2025
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Figure - PMF_V_Pre
Maximum Velocity Map
Rhys Mikhail - 24/11/2025
R:/RTS PROJECTS/2025/251004 - 2A-2-6 Conway Ave + 38-40 Carlisle St, Rose Bay/ENG DESIGN/251004_QGIS_01.qgz



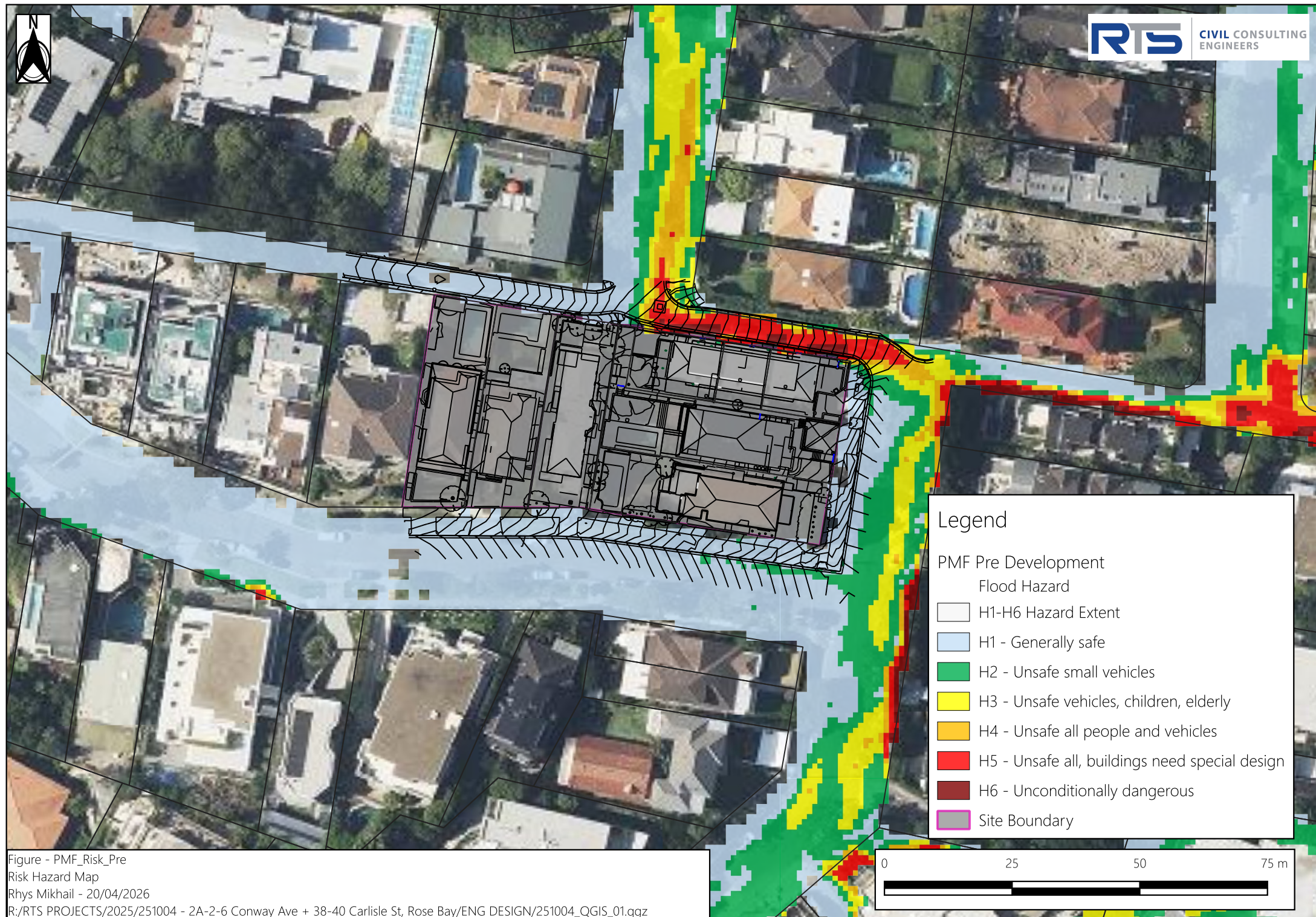


Figure - PMF_Risk_Pre

Risk Hazard Map

Rhys Mikhail - 20/04/2026

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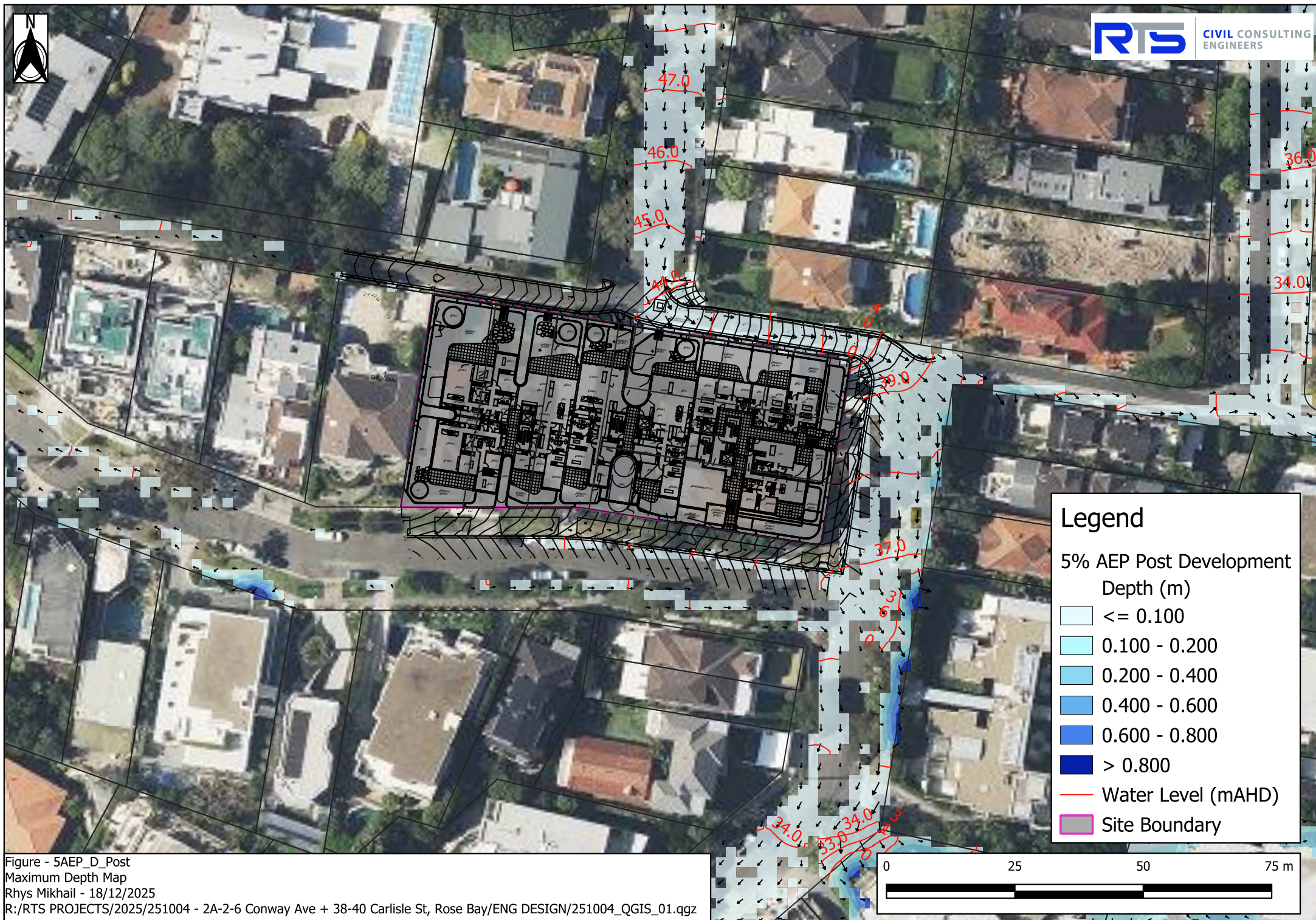
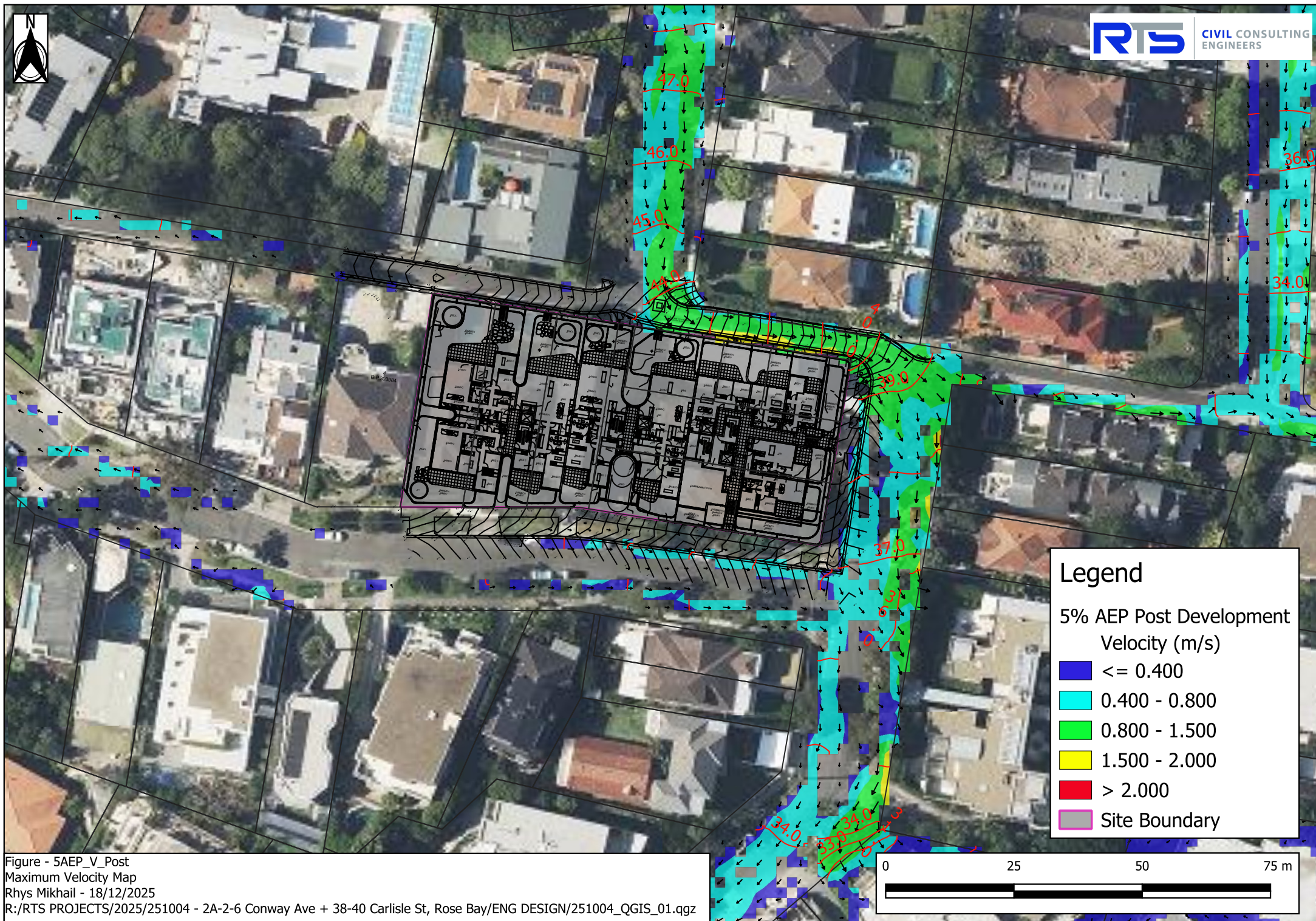


Figure - 5AEP_D_Post
Maximum Depth Map
Rhys Mikhail - 18/12/2025
R:/RTS PROJECTS/2025/251004 - 2A-2-6 Conway Ave + 38-40 Carlisle St, Rose Bay/ENG DESIGN/251004_QGIS_01.qgz



Legend

5% AEP Post Development
Velocity (m/s)

- ≤ 0.400
- 0.400 - 0.800
- 0.800 - 1.500
- 1.500 - 2.000
- > 2.000
- Site Boundary

Figure - 5AEP_V_Post
Maximum Velocity Map
Rhys Mikhail - 18/12/2025
R:/RTS PROJECTS/2025/251004 - 2A-2-6 Conway Ave + 38-40 Carlisle St, Rose Bay/ENG DESIGN/251004_QGIS_01.qgz



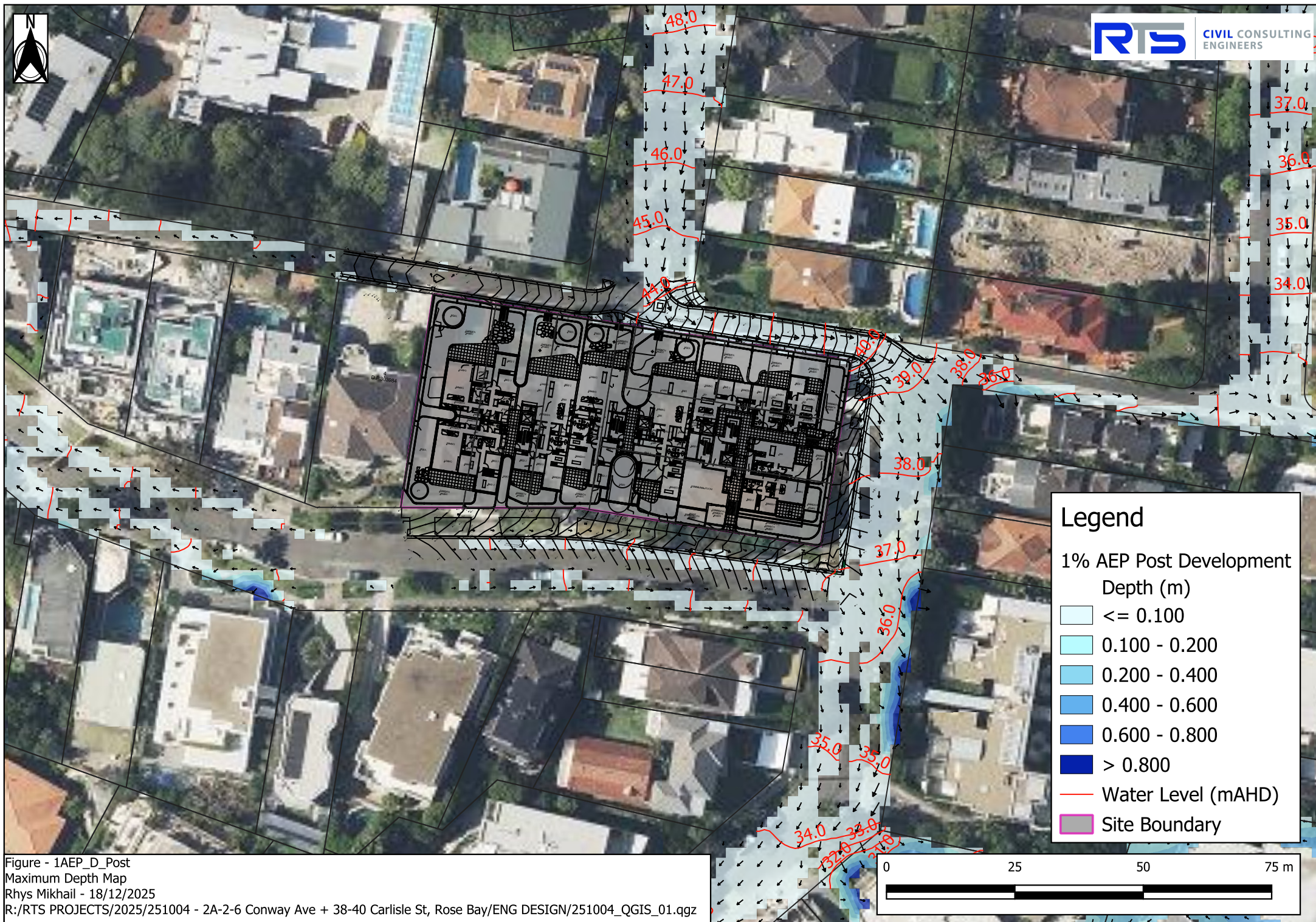
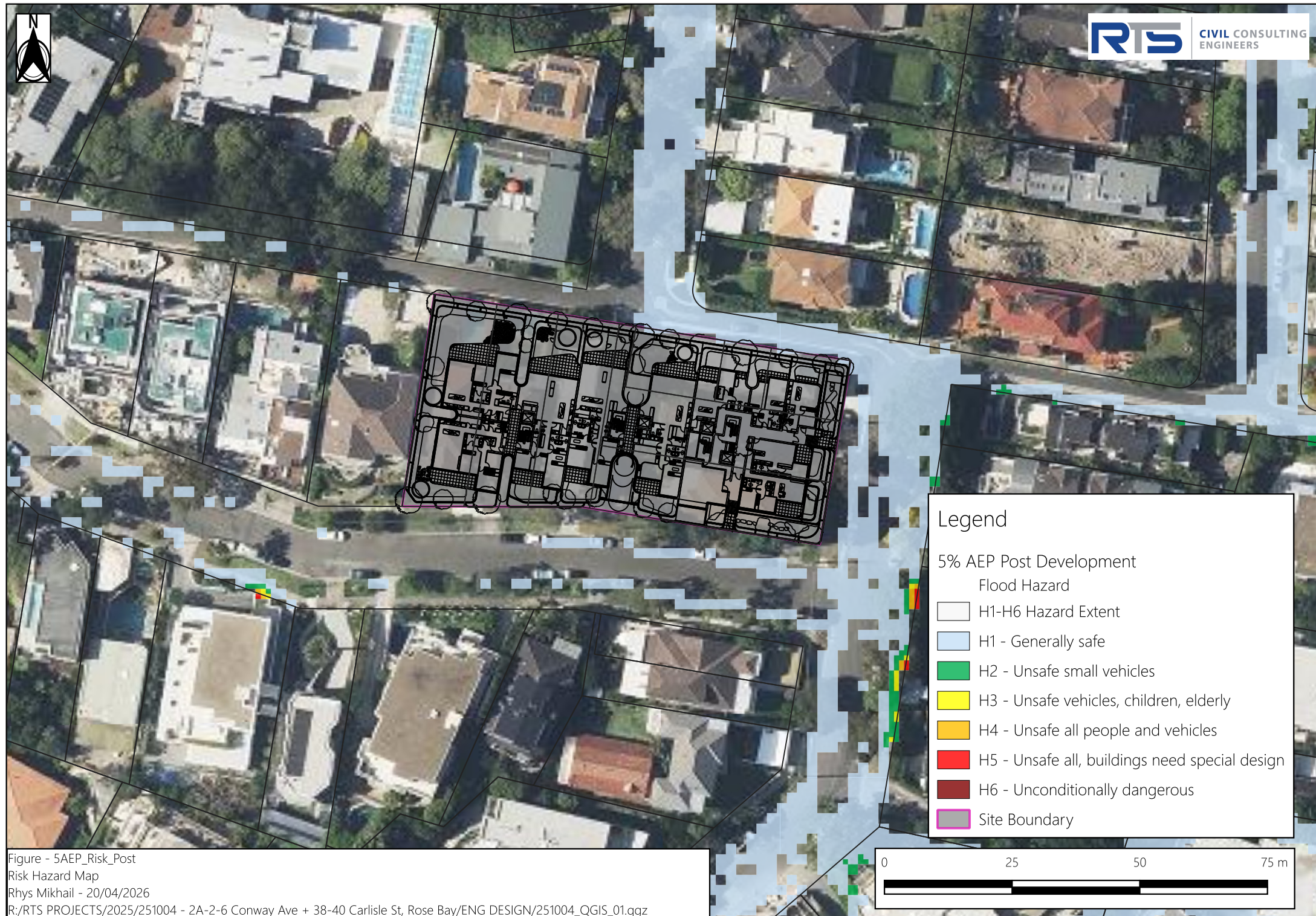


Figure - 1AEP_D_Post
Maximum Depth Map
Rhys Mikhail - 18/12/2025
R:/RTS PROJECTS/2025/251004 - 2A-2-6 Conway Ave + 38-40 Carlisle St, Rose Bay/ENG DESIGN/251004_QGIS_01.qgz



Legend

5% AEP Post Development
Flood Hazard

-  H1-H6 Hazard Extent
-  H1 - Generally safe
-  H2 - Unsafe small vehicles
-  H3 - Unsafe vehicles, children, elderly
-  H4 - Unsafe all people and vehicles
-  H5 - Unsafe all, buildings need special design
-  H6 - Unconditionally dangerous
-  Site Boundary

Figure - 5AEP_Risk_Post

Risk Hazard Map

Rhys Mikhail - 20/04/2026

R:/RTS PROJECTS/2025/251004 - 2A-2-6 Conway Ave + 38-40 Carlisle St, Rose Bay/ENG DESIGN/251004_QGIS_01.qgz



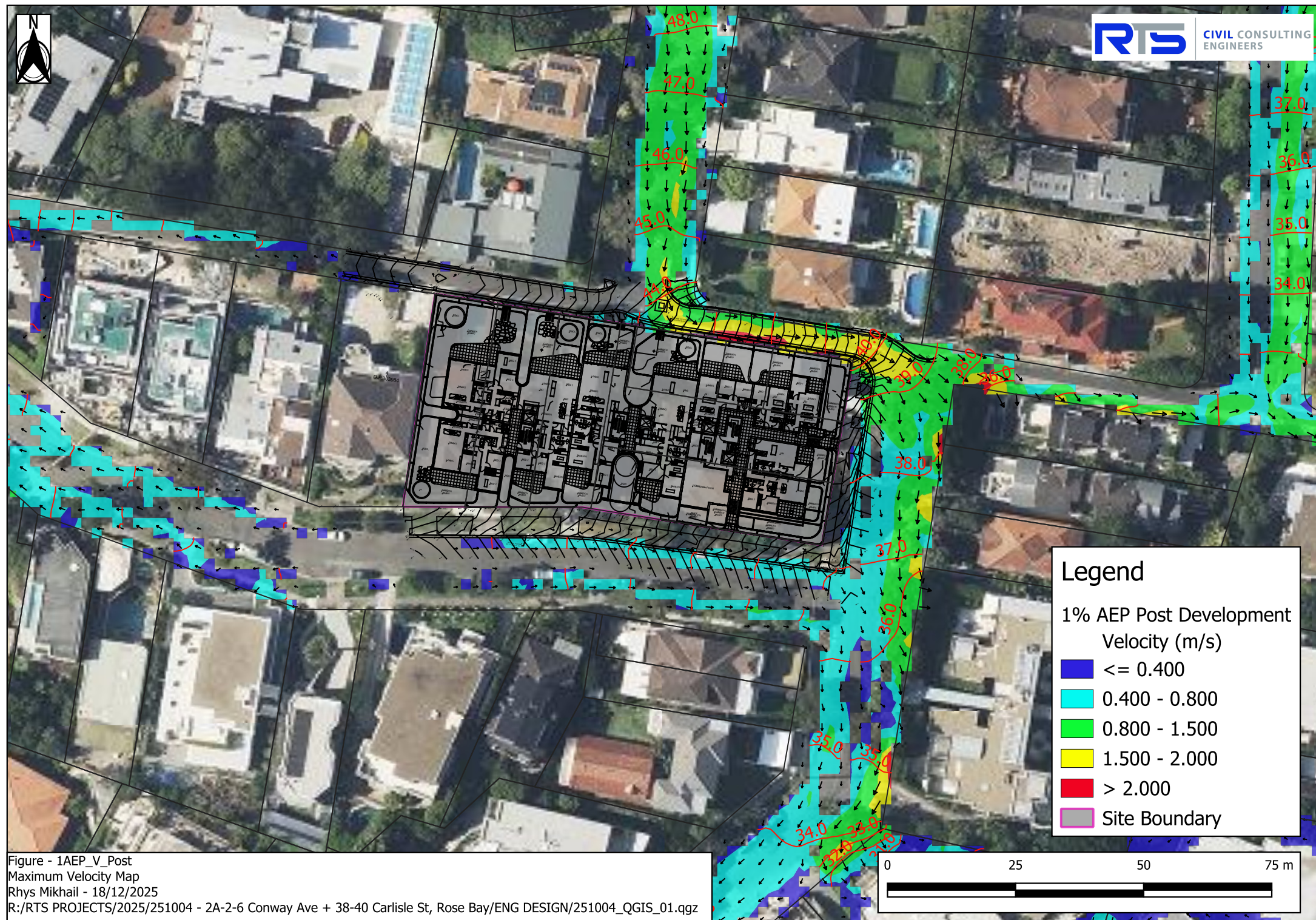


Figure - 1AEP_V_Post
Maximum Velocity Map
Rhys Mikhail - 18/12/2025
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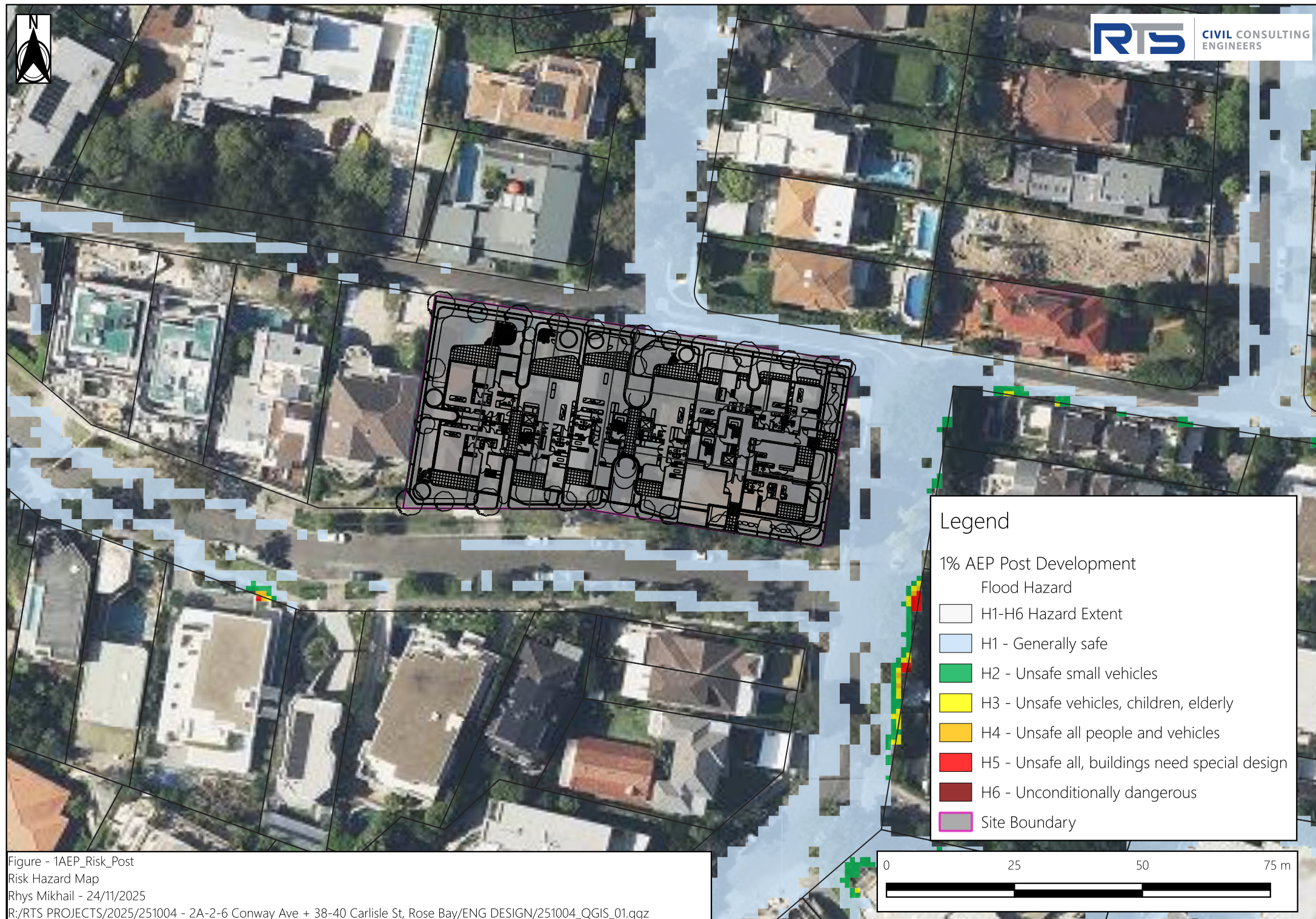
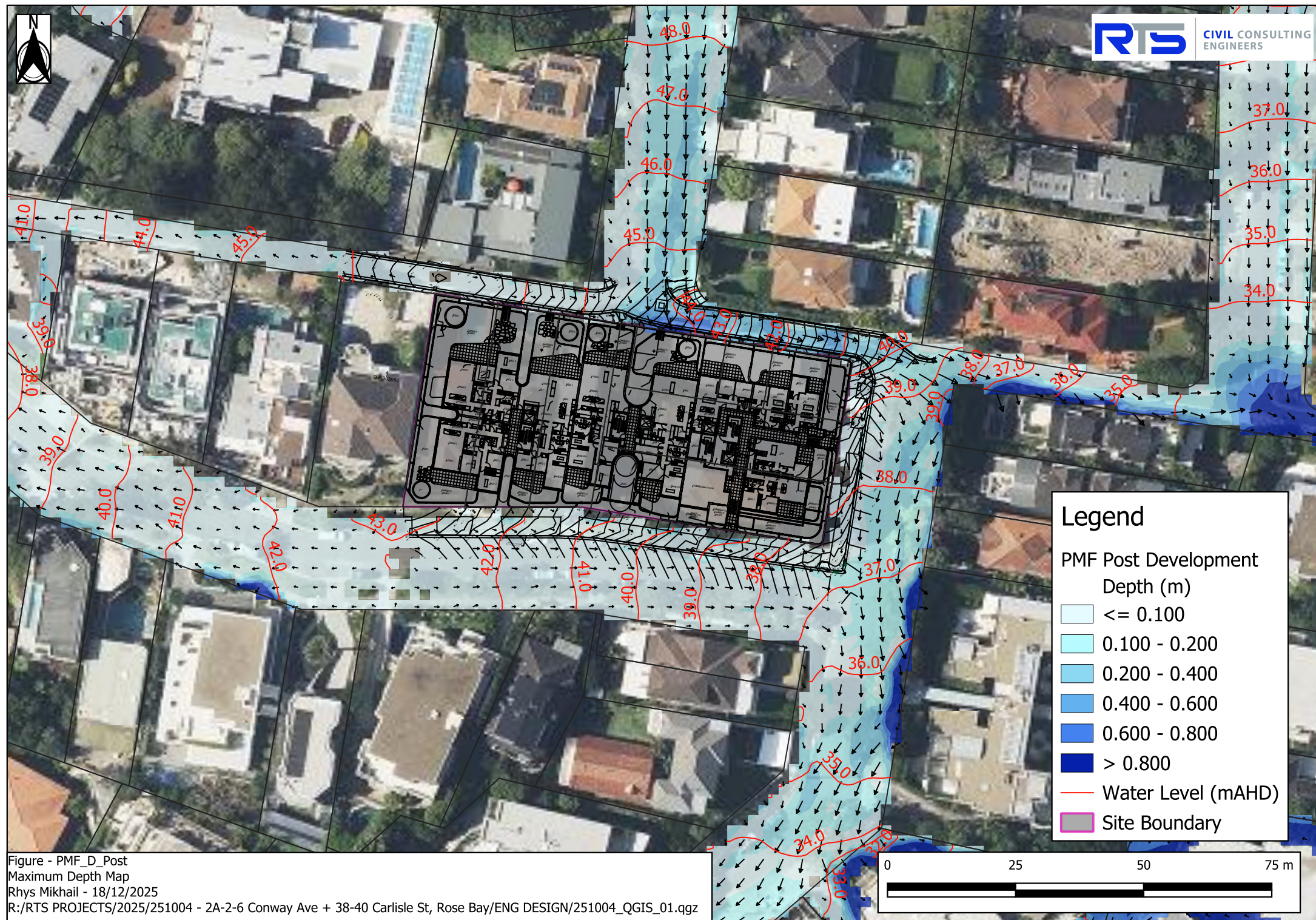


Figure - 1AEP_Risk_Post

Risk Hazard Map

Rhys Mikhail - 24/11/2025

R:/RTS PROJECTS/2025/251004 - 2A-2-6 Conway Ave + 38-40 Carlisle St, Rose Bay/ENG DESIGN/251004_QGIS_01.qgz



Legend

PMF Post Development
Depth (m)

- ≤ 0.100
- 0.100 - 0.200
- 0.200 - 0.400
- 0.400 - 0.600
- 0.600 - 0.800
- > 0.800
- Water Level (mAHD)
- Site Boundary

Figure - PMF_D_Post
Maximum Depth Map
Rhys Mikhail - 18/12/2025
R:/RTS PROJECTS/2025/251004 - 2A-2-6 Conway Ave + 38-40 Carlisle St, Rose Bay/ENG DESIGN/251004_QGIS_01.qgz





Figure - PMF_V_Post
Maximum Velocity Map
Rhys Mikhail - 18/12/2025
R:/RTS PROJECTS/2025/251004 - 2A-2-6 Conway Ave + 38-40 Carlisle St, Rose Bay/ENG DESIGN/251004_QGIS_01.qgz

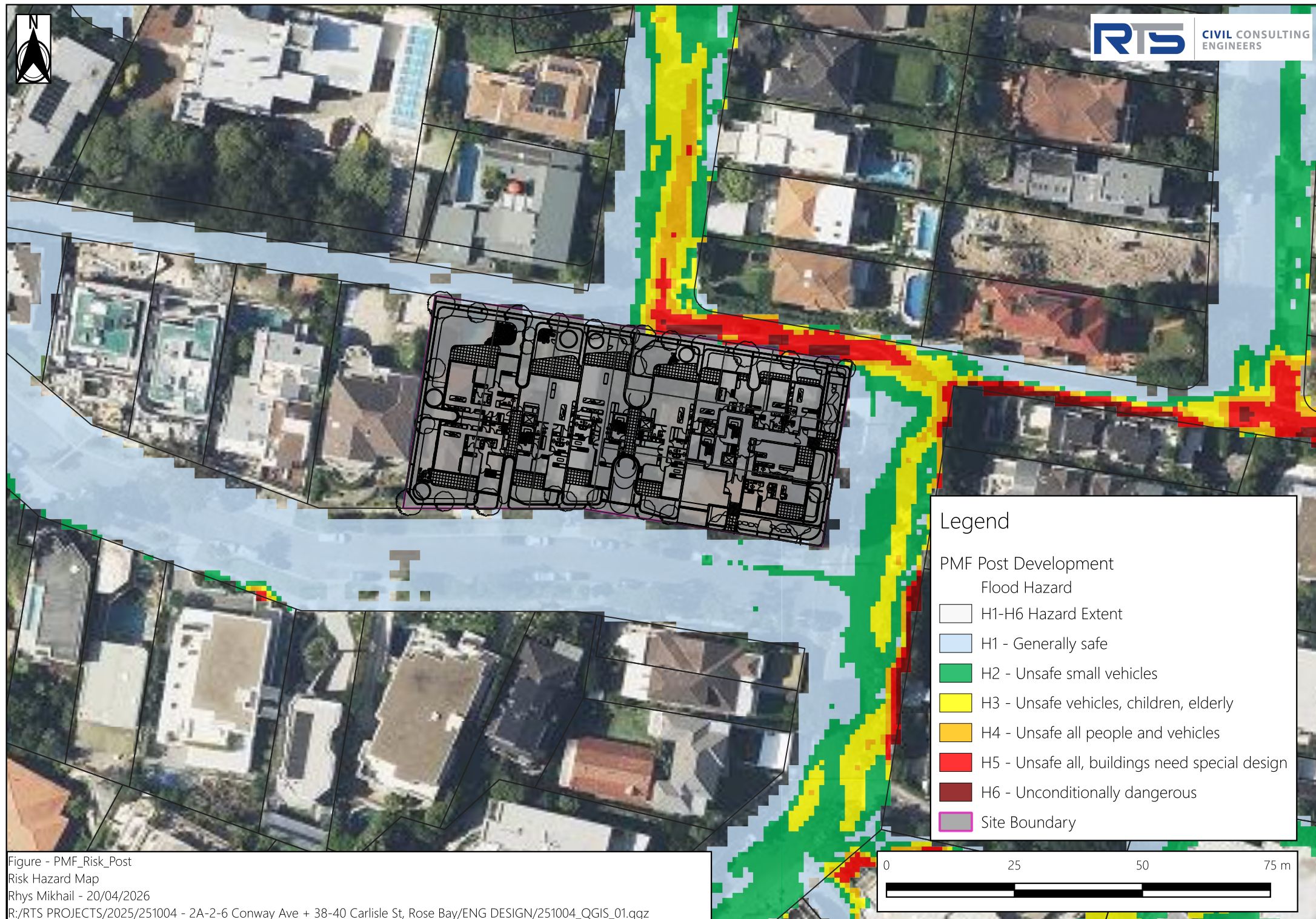


Figure - PMF_Risk_Post

Risk Hazard Map

Rhys Mikhail - 20/04/2026

R:/RTS PROJECTS/2025/251004 - 2A-2-6 Conway Ave + 38-40 Carlisle St, Rose Bay/ENG DESIGN/251004_QGIS_01.qgz

APPENDIX A4 – COMPLIANCE WITH SEARs AND WOOLLAHRA COUNCIL REQUIREMENTS

Table 4 – Compliance with the Requirements of SEARs and Woollahra Council

Woollahra Development Control Plan (2015) Chapter E2 – Stormwater and Flood Risk Management		
Planning Consideration	Compliance	Comments
Flood Planning Level		
Habitable floor areas shall be no lower than the 1% AEP flood level plus 0.5 m freeboard.	Yes	The proposed upper basement finished floor level is RL 40.50 m AHD. Where habitable floor levels are adjacent localised 1% AEP flood levels at Fernleigh Avenue and part of Carlisle Street frontages, the building envelope is safeguarded by passive flood protection comprising raised landscape crests, raised planter walls and raised pedestrian thresholds that establish a continuous protective line 0.5 m above 1% AEP flood levels. No automatic or mechanical flood barrier is relied upon (refer to Section 7.3 / Appendix A6 Response to Submissions Summary). The minimum passive threshold levels noted in Tables 3a and 3b exceed the corresponding 1% AEP flood level by ≥ 500 mm at all designated passive threshold (PT) locations, ensuring a compliant and continuous protective line between external floodwaters and internal habitable areas. Therefore, all habitable floor areas are protected at or above the 1% AEP flood level + 0.5 m freeboard.
Non-habitable floor areas shall be no lower than the 1% AEP flood level plus 0.3 m freeboard.	Yes	The proposed upper basement finished floor level is RL 40.50 m AHD. The basement entrance locations are proposed along Conway Avenue where floodwaters are contained within road kerb, and PMF effects diminish at or lower than the property boundary. These proposed external boundary levels exceed the 1% AEP level by ≥ 0.30 m freeboard, providing compliant passive flood protection without elevating the slab and without mechanical devices. As a result, no additional flood protection measures are required for the basement or enclosed parking area, and residual risk is minimal. Therefore, all basement floor areas are protected at or above the 1% AEP flood level + 0.3 m freeboard.

Planning Consideration	Compliance	Comments
General Requirements		
All structures to have flood compatible building components at and below the 1% AEP flood level + 0.5 m freeboard.	Yes	Flood-compatible materials will be adopted for all building elements located below the relevant flood exposure level in accordance with the ABCB Standard for Construction of Buildings in Flood Hazard Areas, Reducing Vulnerability of Buildings to Flood Damage – Guidance of Building in Flood Prone Areas, and the NSW Reconstruction Authority Flood Resilient Design Guide on flood-resilient construction. These include sealed concrete slab-on-ground, masonry or concrete blockwork walls, fibre-cement sheeting or waterproofed external finishes, stainless or galvanised metal fixings, waterproof or epoxy-grouted floor finishes, and sealed service penetrations. Final material schedule will be provided at CC stage.
All electrical equipment (e.g. air conditioners and pool pumps) is located or protected to above the 1% AEP level plus 0.5 m freeboard.	Yes	Electrical equipment and services can comply by locating them above the 1% AEP flood level + 0.5 m freeboard within protected areas of the building. Future design of power supply, metering equipment, air-conditioning systems, fuel supply and ducting should be located above the nominated protection level or be detailed to minimise damage if temporary submersion occurs. All electrical power points, wiring and services installed outside the basement are to be located above the nominated protection level. Provisions are to be made so that any equipment or valuables stored externally can be removed or stored above this level when required. These items can be addressed through conditions of consent and detailed Construction Certificate documentation.
All storage areas such as shelving are above the 1% AEP level plus 0.5 m freeboard. No storage of materials below the 1% AEP plus freeboard which may cause pollution or be potentially hazardous during any flood.	Yes	Storage of goods in the basement is protected by the driveway entrance level of 1% AEP level plus 0.3 m freeboard. Store of goods at ground floor level and higher exceeds Council minimum freeboard levels. The development is not envisaged to contain major hazardous substances.

Planning Consideration	Compliance	Comments
Structural Soundness		
The structure is built to withstand the forces of floodwater, debris and buoyancy up to and including the 1% AEP level plus 0.5 m freeboard. Buildings or structures constructed in high flood risk precincts are designed to withstand the PMF event.	Yes	The design of the passive protection structures (raised landscape crests, planter walls and raised pedestrian thresholds) for any items located below the PMF shall be certified by a structural engineer registered on the National Engineers Register for Structural Engineering (NER-Structural) during the Construction Certificate phase of the project. The structural engineer shall certify that any new structure can withstand the forces of floodwater, debris & buoyancy up to & including the PMF level.
Flood Affection		
Ensure no adverse impact on flooding to the subject land or surrounding land.	Yes	The flood storage for the development is considered negligible as the predicted flood extents are contained within Council's road reserve areas. Any increase in overland flow velocities up to and including the 1% AEP flood events are considered negligible. Refer to Appendix A3 for TUFLOW flood maps.
Car Parking & Driveway Access		
Enclosed car parking spaces (3 or more) shall be no lower than the 1% AEP flood level plus 0.3 m freeboard. To achieve the required protection for car parking, Council may allow the use of mechanical barriers such as flood gates. Where a mechanical barrier is permitted: a) a 0.5m freeboard is provided b) the mechanical barrier is located wholly on private property c) the mechanical barrier may require the provision of an on-site queuing area Note: The mechanical barrier must be designed and installed by a suitably qualified practitioner. A positive covenant will be required for maintenance of the mechanical barrier.	Yes	The proposed upper basement finished floor level is RL 40.50 m AHD. The basement entrance locations are proposed along Conway Avenue where floodwaters are contained within road kerb, and PMF effects diminish at or lower than the property boundary. These proposed external boundary levels exceed the 1% AEP level by ≥ 0.30 m freeboard, providing compliant passive flood protection without elevating the slab and without mechanical devices. As a result, no additional flood protection measures are required for the basement or enclosed parking area, and residual risk is minimal. Therefore, all basement floor areas are protected at or above the 1% AEP flood level + 0.3 m freeboard.

Planning Consideration	Compliance	Comments
Emergency Management		
Reliable evacuation access for pedestrians is provided from the lowest habitable floor area to a refuge area above the PMF level and designed to withstand PMF water forces.	N/A	The critical duration for the PMF storm event has been estimated at 90 minutes, based on the Rose Bay Catchment Flood Study. During a PMF event, floodwater depths over the site footprint are expected to range between 100–200 mm and remain essentially overland flow per Council flood mapping. Localised peak depths at the Fernleigh/Carlisle kerb sag-point reach approximately 0.81 m on the egress route — refer Table A6.2. Notwithstanding the minimal nature, floodwaters may cut off access via the frontage road, making off-site evacuation impractical. Therefore, in a Council DCP designated High Hazard (due to velocity) location such as Fernleigh Avenue and Carlisle Street, evacuation to the public road cannot be relied upon during an extreme event. Travelling through floodwaters on foot or in a vehicle is not recommended due to hidden obstructions from floodwaters, the chance of being swept away (on foot or within a vehicle), or risk of polluted and contaminated floodwaters. During flood events, other roads may be cut off by floodwaters which may make the escape by vehicle difficult. Given these conditions, a Shelter-in-Place strategy is considered the most effective flood emergency response for the site. The overland-flow nature of the flooding also indicates a peak flood duration of 90 minutes (less than 6 hours), which complies with the NSW Shelter-in-Place Guideline. Reliable vertical evacuation is provided from all lower levels, including the basement carpark, to refuge areas above the PMF level via both lifts and fire stairs. Should off-site evacuation be unfeasible, residents on lower floors can access higher-level units through the central lobby corridor and adjacent stairways. A detailed Flood Emergency Response Plan (FERP) should be developed for all residents, outlining actions to take before, during, and after a flood event, including instructions for sheltering in place and coordinating with emergency services. Whilst flood impact is relatively minor and short duration, it is recommended that each residential unit owner shall develop an Emergency FloodSafe Plan. This can be integrated into the detailed flood emergency response plan required for each apartment. A template for a residential premises Emergency FloodSafe Plan is available from: www.seshomeemergencyplan.com.au The plans should be displayed in a prominent location in the residence.

Planning Consideration	Compliance	Comments
State Emergency Service Evacuation	Yes	Residents may however be instructed by the State Emergency Services (SES) or police or similar regulating authority to evacuate the premises and seek higher ground. If so, residents must evacuate based on regulating authority instructions. The State Emergency Service of New South Wales (NSW SES) is responsible for providing flood updates and issuing Flood Evacuation Warnings and Flood Evacuation Orders. Flood information issued by the NSW SES may be received by local, radio and television news, SMS messaging, Facebook and door-knocking in affected communities. The timing for evacuation of persons is to be established in consultation with the NSW SES. It is strongly recommended to register the mobile number to SES to receive notification about flood warning when there is intense rain at Sydney region and Rose Bay area.
Flood Signage Recommended	Yes	Permanent flood risk signage shall be installed in a prominent area of the garage and/or within an area often frequented such as the laundry of the residence. A permanent plaque is to be mounted in a prominent position stating, "The roadway frontage and property is subject to flooding – take caution existing and entering the premises after rain. Shelter-in-place is recommended in extreme rainfall events." Refer to Appendix A7.
Fencing		
In overland flow paths, fencing is generally not be permissible. However, in low and medium flood risk precincts permeable/open type fences may be approved where it can be demonstrated that there will be no adverse impact on flooding to the subject land or surrounding properties. No new fencing of any type is permitted in high flood risk precincts unless it can be demonstrated, by a suitably qualified practitioner, that there will be no adverse impact on flooding to the subject land or surrounding properties.	Yes	Any proposed fencing and walls located below the flood levels is to be designed by a structural engineer to withstand hydrostatic forces up to and including the PMF event, whichever is greatest, and flood debris along the boundary fronting Fernleigh Avenue and Carlisle Street.

Planning Secretary's Environmental Assessment Requirements (SEARs) - Section 19 – Flood Risk Requirements		
Planning Consideration	Compliance	Comments
Identify the flood planning area and level as set out in the relevant EPI (Environmental Planning Instrument) and other supporting documents to determine: ○ The flood extent and velocity up to the Probable Maximum Flood and risk on-site having regard to adopted flood studies and, floodplain risk management studies and plans ○ The site access and egress routes ○ The potential effects of climate change ○ Any relevant provisions of the NSW Flood Risk Management Manual, and any other relevant guidelines.	Yes	○ Refer to all sections of this Table ○ Refer to the “Emergency Management” section of this Table under Woollahra DCP requirements ○ Floodplain risk management in NSW requires consideration of climate change in accordance with the 2005 Floodplain Development Manual. Consistent with this requirement, the Rose Bay Catchment Flood Study (WMAwater, 2010) incorporated climate change sensitivity testing for the 1% AEP event based on the IPCC (2007) sea level rise projections, using elevated tailwater levels of +0.18 m (1.18 m AHD), +0.55 m (1.55 m AHD) and +0.91 m (1.91 m AHD). The flood study results indicate that the effects of climate change on water levels and hazard are minor and limited to small, localised areas of the Rose Bay catchment, with negligible influence on flood depth or hazard classification at this site. Based on current best-available data, climate change is therefore not expected to materially alter flood risk within the defined flood planning area. ○ Refer to the “Flood Planning Level”, “Car Parking & Driveway Access” and “Emergency Management” sections of this Table under Woollahra DCP requirements

Where the development is occurring on flood prone land a flood impact and risk assessment (FIRA) must be prepared having regard to the Flood Impact and Risk Assessment – Flood Risk Management Guide LU01. When determining the scope and category of the FIRA the requirements outlined in the FIRA guide must be considered.	Yes	This FIRA prepared by RTS Civil in support of the proposed development.
Detail any flood risk management measures that are to be incorporated as part of the development having regard to relevant guidelines (including any design solutions, flood modification measures, property modification measures, operational procedures or Flood Emergency Response Plan).	Yes	Refer to all sections of this Table under Woollahra DCP requirements
Woollahra Local Environmental Plan 2014 – Part 5.21 Flood Planning		
Planning Consideration	Compliance	Comments
(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 flood function and behaviour on the land, taking into account projected changes as a result of climate change, (c) to avoid adverse or cumulative impacts on flood behaviour and the environment, (d) to enable the safe occupation and efficient evacuation of people in the event of a flood.	Yes	Refer to all sections of this Table under Woollahra DCP, LEP, and SEARs requirements
(2) Development consent must not be granted to development on land the consent authority considers to be within the flood planning area unless the consent authority is satisfied the development— (a) is compatible with the flood function and behaviour on the land, and	Yes	Refer to all sections of this Table under Woollahra DCP, LEP, and SEARs requirements The site does not adjoin a natural watercourse, and flood behaviour is confined to the road reserves and drainage infrastructure network. The development is not predicted to alter overland flow paths, increase velocities, or introduce erosive conditions, and no riparian vegetation or channel stability is impacted.

(b) will not adversely affect flood behaviour in a way that results in detrimental increases in the potential flood affectation of other development or properties, and (c) will not adversely affect the safe occupation and efficient evacuation of people or exceed the capacity of existing evacuation routes for the surrounding area in the event of a flood, and (d) incorporates appropriate measures to manage risk to life in the event of a flood, and (e) will not adversely affect the environment or cause avoidable erosion, siltation, destruction of riparian vegetation or a reduction in the stability of river banks or watercourses.		Accordingly, there are no anticipated environmental impacts or risk of erosion, siltation or watercourse degradation.
Planning Consideration	Compliance	Comments
(3) In deciding whether to grant development consent on land to which this clause applies, the consent authority must consider the following matters— (a) the impact of the development on projected changes to flood behaviour as a result of climate change, (b) the intended design and scale of buildings resulting from the development, (c) whether the development incorporates measures to minimise the risk to life and ensure the safe evacuation of people in the event of a flood, (d) the potential to modify, relocate or remove buildings resulting from development if the surrounding area is impacted by flooding or coastal erosion.	Yes	Refer to all sections of this Table under Woollahra DCP, LEP, and SEARs requirements
(4) A word or expression used in this clause has the same meaning as it has in the Considering Flooding in Land Use Planning Guideline unless it is otherwise defined in this clause.	N/A	This clause outlines terminology sources and definitions. No planning impacts or development controls require demonstration. Compliance with flood planning matters is addressed in this FIRA.

(5) In this clause— Considering Flooding in Land Use Planning Guideline means the <i>Considering Flooding in Land Use Planning Guideline</i> published on the Department’s website on 14 July 2021. Flood planning area has the same meaning as it has in the Flood Risk Management Manual. Flood Risk Management Manual means the <i>Flood Risk Management Manual</i>, ISBN 978-1-923076-17-4, published by the NSW Government in June 2023.	N/A	This clause outlines terminology sources and definitions. No planning impacts or development controls require demonstration. Compliance with flood planning matters is addressed in this FIRA.
Woollahra Local Environmental Plan 2014 – Part 5.22 Special Flood Considerations		
Planning Consideration	Compliance	Comments
[Not adopted]	N/A	N/A

APPENDIX A6 – RESPONSE TO SUBMISSIONS SUMMARY

This Appendix summarises RTS Civil's Response to Submissions received on the Environmental Impact Statement lodged for SSD-101842729. The submissions addressed are:

- DPHI Key Issues Letter – items 6 and 7 (flood);
- NSW State Emergency Service, letter dated 19 March 2026;
- NSW DCCEEW Water Group, letter dated 17 March 2026;
- Woollahra Municipal Council submission dated 2 March 2026 (Section 26 Flood and Section 27 Stormwater);
- Annexure A – draft conditions of consent (flood and stormwater items).

A consolidated compliance matrix is provided at the end of this Appendix. Submissions relating to groundwater, dewatering and basement hydrogeology are being addressed separately by EI Australia and are not repeated here beyond the flood and stormwater interfaces.

A6.1 DPHI KEY ISSUES – ITEMS 6 AND 7

DPHI Key Issue item 6 requires the FIRA to respond to the DCCEEW and SES submissions. Item 7 requires removal of automatic rising flood barriers, Lower Ground and Ground Floor levels at or above the Flood Planning Level (FPL), and all basement openings (ramp, vents, pedestrian entries) above the PMF or the 1% AEP plus freeboard, whichever is higher.

Both items are accepted. The flood protection strategy has been revised from active/automatic barriers to passive protection as detailed in the revised Section 7.3 of this report. The DCCEEW response is provided in Section A6.2 and the SES response in Section A6.3.

A6.2 NSW DCCEEW CPHR RESPONSE – 12-POINT FIRA LIST AND PASSIVE PROTECTION

The DCCEEW Conservation Programs, Heritage and Regulation (CPHR) submission of 23 March 2026 (Susan Harrison, Senior Team Leader, Central Metropolitan) provides 12 sub-items under Key Issue 1 (FIRA contains insufficient information) and a separate Key Issue 2 (flood protection works). Each is addressed below. DPHI Key Issues item 6 (24 March 2026) explicitly directs the FIRA to respond to the CPHR submission.

Tables A6.x and A6.y below tabulate the point-by-point response. Table A6.5 covers the 12 Issue 1 sub-items; Table A6.6 covers Issue 2 (flood protection works).

Table A6.5 – DCCEW CPHR FIRA Issue 1 Sub-Items – RTS Response

Item	CPHR Comment (paraphrased)	RTS Response	FIRA Location
1	Properties raised to contain flow to roads – approach not suitable for FIRA, must demonstrate actual site flood behaviour.	Acknowledged. The Rose Bay Catchment Flood Study (WMAwater, 2010) raised on-lot ground to preserve catchment-scale road-corridor flow. For this site, on-lot natural ground surveyed by Rygate (80854 Rev C, 17/10/2025) is elevated above adjacent kerb levels along Fernleigh Avenue and Carlisle Street, so overland flow naturally remains within the road corridor. The TUFLOW model reflects this with refinements at sag points.	Section 2.4, Section 5.1, App A2
2	Fernleigh / Carlisle intersection PMF >0.8m ponding against permeable slatted gate; fences must be appropriately represented.	Confirmed. Fences along the road frontages are modelled as permeable to overland flow consistent with the Rose Bay Flood Study assumption. The PMF depth concentration at the intersection reflects natural sag-point ponding rather than fence blockage.	Section 5.1, App A2
3	Hydrological assumptions not identified – catchment area, sub-catchment delineation, losses.	Addressed. Section 5.1.1 “Modelling Parameters and Assumptions” (new) and Appendix A2 (Tables A2.x) document modelled catchment area, sub-catchment delineation (Figure A2.x) and ARR 2019 losses extracted from the AR&R Data Hub for the catchment centroid.	Section 5.1.1, App A2
4	Hydraulic assumptions not identified – Manning’s, network extent, blockage.	Addressed. Manning’s n, modelled stormwater network extent and pit/pipe blockage assumptions are documented in Appendix A2 (Table A2.y) consistent with the Rose Bay Catchment Flood Study (WMAwater, 2010) blockage approach.	Section 5.1.1, App A2
5	Verification level locations not identified.	Addressed. Verification undertaken at the Conway, Fernleigh and Carlisle site frontages — agreement with the Rose Bay Flood Study to within ±0.02–0.03 m (refer §5.1.1 and Tables 1 and 2).	App A2 (Fig A2.z)
6	Climate change – rainfall intensity uplift required, not just sea-level rise.	Addressed. ARR 2019 climate-change rainfall intensity uplift applied (SSP5-8.5, 2090 horizon, factor 1.77 — 77% uplift). The 1% AEP and PMF have been re-checked with the uplifted rainfall; the modest depth increase at the site frontage remains within the freeboard provided in Tables 3a/3b.	Section 5.1.1, App A2
7	Hazard mapping per AR&R 2019 Book 6 (H1–H6); risk category definitions unclear.	Addressed. Hazard mapping classified per AR&R 2019 Book 6 (H1–H6) is provided in Appendix A3 for the 5% AEP, 1% AEP and PMF events. Flood risk category definitions are tabulated in Section 7.1.	Section 7.1, App A3
8	Separate flood function mapping with definitions required.	Addressed. Flood function mapping (Floodway, Flood Storage, Flood Fringe) is provided in Appendix A3 with definitions per the NSW Flood Risk Management Manual (2023).	App A3
9	Flood impact mapping for all modelled events.	Addressed. Pre vs post-development depth, velocity, hazard and flow direction maps for the 5% AEP, 1% AEP and PMF events are provided in Appendix A3.	App A3
10	Locations in Table 3 not shown in Appendix A5.	Addressed. Table 3 has been split into Tables 3a (PT 01–PT 06) and 3b (Conway basement). PT 01–PT 06 levels are detailed in Tables 3a/3b; threshold	Tables 3a/3b, App A6

		locations are shown on the MHNDU architectural plans in Appendix A7.	
11	Critical duration not identified.	Addressed. The critical duration is determined via the AR&R 2019 ensemble approach (10 temporal patterns per duration) and reported in Section 5.1.1. Adopted critical duration approximately 90 minutes for all events.	Section 5.1.1, App A2
12	Available warning time and isolation duration not identified; PMF protection lacking – SIP not currently suitable.	Addressed. Time-to-onset, isolation duration and hydraulic hazard on each egress route are tabulated in Table A6.2 and discussed in Section 2.6. PMF protection is now provided via passive landscape elements (Section 7.3, Tables 3a/3b), so the site is suitable for SIP per the assessment in Table A6.3.	Section 2.6, Section 7.3, Tables 3a/3b, A6.2/A6.3

Table A6.6 – DCCEEW CPHR Issue 2 (Flood Protection Works) – RTS Response

Issue	CPHR Comment (paraphrased)	RTS Response	FIRA Location
Issue 2	Automatic rising flood barriers not suitable for new development; passive design preferred. Carlisle and Conway entries are lower than PMF.	Accepted. All automatic, mechanical and tilting flood barriers have been removed from the design. Passive protection has been adopted via raised landscape crests, planter walls and raised pedestrian thresholds (refer Section 7.3, Tables 3a/3b). All basement openings, including the Conway Avenue ramp crest, vents and pedestrian entries, are at or above the PMF level or the 1% AEP plus freeboard, whichever is higher. Refer to RTS commentary at end of Section 8 regarding the required amendment to draft Council condition G.3(d) for full alignment.	Section 7.3, Section 8, Tables 3a/3b

A6.3 NSW DCCEEW WATER GROUP RESPONSE (FLOOD–GROUNDWATER INTERFACE)

Note: The DCCEEW Water Group submission (Rob Brownbill, 17 March 2026) addresses groundwater take, dewatering and aquifer interference. The FIRA-relevant DCCEEW agency is Conservation Programs, Heritage and Regulation (CPHR), whose submission (Susan Harrison, 23 March 2026) is addressed in Section A6.2 above.

The DCCEEW Water Group recommendations relate to groundwater take, dewatering infrastructure and aquifer interference. These matters fall outside the scope of flood impact and risk assessment and are being addressed by EI Australia through the Construction Phase Hydrogeological Report and associated Dewatering Management Plan (DMP).

For the interface between flood and groundwater design:

- EI Australia is undertaking ongoing groundwater monitoring to inform the final dewatering strategy;
- The current recommendation is for a drained basement, subject to confirmation on completion of monitoring;
- Groundwater discharge strategy and discharge point will be confirmed by EI Australia through the CPHR/DMP;

- Any pumped seepage or dewatering discharge will not be released to Council's kerb and gutter or stormwater network (consistent with WDCP E2.2.5, E2.2.10 and Annexure A draft conditions D.32(d) and D.34(i)).

Flood behaviour at the site is driven by overland flow and is not affected by groundwater. No changes to the flood design are required by the DCCEEW submission.

A6.4 NSW STATE EMERGENCY SERVICE RESPONSE

The NSW SES submission dated 19 March 2026 raises four principal matters. Each is addressed in Table A6.1 below. Supporting data for time-to-onset, duration and hydraulic hazard classification on egress routes is provided in Table A6.2. A Shelter-in-Place compliance assessment against the NSW Government Shelter-in-Place Guideline for Flash Flooding (January 2025) is provided in Table A6.3.

Table A6.1 – SES Submission Point-by-Point Response

No.	SES Comment	RTS Response
1	No automatic rising/tilting flood barriers. Passive flood protection preferred.	Accepted. Automatic and tilting flood barriers have been removed from the design. Passive flood protection has been adopted through raised landscape crests, raised planters and raised pedestrian thresholds, with basement opening levels set above the PMF or 1% AEP plus freeboard. Refer to revised Section 7.3.
2	FIRA to assess time-to-onset of inundation, duration of isolation and hydraulic hazard (H1-H6) on access and egress routes.	Addressed. Hydraulic hazard classification (H1-H6), time-to-onset and isolation duration have been extracted from the updated TUFLOW model and are tabulated in Table A6.2 for Conway Avenue, Fernleigh Avenue and Carlisle Street for the 5% AEP, 1% AEP and PMF events.
3	Shelter-in-Place assessment against the NSW Shelter-in-Place Guideline for Flash Flooding.	Addressed. A point-by-point compliance assessment against items 1–10 and design criteria I–X of the Guideline is provided in Table A6.3. Flash flooding is the only flood risk at the site; flood duration is short (peak duration approx. 90 minutes); the building footprint is not subject to H5/H6 hazard (egress-route hazard classification on the surrounding road network is provided in Table A6.2); and refuge levels above the PMF are provided via the first residential level and all floors above.
4	All basement openings (ramp, vents, pedestrian entries) at or above PMF or 1% AEP plus freeboard, whichever is higher.	Accepted and confirmed. The basement ramp crest along Conway Avenue is set above the PMF level. All vents and pedestrian entries within flood-affected zones are set above the applicable controlling level. Refer to revised Section 7.3 and updated Tables 3a and 3b.

Table A6.2 – Flood Hazard, Time-to-Onset and Duration of Isolation on Egress Routes

Event	Egress Route	Max Depth (m)	Max Velocity (m/s)	Max D×V (m ² /s)	Hazard (AR&R 2019 Book 6)	Time-to-onset / Duration (min)
5% AEP	Conway Ave	0.010	0.440	< 0.2	H1	60 / 60 approx.
5% AEP	Fernleigh Ave	0.033	1.630	< 0.2	H1	60 / 60 approx.
5% AEP	Carlisle St	0.009	0.889	< 0.2	H1	60 / 60 approx.
1% AEP	Conway Ave	0.014	0.541	< 0.2	H1	45 / 75 approx.
1% AEP	Fernleigh Ave	0.055	2.100	< 0.2	H1	45 / 75 approx.
1% AEP	Carlisle St	0.011	0.956	< 0.2	H1	45 / 75 approx.
PMF	Conway Ave	0.140	2.017	0.2 – 0.8	H1 – H2	30 / 90 approx.
PMF	Fernleigh Ave	0.813	2.405	1.2 – 2.0	H3 – H4	30 / 90 approx.
PMF	Carlisle St	0.105	1.980	0.2 – 0.8	H1 – H2	30 / 90 approx.

NOTE: Time-to-onset and duration values are estimates derived from TUFLOW hydrograph response at frontage monitoring points and the catchment flash-flood characterisation in the Rose Bay Catchment Flood Study (WMAwater, 2010). To be confirmed at Construction Certificate via PO line outputs.

Notes:

- D×V ranges above are derived from the TUFLOW D×V hazard grids produced for FIRA Rev 02 via QGIS post-processing (reclassification to FB03 colour scheme).
- PMF hazard along Carlisle Street remains within H1–H2 across the trafficable width. The H3–H4 hazard band in the PMF is confined to the eastern Fernleigh/Carlisle intersection sag-point on the Fernleigh frontage.
- Peak flood duration at the site is approx. 90 minutes consistent with the overland flow catchment characteristics (Rose Bay Flood Study 2010 and Rose Bay Floodplain Risk Management Study and Plan 2014).

Table A6.3 – Shelter-in-Place Compliance Assessment (NSW SIP Guideline, January 2025)

Item	Guideline Consideration	Compliance	RTS Comment
1	Does SIP align with existing emergency management strategies for the area (SES, FRM process)?	Yes	The Rose Bay Floodplain Risk Management Study and Plan (WMAwater, 2014) acknowledges overland flash flooding in the catchment with minimal warning time and recognises the role of on-site emergency response for flood-affected properties. SIP is consistent with SES advice for flash-flood urban sites where off-site evacuation routes may be compromised.
2	Has evacuation off-site been investigated and determined to be unachievable?	Yes	Evacuation off-site during the PMF peak is not reliable because Fernleigh Avenue and Carlisle Street experience elevated hazard conditions during PMF peaks. Time-to-onset is within the definition of flash flooding (<6 hours from causative rainfall). Off-site evacuation prior to onset is supported where warning is available; where not, SIP is the primary emergency response.

Item	Guideline Consideration	Compliance	RTS Comment
3	Does the development include medical centres, emergency service or community facilities, or sensitive/hazardous land uses?	N/A	The development is a residential flat building with in-fill affordable housing. It is not a sensitive or hazardous use as defined in Clause 5.22(5) of the Standard Instrument LEP.
4	Greenfield development – not supported for SIP.	N/A	The site is an established urban infill redevelopment, not greenfield.
5	Are existing government flood warning systems available to allow sufficient evacuation time?	Partial	BoM severe weather warnings and SES flood watches apply to the Sydney region; however, the Rose Bay catchment has no site-specific gauge-based warning system for overland flash flooding. Residents will be advised through the FERP to monitor BoM and SES warnings and subscribe to SES SMS alerts. SIP is the fallback where warning time is insufficient.
6	Can the community effectively be informed of the risks?	Yes	A Flood Emergency Response Plan (FERP) and individual Emergency FloodSafe Plans (per SES guidance) will be prepared prior to occupation. Plans will be displayed in common areas and issued to residents at handover.
7	FIRA to demonstrate evacuation off-site is not achievable.	Yes	Demonstrated – refer to Section 6.2 and Item 2 above. Short warning time, elevated kerb-line hazard during PMF peaks, and short peak duration (approx.90 minutes) make SIP a more defensible response than mid-event evacuation.
8a	Flash flooding is the only flood risk at the site.	Yes	The only flood risk is local overland flow per the Rose Bay Catchment Flood Study (WMAwater, 2010). The site is not subject to mainstream, riverine, coastal or tidal flooding.
8b	Flooding occurs within <6 hours of causative rain and SIP isolation <12 hours from commencement of rainfall.	Yes	Flood onset is within approx.30–90 minutes of causative rain (flash flood by definition). Peak duration is approx.90 minutes. Total isolation duration at the site is <12 hours and in practice closer to 2–3 hours.
8c	Development is not subject to H5/H6 flooding and surrounding roadways are not subject to high hazard flooding.	Yes (conditional)	The building footprint is H1 in the PMF, with small H2 patches at the property boundary. The building is not subject to H5 or H6 hazard. Surrounding roadway hazard in the PMF (refer Table A6.2): Conway Avenue H1–H2; Carlisle Street H1–H2 across the trafficable width; Fernleigh Avenue rises to H3–H4 (D=0.813 m, V=2.405 m/s, D×V≈1.96 m ² /s) along the eastern frontage. The PMF egress hazard at Fernleigh is mitigated by (i) a continuous 810 mm raised landscape threshold along the Fernleigh frontage, sized to the local PMF depth (refer Section 7.3 and Tables 3a/3b), and (ii) SIP refuge above the PMF on Level 1 and all upper residential levels. Off-site evacuation via Fernleigh Avenue during the PMF peak is therefore not relied upon. SIP is the primary response and the intent of Item 8c is considered satisfied.
9	SIP emergency management response and communication to occupants.	Yes	A Flood Emergency Response Plan (FERP) covering pre-flood, during-flood and post-flood actions will be developed prior to occupation. Communication maintained through the Owners Corporation / Building Manager for the life of the development.
10	Secondary risks (medical, fire, health/wellbeing) considered per EM01 Table 12.	Yes	Addressed in the FERP. Short isolation duration (approx.90 min peak, <12 hours total) materially limits the scale of secondary risks. First aid provisions, back-up emergency lighting and internal refuge areas above the PMF form part of the standard building services scope.
I	Floor level of SIP part of the development is above the PMF.	Yes	Level 1 and all higher residential levels are above the PMF. The lowest SIP refuge floor is well above the PMF level.

Item	Guideline Consideration	Compliance	RTS Comment
II	Structural soundness for PMF conditions (flood and debris forces) verified by a structural engineer.	To be confirmed at CC	The structural engineer will verify the design at Construction Certificate stage. Given flood affectation on the site is H1–H2 in the PMF and confined to the perimeter, structural demand from flood forces is low.
III	Area and access self-directing, not reliant on electricity, clearly marked.	Yes	Refuge via internal stairs from lower levels to Level 1 and above. Emergency lighting independent of mains power provided per BCA requirements. Signage to be confirmed at CC.
IV–X	Supplementary design criteria – weather protection, hygiene, floor space (2 m ² /person), self-sufficiency items, communal shelter access, back-up power, maintenance plan.	Addressed at CC	As the SIP refuge comprises the occupants' own residential units, these items are inherent to the building design. Maintenance of the FERP will be the responsibility of the Owners Corporation / Building Manager and will be documented at Construction Certificate stage.

A6.5 WOOLLAHRA MUNICIPAL COUNCIL RESPONSE – FLOOD (SECTION 26)

The Council submission requests DPHI to ensure the proposal accords with Clause 5.21 of WLEP 2014. A sub-clause by sub-clause compliance narrative is provided in Table A6.4.

Table A6.4 – WLEP 2014 Clause 5.21 Flood Planning Compliance Narrative

Clause	Requirement	RTS Comment
5.21(2)(a)	Development is compatible with the flood function and behaviour on the land.	The development is compatible with the flood function of the land. Flood modelling demonstrates that the post-development scenario does not materially alter flood behaviour on the site or surrounding land. Overland flow remains confined to the road reserve (Fernleigh Avenue, Carlisle Street and east Conway Avenue). Refer to Sections 5 and 6 of this report.
5.21(2)(b)	Development will not adversely affect flood behaviour (levels, flows, storage) on surrounding land.	Pre- and post-development TUFLOW modelling demonstrates negligible afflux at surrounding properties. No reduction in flood storage. No blockage of flow paths. The post-development surface is compatible with the pre-development surface in flood-conveyance terms.
5.21(2)(c)	Development incorporates appropriate measures to manage risk to life from flood.	Passive flood protection is provided at the building perimeter (raised landscape crest, raised thresholds). All habitable floor levels are at or above the 1% AEP + 500 mm freeboard. Basement openings are above the PMF. Shelter-in-Place with above-PMF refuge is supported by the flood regime at the site (Table A6.3). A FERP will be developed prior to occupation.
5.21(2)(d)	Development is not likely to significantly adversely affect the environment or cause increased flood risk elsewhere.	No significant adverse environmental impact. No increased flood risk to upstream, downstream or adjoining properties. Stormwater quantity is managed by on-site detention; quality is managed via WSUD measures per the IWMP.
5.21(2)(e)	Development provides for emergency response and evacuation.	Emergency response is addressed in Section 2.6 of this report and Table A6.3. Off-site evacuation is the primary strategy where warning time allows; Shelter-in-Place is the secondary strategy for events with insufficient warning. A FERP will be developed prior to occupation.
5.21(3)(a)	Development is compatible with the flood hazard of the land.	The site is predominantly H1 (Generally Safe) in the 1% AEP and PMF events with small areas of H2 at the perimeter. The proposed residential use is compatible with this hazard classification. Basement access and parking are set above the controlling flood level at the Conway Avenue entry.

Clause	Requirement	RTS Comment
5.21(3)(b)	Development will not adversely affect the safe occupation and evacuation of the land.	Safe occupation is supported by habitable levels above the FPL, passive flood protection and SIP refuge above the PMF (Table A6.3). Evacuation routes along Conway Avenue, Fernleigh Avenue and Carlisle Street are available in most events; SIP is the fallback where off-site evacuation is not achievable.
5.21(3)(c)	Development incorporates appropriate measures to manage risk to life and property from flood.	Refer to Clause 5.21(2)(c) above. Additionally, all building elements located below the FPL will be of flood-compatible construction per the ABCB Standard for Construction of Buildings in Flood Hazard Areas and the NSW Reconstruction Authority Flood Resilient Design Guide.
5.21(3)(d)	Development is not likely to significantly adversely affect the environment or cause increased flood risk elsewhere.	Refer to Clause 5.21(2)(d) above. No increased flood risk elsewhere; no significant adverse environmental impact.

A6.6 WOOLLAHRA COUNCIL RESPONSE – STORMWATER (SECTION 27) AND ANNEXURE A

Council's Section 27 stormwater comments and Annexure A draft conditions (D.6, D.32, D.34, D.35) are addressed in the companion Integrated Water Management Plan Rev 02 and Stormwater Management Plan Issue 02. Key positions:

- On-Site Detention storage to be provided per WDCP E2.2.4 and Annexure A; Peak Site Discharge limited to 105.5 L/s in the 1% AEP.
- OSD outlet invert above the downstream Hydraulic Grade Line using top-of-kerb at the connecting kerb inlet as tailwater. No submerged outlets. No non-return valves.
- Stormwater quality treatment via WSUD per WDCP E2.2.3; final treatment train (raingardens vs OSD uplift) confirmed at Construction Certificate stage.
- All invert levels and finished levels at junction pits and kerb inlet pits clearly shown on CC drawings.
- Annexure A D.6 (Flood Planning Level): habitable 1% AEP + 500 mm; car parking >3 spaces 1% AEP + 300 mm. Passive flood protection satisfies these levels.
- Annexure A D.32 (geotechnical and hydrogeological design / tanking / no subsoil discharge to kerb and gutter, with the corresponding D.34(i) drawings notation): addressed by EI Australia. IWMP Section 3.2 confirms no subsoil discharge to Council's kerb and gutter.

A6.7 RFI RESPONSE COMPLIANCE MATRIX

The following matrix tabulates each submission item relevant to RTS Civil's scope, a summary response, and the location of the detailed response in the FIRA Rev 02. Source codes used in the matrix are aligned with the IWMP Rev 02 Source Document Register: DPHI, DCCEEW-CPHR, SES, DCCEEW-W, WC, WC-DC, FPD. Items marked "Refer IWMP" are addressed in the companion IWMP Rev 02 and are not duplicated here.

Item	Source	RFI / Submission Matter (paraphrased)	RTS Response (Summary)	Location / Compliance
6	DPHI	Updated FIRA responding to DCCEEW CPHR.	Addressed via Section A6.2 (CPHR 12-point) and Section A6.4 (SES).	FIRA Section A6.2 – Complies

Item	Source	RFI / Submission Matter (paraphrased)	RTS Response (Summary)	Location / Compliance
7	DPHI	No automatic flood barriers; LG/GF at FPL; basement openings $\geq$ PMF or 1%+freeboard.	Automatic barriers removed. Passive protection adopted. All basement openings above controlling level.	FIRA Section 7.3, Tables 3a/3b – Complies
CPHR-1.1	DCCEEW-CPHR	Properties raised to contain road flow – approach not fit for FIRA.	Acknowledged; site-specific on-lot ground levels above kerb (Rygate 80854-C); model reflects actual behaviour.	Section 2.4, Section 5.1, App A2 – Complies
CPHR-1.2	DCCEEW-CPHR	Fences – Fernleigh/Carlisle PMF >0.8m ponding.	Fences modelled as permeable; ponding reflects sag-point depth concentration.	App A2 – Complies
CPHR-1.3	DCCEEW-CPHR	Hydrological assumptions (catchment, sub-catchment, losses) not identified.	Documented in new Section 5.1.1 + App A2 (Tables A2.x).	Section 5.1.1, App A2 – Complies
CPHR-1.4	DCCEEW-CPHR	Hydraulic assumptions (Manning's, network, blockage) not identified.	Documented in App A2 (Table A2.y).	Section 5.1.1, App A2 – Complies
CPHR-1.5	DCCEEW-CPHR	Verification level locations not identified.	Verified at Conway, Fernleigh and Carlisle frontages (refer §5.1.1, Tables 1 and 2).	App A2 – Complies
CPHR-1.6	DCCEEW-CPHR	Climate change – rainfall uplift, not just SLR.	ARR 2019 rainfall uplift applied (SSP5-8.5, 2090 horizon, factor 1.77); depth uplift checked.	Section 5.1.1, App A2 – Complies
CPHR-1.7	DCCEEW-CPHR	Hazard mapping per AR&R 2019 Book 6 (H1–H6).	Hazard maps for 5%, 1%, PMF embedded in App A3.	Section 7.1, App A3 – Complies
CPHR-1.8	DCCEEW-CPHR	Flood function mapping with definitions.	Floodway/Storage/Fringe maps in App A3 with FRMM 2023 definitions.	App A3 – Complies
CPHR-1.9	DCCEEW-CPHR	Flood impact mapping for all modelled events.	Pre vs Post depth/velocity/hazard maps for 5%, 1%, PMF in App A3.	App A3 – Complies
CPHR-1.10	DCCEEW-CPHR	Table 3 locations not shown in App A5.	PT 01–PT 06 levels in Tables 3a/3b; locations on architectural plans (App A7).	Tables 3a/3b, App A6 – Complies
CPHR-1.11	DCCEEW-CPHR	Critical duration not identified.	AR&R 2019 ensemble approach; documented per event.	Section 5.1.1, App A2 – Complies

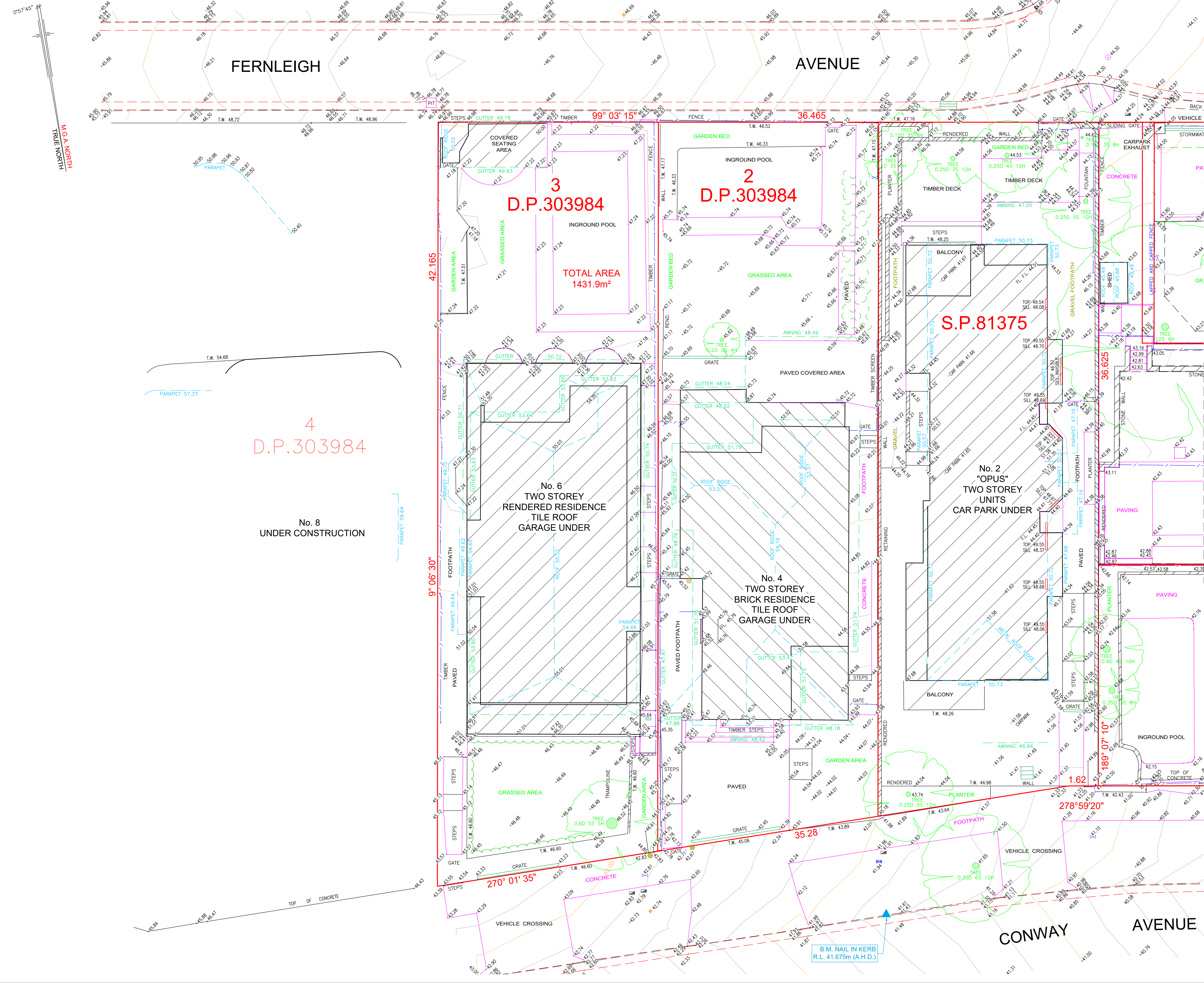
Item	Source	RFI / Submission Matter (paraphrased)	RTS Response (Summary)	Location / Compliance
CPHR-1.12	DCCEEW-CPHR	Warning time / isolation duration not identified; PMF protection lacking.	Time-to-onset and isolation in Table A6.2; PMF protection now passive (Section 7.3); SIP suitable per Table A6.3.	Section 2.6, Section 7.3, Tables 3a/3b, A6.2/A6.3 – Complies
CPHR-2	DCCEEW-CPHR	Automatic flood barriers unsuitable; Carlisle/Conway entries below PMF.	All automatic devices removed; passive protection; Conway access above PMF.	Section 7.3, Section 8, Tables 3a/3b – Complies
SES-1	SES	Time-to-onset, isolation duration, hydraulic hazard on access/egress.	Table A6.2 (TUFLOW-derived).	Table A6.2 – Complies
SES-2	SES	SIP assessment per NSW SIP Guideline.	Point-by-point Table A6.3.	Table A6.3 – Complies
SES-3	SES	Passive flood protection (not flood gates).	Accepted; passive only via raised landscape/architectural elements.	Section 7.3 – Complies
SES-4	SES	Basement openings (ramp, vents, pedestrian) $\geq$ PMF or 1%+freeboard.	Confirmed.	Section 7.3, Tables 3a/3b – Complies
SES-P1	SES	Compatibility with NSW State Flood Plan and Waverley/Woollahra Sub Plan.	Aligned; SIP supports the Sub Plan strategy where evacuation impractical.	Section 2.6 – Complies
SES-P2	SES	Full range of risks incl. PMF velocity >2 m/s mapping.	PMF velocity and AR&R Book 6 hazard mapping in App A3.	App A3 – Complies
SES-P3	SES	Basement openings above PMF; no mass rescue assumption.	Confirmed (refer SES-4).	Section 7.3 – Complies
SES-P4	SES	High Flood Island – isolation, secondary risks, behaviour.	Addressed in Table A6.3 and consolidated narrative.	Table A6.3 – Complies
SES-P5	SES	Itinerant population.	Addressed in FERP scope.	Section 2.6 – Complies at CC
SES-P6	SES	Flood warning systems (AWS, BoM, HazardWatch).	Hazards Near Me, NSW SES website, HazardWatch referenced in Section 2.6.	Section 2.6 – Complies
SES-P7	SES	Ongoing community awareness; private plan insufficient.	Acknowledged; FERP + signage + drills; SES tools referenced.	Section 2.6 – Complies
WC Section 26	WC	WLEP Cl 5.21(2)(a)–(e), 5.21(3)(a)–(d).	Sub-clause narrative.	Table A6.4 – Complies
WC Section 27	WC	Stormwater (raingarden / OSD uplift / outlet HGL / no NRV / ILs).	Refer companion IWMP Rev 02.	IWMP Section 4 / SWMP – Refer IWMP
WC-DC D.6	WC-DC	Habitable +500mm; car parking +300mm above 1% AEP.	Accepted; FRMP at CC.	Table 4 (R3, R4), Section A6.6 – Complies at CC

Item	Source	RFI / Submission Matter (paraphrased)	RTS Response (Summary)	Location / Compliance
WC-DC G.3	WC-DC	Flood inundation protection (waterproof wall, FRMP, lights, barrier, materials, electrical, certification).	Accepted G.3(a), (b), (c), (e), (f), (g), (h). G.3(d) flagged as inconsistent with passive strategy and CPHR/SES advice; RTS recommends DPHI amend G.3(d) prior to consent issue (refer Section 8 closing paragraph).	Section 7.3, Section 8, Tables 3a/3b – Complies subject to G.3(d) amendment
WC-DC D.34	WC-DC	OSD 77.6 m ³ , PSD 105.5 L/s; no submerged outlet; no NRV.	Refer IWMP Rev 02.	IWMP Section 4 / SWMP – Refer IWMP
WC-DC D.32	WC-DC	Geotech / tanking / no subsoil discharge to kerb.	Defer to EI Australia.	EI Aus / IWMP Section 3.2 – Refer EI Aus
DCCEEW-W (1–3)	DCCEEW-W	Groundwater take, aquifer interference, WAL/exemption.	Defer to EI Australia via CPHR/DMP. No flood-design impact (overland flow only).	EI Aus CPHR – Refer EI Aus
FPD Section 4	FPD	Consolidated CPHR tabulation.	Source items addressed via CPHR-1.x and CPHR-2 above.	App A6.6 – Refer CPHR rows
FPD Section 5	FPD	Consolidated SES tabulation.	Source items addressed via SES-1–4 and SES-P1–P7 above.	App A6.6 – Refer SES rows
FPD Section 6.2	FPD	Flood hazard suitability – Rose Bay flood study should be updated.	Acknowledged; assumptions disclosed (CPHR-1.3–1.6); refined model accepts and improves on Rose Bay Study.	Section 5.1, App A2 – Complies
FPD Section 6.3	FPD	Concerns proposed barriers redirect water.	Barriers removed; passive protection only.	Section 7.3 – Complies
FPD Section 6.4	FPD	Inconsistency with draft Sydney Plan Appendix I Flood Planning Principles.	Point-by-point compliance with the seven Flood Planning Principles tabulated in Section 4.4 (Table 4.4).	Section 4.4, Table 4.4 – Complies
FPD Section 6.5	FPD	Flood modelling does not consider groundwater interaction.	Site flood behaviour is overland-flow only; no groundwater–flood interaction (per Rose Bay Catchment Flood Study and EI Aus).	Section 5.1 – Complies
FPD Section 6.6	FPD	SIP rather than safe egress under major rainfall.	SIP justified per Table A6.3; SES Principle 1; Sub Plan Section 5.8 alignment.	Section 2.6, Table A6.3 – Complies
FPD Section 6.7	FPD	FRMP availability.	FRMP developed at CC stage.	Section 7.x – Complies at CC

Item	Source	RFI / Submission Matter (paraphrased)	RTS Response (Summary)	Location / Compliance
FPD Section 6.8	FPD	Downstream SW capacity (basement pump-out, seepage discharge, surcharge).	Refer IWMP Rev 02 (RTS-claimed therein).	IWMP – Refer IWMP REV-A
FPD Section 6.9	FPD	Climate change impacts.	ARR 2019 rainfall uplift applied (refer CPHR-1.6).	Section 5.1.1, App A2 – Complies
FPD Section 19.2	FPD	Local flood study not addressed.	Addressed at Section 4.2 of FIRA (WLEP CI 5.21 + Rose Bay Flood Study reference framework).	Section 4.2 – Complies

End of Appendix A6.

APPENDIX A7 – SITE SURVEY, PROPOSED PLANS AND MANAGEMENT MEASURES



NOTES:

IF ACCURATE LOCATION OF SERVICES IS REQUIRED SERVICE TRACE IS RECOMMENDED.

INFORMATION SHOWN ON PLAN AND ELEVATIONS OF ADJOINING PROPERTIES HAS BEEN OBTAINED BY REMOTE SURVEY METHODS FROM WITHIN SUBJECT LAND AND STREET.

RESTRICTED VISIBILITY ALONG THE EASTERN AND WESTERN BOUNDARIES OF THE SUBJECT LAND HAS PREVENTED DIRECT MEASUREMENTS TO THE ADJOINING BUILDINGS.

SYMBOLS REPRESENTING SERVICE PITS, POLES AND STREET FURNITURE ARE NOT TO SCALE.

TREE SPREADS AND TRUNK DIAMETERS SHOWN ARE DIAGRAMMATIC ONLY AND TREE HEIGHTS ARE ESTIMATED. IF ANY OF THESE ELEMENTS ARE CRITICAL TO DESIGN (IN PARTICULAR DRIP LINES) MORE SPECIFIC DETAILS SHOULD BE REQUESTED FOR ACCURATE LOCATION.

BEARINGS SHOWN RELATE TO M.G.A. NORTH.

VISIBLE SURFACE PITS ONLY SHOWN.
THE EXISTENCE AND POSITION OF UNDERGROUND SERVICES HAS NOT BEEN INVESTIGATED.

PIT SIZE IS SHOWN AT GROUND LEVEL. PITS MAY BE LARGER BELOW THE SURFACE.

CONSTRUCTION WORKS MUST BE RELATED TO THE SITE BENCH MARK AND NOT LEVELS OF STRUCTURES SHOWN ON THE PLAN.

IT IS THE RESPONSIBILITY OF EACH CONTRACTOR AND/OR CONSULTANT TO CONTACT THE RELEVANT AUTHORITY AND/OR "Before You Dig Australia" (Phone 1100) BEFORE COMMENCING ANY EXCAVATION.

THIS PLAN HAS BEEN CREATED AT A SCALE OF 1:100 AND MAY NOT BE SATISFACTORY FOR OTHER PURPOSES. THE ACCURACY OF ANY ENLARGEMENT OR OTHER REPRODUCTION MAY BE LESS THAN THAT OF THE ORIGINAL.

POSITIVE COVENANT ON LOTS 1, 2 AND 3 IN D.P.1201196

BOUNDARIES HAVE BEEN SURVEYED IN ACCORDANCE WITH THE SURVEYING & SPATIAL INFORMATION REGULATION 2024.

Michael Brown
M.A. BROWN, B.Surv. M.I.S.
Registered Land Surveyor
Surveyor ID: SU008739

- LEGEND
- | | | |
|-----------------------|------------------------|----------------------|
| ELECTRICITY PIT | WATER METER | BENCHMARK |
| ELEC POLE WITH LIGHT | WATER TAP | GROUND CONTROL POINT |
| ELECTRICITY POLE | STOP VALVE | PERMANENT MARK |
| LIGHT POLE | HYDRANT | STATE SURVEY MARK |
| TRAFFIC SIGNAL | STORM WATER GRATE | REFERENCE MARK |
| ELECTRICITY PILLAR | STORM WATER GRATE | BIN |
| MULTI FUNCTION POLE | STORM WATER MANHOLE | CAMERA |
| GAS METER | STORM WATER PIT | HILLS HOIST |
| GAS VALVE | DOWNPIPE | MAILBOX |
| POLE (UNSPECIFIED) | SEWER INSPECTION POINT | SIGN |
| PIT (UNSPECIFIED) | MANHOLE SEWER | PARKING METER |
| MANHOLE (UNSPECIFIED) | MANHOLE SEWER | FIRE HYDRANT |
| TELECOM PIT | BOLLARD | GATE |
| TELECOM PILLAR | | STORM WATER |
| RTA PIT | | TOP OF BANK |
| T.W. TOP OF WALL | | BOTTOM OF BANK |
| B.W. BOTTOM OF WALL | | OVERHEAD POWER LINES |

SEE SHEET 2 FOR CONTINUATION	
C	17/10/2025
B	26/08/2025
A	05/08/2025
REV.	DATE
AMENDMENTS	
DETAIL 38-40 CARLISLE ST, 15 FERNLEIGH AVENUE INCL (80907)	
TRUE NORTH INCLUDED ON PLAN	
ISSUED FOR INFORMATION	

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SURVEYING SINCE 1993

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SURVEYOR	DRAWN	CHECKED	APPROVED
A.C. / L.M.	T.O.	A.C.	S.H.B.

0 10m
REDUCTION RATIO 1:100 @ A1

DATUM: AUSTRALIAN HEIGHT DATUM
CONTOUR INTERVAL: 0.2m
ORIGIN OF LEVELS: S.S.M. 64008 R.L. 30.238m (A.H.D.)

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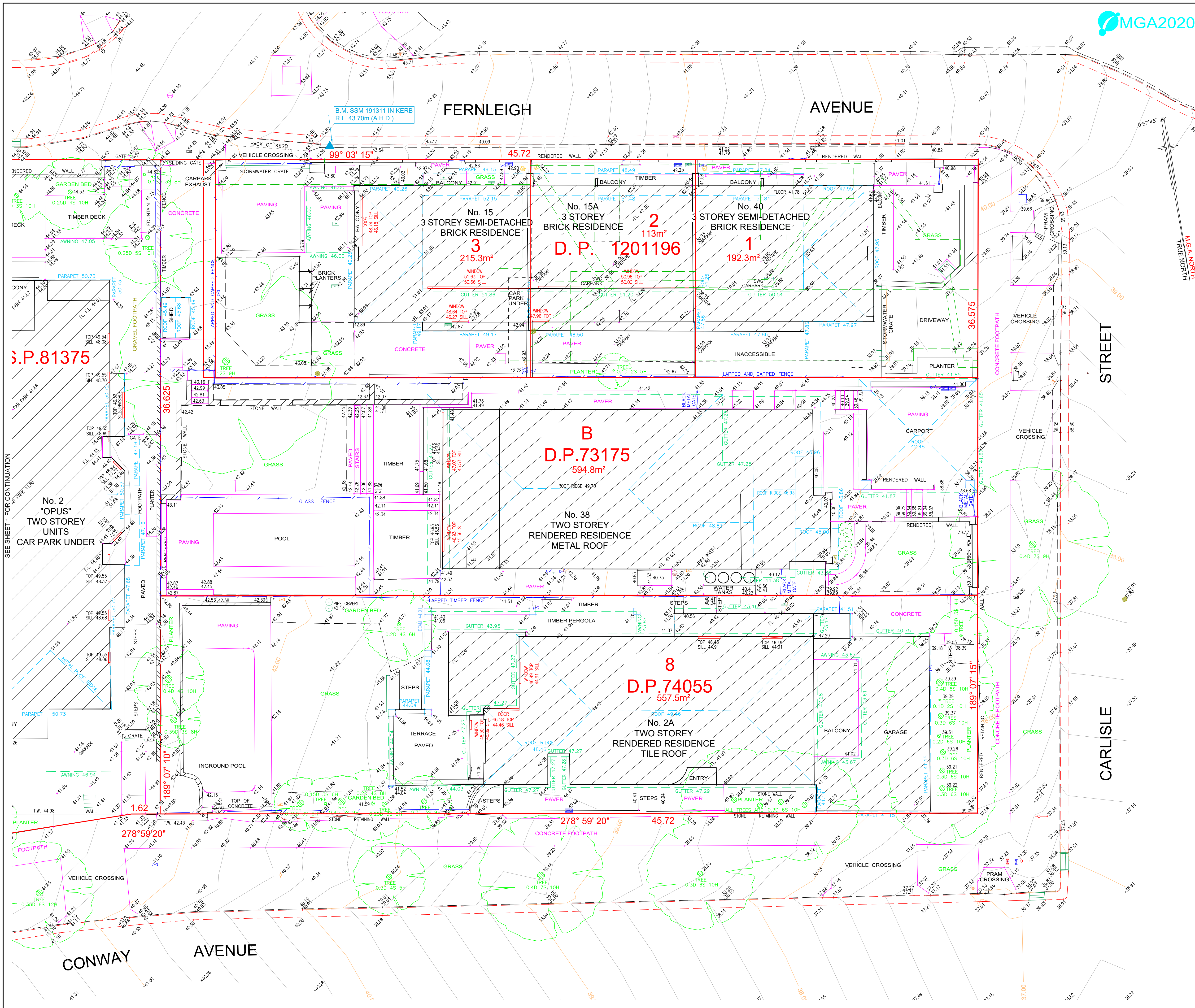
CLIENT
MATHIESON PROPERTY

LOCALITY
ROSE BAY

L.G.A.
WOOLLAHRA

PLAN
SHOWING DETAIL & LEVELS
2-6 CONWAY AVENUE
S.P. 81375, LOT 2-3 D.P.303984

REFERENCE No.	PLAN No.	DATE	SHEET NO
80854	80854-C.DWG	05/08/2025	1 OF 3 SHEETS



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POSITIVE COVENANT ON LOTS 1, 2 AND 3 IN D.P.1201196

BOUNDARIES HAVE BEEN SURVEYED IN ACCORDANCE WITH THE SURVEYING & SPATIAL INFORMATION REGULATION 2024.

Michael Brown
M.A. BROWN, B.Surv. M.I.S.
Registered Land Surveyor
Surveyor ID: SU008739

LEGEND	
	ELECTRICITY PIT
	ELEC POLE WITH LIGHT
	ELECTRICITY POLE
	LIGHT POLE
	TRAFFIC SIGNAL
	ELECTRICITY PILLAR
	MULTI FUNCTION POLE
	GAS METER
	GAS VALVE
	POLE (UNSPECIFIED)
	PIT (UNSPECIFIED)
	MANHOLE (UNSPECIFIED)
	TELECOM PIT
	TELECOM PILLAR
	RTA PIT
	T.W. TOP OF WALL
	B.W. BOTTOM OF WALL
	WATER METER
	WATER TAP
	STOP VALVE
	HYDRANT
	STORM WATER GRATE
	STORM WATER GRATE
	STORM WATER MANHOLE
	STORM WATER PIT
	DOWNPIPE
	SEWER INSPECTION POINT
	MANHOLE SEWER
	BOLLARD
	BENCHMARK
	GROUND CONTROL POINT
	PERMANENT MARK
	STATE SURVEY MARK
	REFERENCE MARK
	BIN
	CAMERA
	HILLS HOIST
	MAILBOX
	SIGN
	FIRE HYDRANT
	PARKING METER
	GATE
	STORMWATER
	TOP OF BANK
	BOTTOM OF BANK
	OVERHEAD POWER LINES

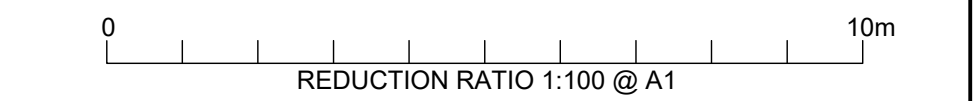
REV.	DATE	AMENDMENTS
C	17/10/2025	DETAIL 38-40 CARLISLE ST, 15 FERNLEIGH AVENUE INCL (80907)
B	26/08/2025	TRUE NORTH INCLUDED ON PLAN
A	05/08/2025	ISSUED FOR INFORMATION

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SURVEYOR	DRAWN	CHECKED	APPROVED
A.C. / L.M.	T.O.	A.C.	S.H.B.



DATUM: AUSTRALIAN HEIGHT DATUM
CONTOUR INTERVAL: 0.2m
ORIGIN OF LEVELS: S.S.M. 64008 R.L. 30.238m (A.H.D.)

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CLIENT	MATHIESON PROPERTY
LOCALITY	ROSE BAY
L.G.A.	WOOLLAHRA

PLAN
SHOWING DETAIL & LEVELS
2A CONWAY AVENUE,
38 & 40 CARLISLE STREET,
15 & 15A FERNLEIGH AVENUE
LOT 8 D.P.74055, LOT B D.P.73175 & LOT1-3 D.P.1201196

REFERENCE No.	PLAN No.	DATE	SHEET No 2
80854	80854-C.DWG	05/08/2025	OF 3 SHEETS

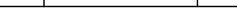
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SPATIAL INFORMATION REGULATION 2024.

Michael Brown

M.A. BROWN, B.Surv. M.I.S.
Registered Land Surveyor
Surveyor ID: SU008739

LEGEND					
	ELECTRICITY PIT		WATER METER		BENCHMARK
	ELEC POLE WITH LIGHT		WATER TAP		GROUND CONTROL POINT
	ELECTRICITY POLE		STOP VALVE		PERMANENT MARK
	LIGHT POLE		HYDRANT		STATE SURVEY MARK
	TRAFFIC SIGNAL		STORM WATER GRATE		REFERENCE MARK
	ELECTRICITY PILLAR		STORMWATER GRATE		BIN
	MULTI FUNCTION POLE		STORM WATER MANHOLE		CAMERA
	GAS METER		STORM WATER PIT		HILLS HOIST
	GAS VALVE		DOWNPIPE		MAILBOX
	POLE (UNSPECIFIED)		SEWER INSPECTION POINT		SIGN
	PIT (UNSPECIFIED)		MAN-HOLE SEWER		PARKING METER
	MANHOLE (UNSPECIFIED)		MAN-HOLE SEWER		FIRE HYDRANT
	TELECOM PIT		BOLLARD		GATE
	TELECOM PILLAR		STORMWATER		STORMWATER
	RTA PIT		TOP OF BANK		TOP OF BANK
	TOP OF WALL		BOTTOM OF BANK		BOTTOM OF BANK
	W. BOTTOM OF WALL		OVERHEAD POWER LINES		OVERHEAD POWER LINES

C	17/10/2025	DETAIL 38-40 CARLISLE ST, 15 FERNLEIGH AVENUE INCL (80907)
B	26/08/2025	TRUE NORTH INCLUDED ON PLAN
A	05/08/2025	ISSUED FOR INFORMATION
REV.	DATE	AMENDMENTS

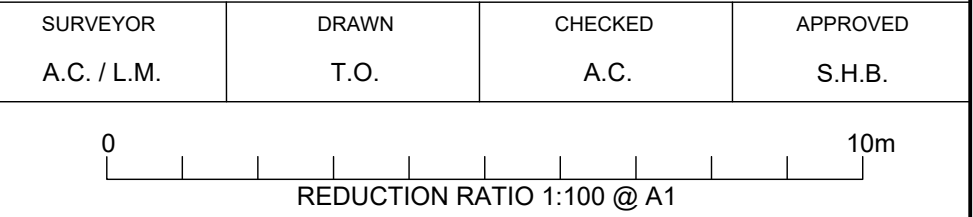

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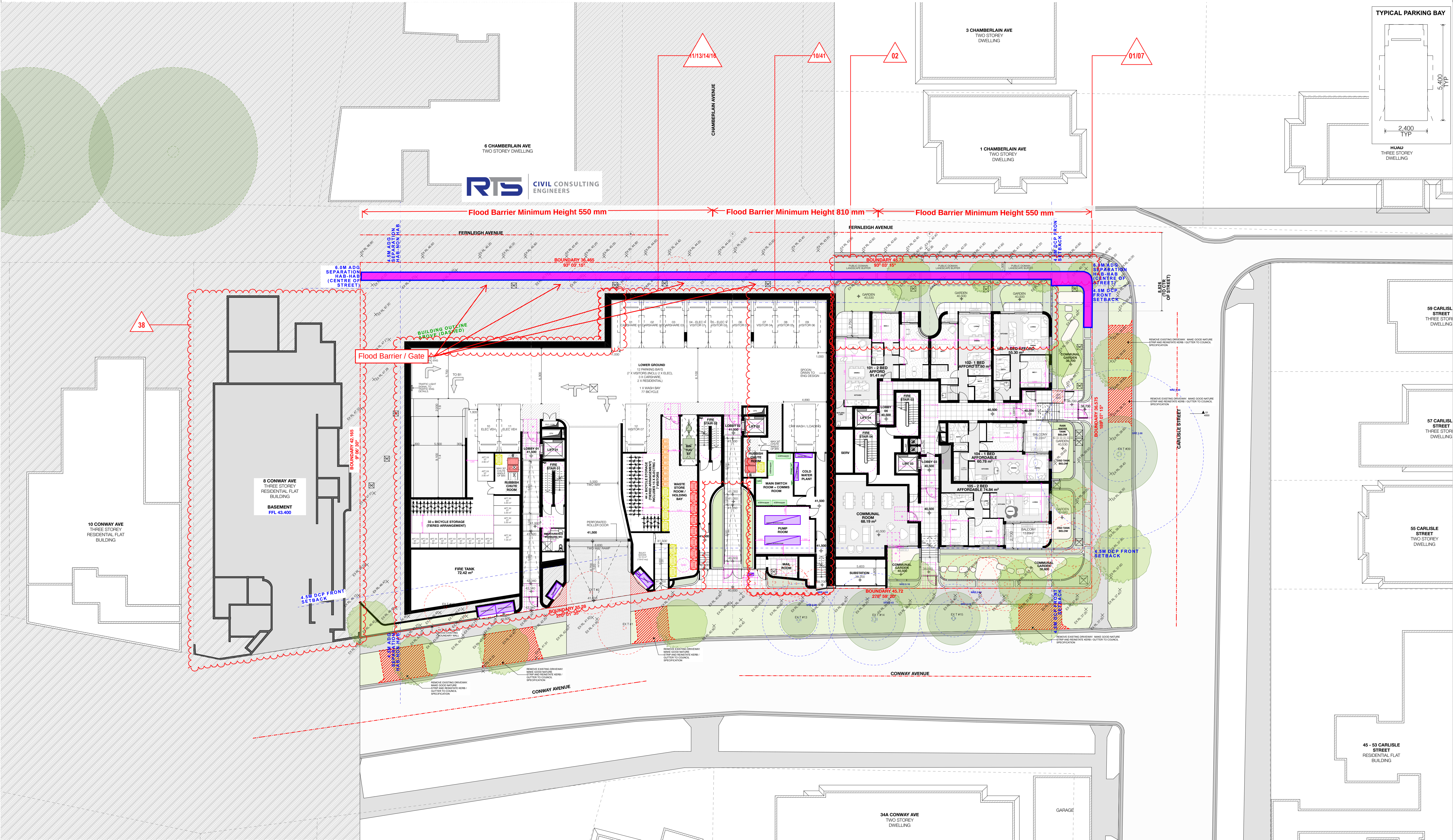
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CLIENT	MATHIESON PROPERTY
LOCALITY	ROSE BAY
G.A.	WOOLLAHRA

PLAN
SHOWING EASEMENTS
40 CARLISE STREET,
15 & 15A FERNLEIGH AVENUE
LOT 1,2 AND 3 D.P.1201196

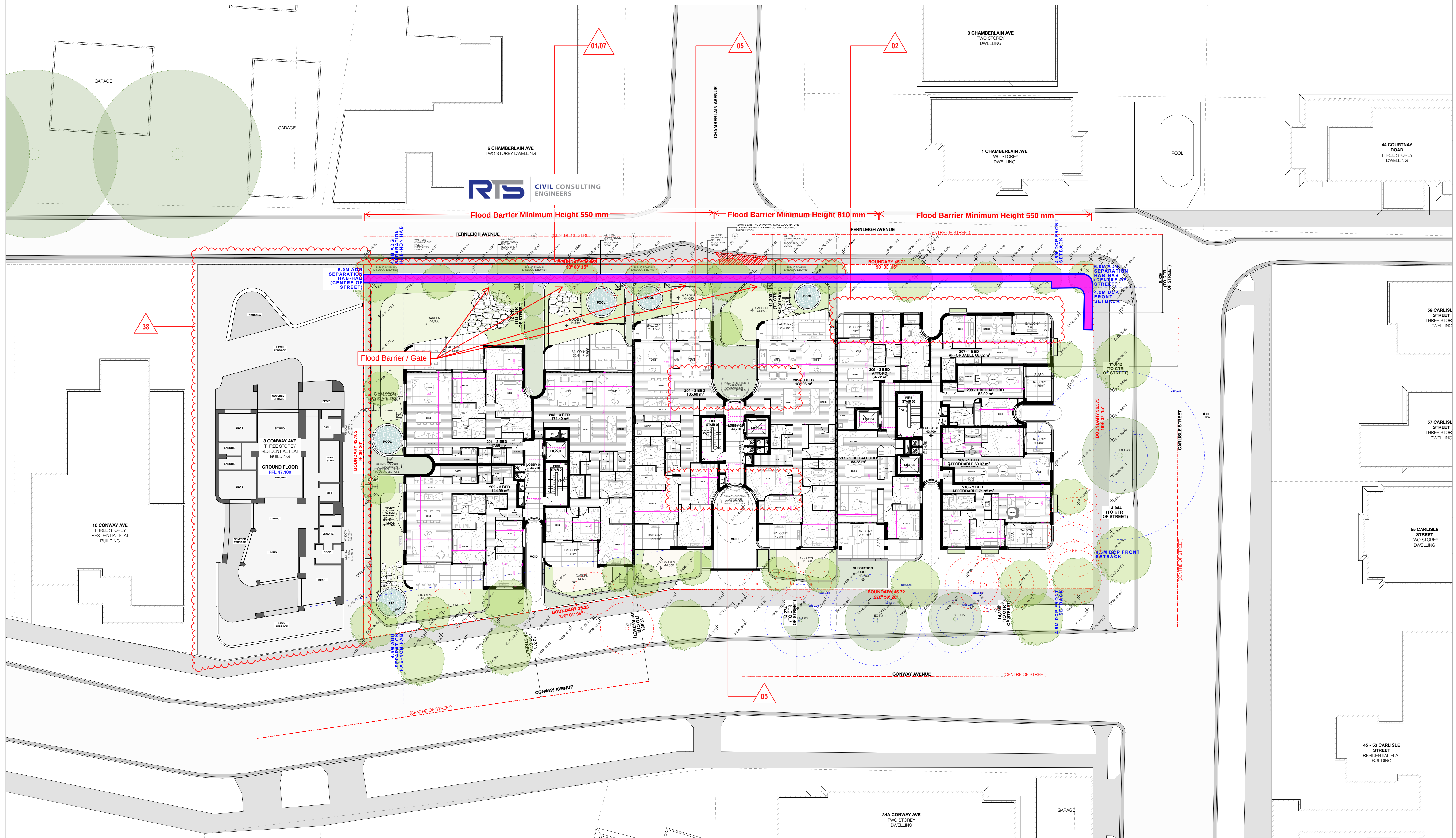
REFERENCE No. 80854	PLAN No. 80854-C.DWG	DATE 05/08/2025	SHEET NO 3 OF 3 SHEETS
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LOWER GROUND

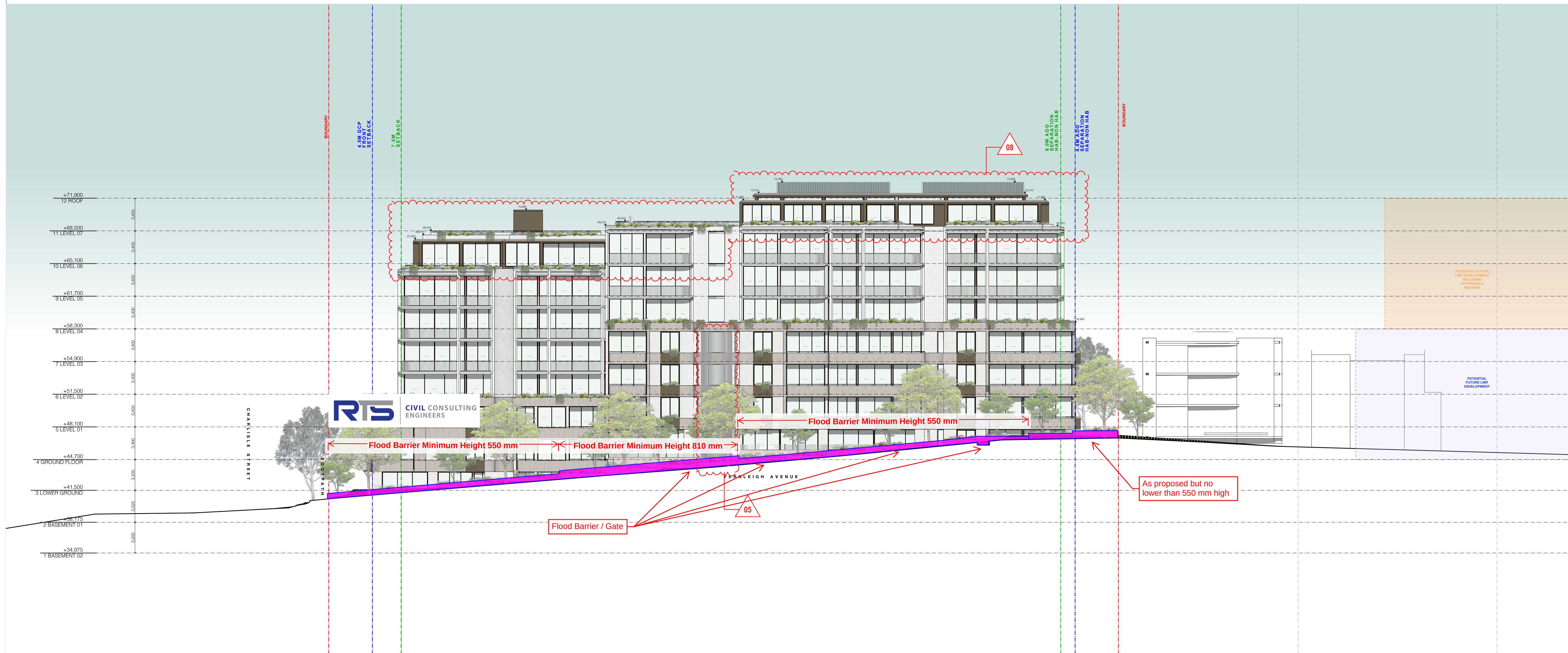


REV	NOTE	DATE	GENERAL NOTES	ALL CONSTRUCTION TO COMPLY AT MINIMUM W/ BCA CLAUSES & AUSTRALIAN STANDARDS	ARTIFICIAL LIGHTING: TO COMPLY WITH BCA PART 4.4 & AS1680	BASIC COMMITMENTS	ENERGY OPTIONS	NOTES:	ARCHITECT:	PROJECT ADDRESS:	DRAWN BY:	CHECKED:
A	SSDA SUBMISSION	17/12/2025	1. ALL WORKS TO BE IN ACCORDANCE WITH THE BUILDING CODE OF AUSTRALIA, AUSTRALIAN STANDARDS, STATUTORY REGULATIONS AND LOCAL AUTHORITY REQUIREMENTS, INCLUDING CONDITIONS OF CONSIST.	CLAUSE B 1.4 MATERIAL & FORMS CONSTRUCTIONS	BAULTRADE REPAIRS: TO COMPLY WITH BCA CLAUSE 12.18	ALL OTHER BASIC COMMITMENTS AS PER	COOLING	EXISTING	MHNDUNION	2A/2-6 CONWAY AVENUE, 38-40 CARLISLE STREET	MB	BW
B	RESPONSE TO PRELIMINARY DPPI ASSESSMENT	15/2026	2. DO NOT SCALE OFF THIS DRAWING. ONLY USE DIMENSIONS PROVIDED.	CLAUSE D2.1 OPERATION OF LATCH	DRAINAGE OUTLETS & DOWNPIPES: TO COMPLY WITH AS/NZS 3500.3.2	SHOWERHEADS:	HEATING	REDUCED LEVEL	35 RICHARDS LANE	+ 15-15A FERNLEIGH AVENUE,	SCALE:	
			3. CONTRACTOR TO VERIFY ALL DIMENSIONS ON SITE PRIOR TO COMMENCING WORK.	CLAUSE D2.2 GENERAL BUILDING ACCESS REQUIREMENTS	MASONRY: TO COMPLY WITH SECTION 17 OF BCA	TOILETS:	WATER HEATING:	BOUNDARY	SURRY HILLS SYDNEY NSW 2010	ROSE BAY, NSW 2029	1:200, 1:100@A1	
			4. MANDU DRAWINGS TO BE READ IN CONJUNCTION WITH ALL CONTRACT DOCUMENTS FROM ALL CONSULTANTS.	CLAUSE D2.3 PARTS OF BUILDING TO BE ACCESSIBLE	HOT WATER: SYSTEMS TO COMPLY WITH PART 17 OF BCA	CLOTHES WASHERS:	ENERGY EFFICIENT LIGHTING:	EX LANDSCAPE TO RETAIN	T +61 2 9101 1111		ISSUE DATE:	REVISION:
			5. CONTRACTOR TO NOTIFY MANDU OF ANY DISCREPANCIES, DIMENSIONAL INCONSISTENCIES, OR THE NEED FOR CLARIFICATION PRIOR TO MANUFACTURING.	CLAUSE D2.4 TACTILE INDICATORS	Mechanical/AC/VENTILATION: TO COMPLY WITH PART 16 OF BCA	KITCHEN TAPS:	COOL TOPS:	NOT ON SURVEY/	F +61 2 9101 1100		15/2026	B
			6. CONTRACTOR TO ENSURE CONSISTENCY BETWEEN MATERIALS IS MAINTAINED THROUGHOUT THE PROJECT.	CLAUSE D2.5 WATERPROOFING OF WET AREAS	Mechanical Exhaust Ventilation: TO COMPLY WITH AS1688 & AS88.2	BATHROOM TAPS:	CLOTHES DRYING LINES:	DEMOLISHED	www.mhndu.com		PROJECT NUMBER:	DWG NUMBER:
			7. MANDU TO REVIEW ALL CONTRACTORS' DETAILED DRAWINGS / SETTING OUT PRIOR TO CONSTRUCTION.	CLAUSE D2.6 OPENING FOR SERVICE INSTALLATIONS	MECHANICAL ALARMS: TO COMPLY WITH BCA PART 4.4 & AS1530.4	DISHWASHERS:	REFRIGERATOR SPACE:	COUNCIL CONTROLS	M-H Design Pty Ltd.		25-135	2102
			8. PROGRESS WORK TO BE VERIFIED AGAINST DRAWINGS FOLLOWING EXECUTION AND ARCHITECT TO BE NOTIFIED OF ANY DISCREPANCIES PRIOR TO CONTRACTOR PROCEEDING WITH NEXT TRADE.	CLAUSE D2.7 SOUND INSULATION OF FLOORS	PENETRATIONS: THROUGH FIRE RATED CONSTRUCTION FOR MECHANICAL/ HYDRAULIC PENETRATIONS TO COMPLY WITH BCA CLAUSE C3.15 & AS1530.4	RAIN WATER TANK:	REFRIGERATOR SPACE:		Nominated Architect			
				CLAUSE D2.8 SOUND INSULATION OF WALLS	STAIR CONSTRUCTION: TO COMPLY WITH BCA CLAUSE D2.13	POOLSPA:	GLAZING SPEC:		Brian Moyerson			
				CLAUSE D2.9 SOUND INSULATION OF ROOFS	WATERPROOFING OF WET AREAS: TO COMPLY WITH AS1742	COLLECT RUN OFF AREA:			REPL: BM/200, 100-20, BM/200 Basic for Archival 2025-135 - 2A-2-6 Conway Avenue, 38-40 Carlisle Street + 15-15A Fernleigh Avenue, Rose Bay, SA			
				CLAUSE D2.10 SOUND INSULATION OF PUMPS		BRIGADE:						

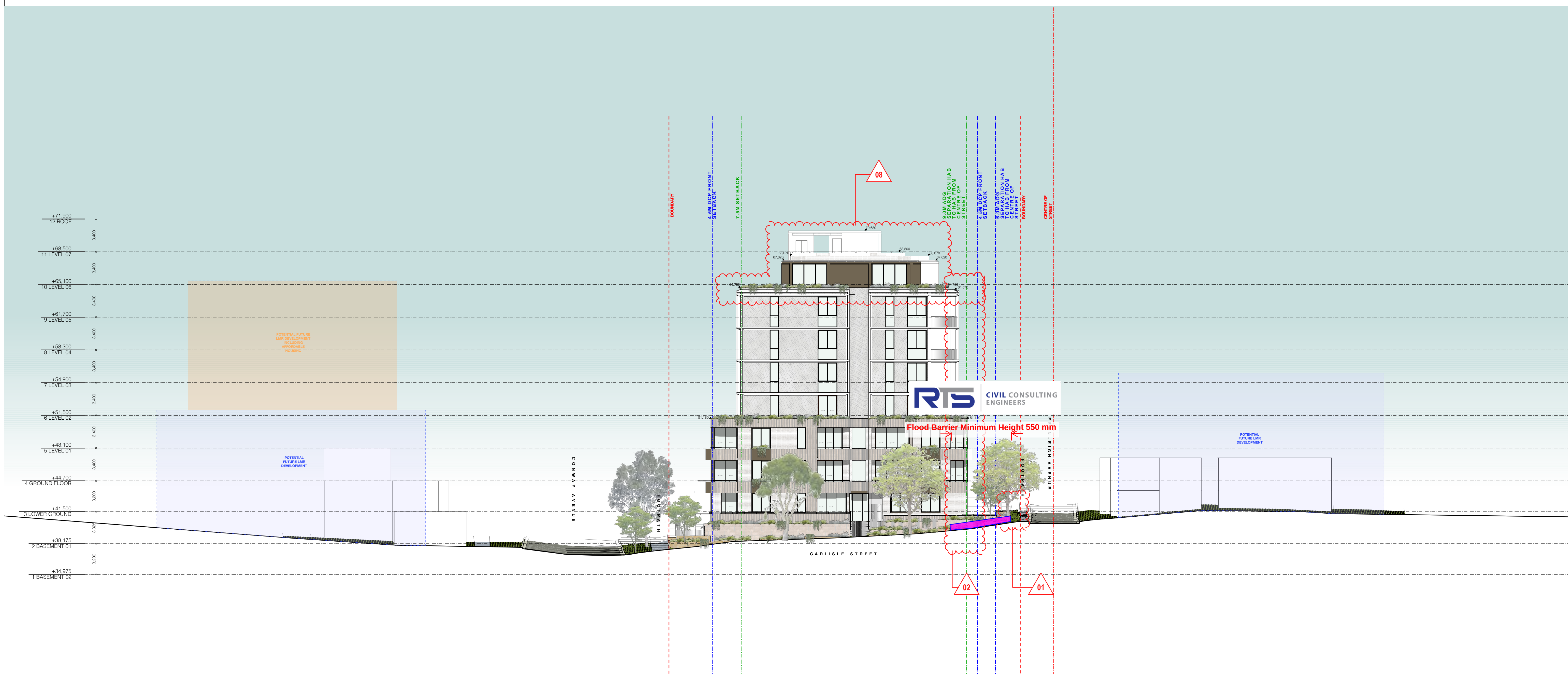
GROUND FLOOR

[illegible]

ELEVATION NORTH

[illegible][illegible]

ELEVATION EAST

[illegible][illegible]