FOUNDATION EARTH SCIENCES

REMEDIATION ACTION PLAN

Property Address

251-257 Maroubra Road & 133 and 135 Garden Street, Maroubra NSW

Prepared for

BWSLD Maroubra Pty Ltd

Date

March 2026

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ABBREVIATIONS

AIP	*Australian Institute of Petroleum Ltd*	**QA/QC**	*Quality Assurance, Quality Control*
ANZECC	*Australian and New Zealand Environment and Conservation Council*	**RAC**	*Remediation Acceptance Criteria*
AST	*Aboveground Storage Tank*	**RAP**	*Remediation Action Plan*
BGL	*Below Ground Level*	**RPD**	*Relative Percentage Difference*
BTEX	*Benzene, Toluene, Ethyl benzene and Xylene*	**SAC**	*Site Assessment Criteria*
COC	*Chain of Custody*	**SVC**	*Site Validation Criteria*
DA	*Development Approval*	**SWL**	*Standing Water Level*
DP	*Deposited Plan*	**TCLP**	*Toxicity Characteristics Leaching Procedure*
DQOs	*Data Quality Objectives*	**TPH**	*Total Petroleum Hydrocarbons*
EPA	*Environment Protection Authority*	**UCL**	*Upper Confidence Limit*
ESA	*Environmental Site Assessment*	**UST**	*Underground Storage Tank*
HIL	*Health-Based Soil Investigation Level*	**VHC**	*Volatile Halogenated Compounds*
LGA	*Local Government Area*	**VOC**	*Volatile Organic Compounds*
NEHF	*National Environmental Health Forum*	**DPI**	Department of Primary Industries
NEPC	*National Environmental Protection Council*		
NHMRC	*National Health and Medical Research Council*		
OCP	*Organochlorine Pesticides*		
OPP	*Organophosphate Pesticides*		
PAH	*Polycyclic Aromatic Hydrocarbon*		
PCB	*Polychlorinated Biphenyl*		
PID	*Photo Ionisation Detector*		
PQL	*Practical Quantitation Limit*		

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1.0 EXECUTIVE SUMMARY

This Remediation Action Plan prepared by Foundation Earth Sciences on behalf of BWSLD Maroubra Pty Ltd is submitted to the Department of Planning, Housing and Infrastructure (DPHI) in support of a concurrent Rezoning Proposal and State Significant Development Application (Rezoning and SSDA) for a residential flat building and ground floor childcare facility at 251-257 Maroubra Road and 133-135 Garden Street, Maroubra NSW.

Soils sampled across the Site were assessed against the Site Acceptance Criteria (SAC) provided by the National Environment Protection (Assessment of Site Contamination) Measure (NEPM 2013) Table 1A – Residential A.

The FES Additional DSI 4th March 2026 indicated a RAP is required for the site a due to the following reasons:

- Borehole BH5 – contains TRH impacted fill to a depth of 0.1m BGL. The delineation of the impacted fill is proposed to be completed as part of the remediation works.
- The RAP also requires the additional sampling to be completed post demolition of site structures to assess beneath the former building footprints, beneath the UST area and further define the extent of the required soil remediation works at the site.

The adopted remedial strategy is the removal of contaminated material to a licensed landfill. The remediation of the site is to take place in the following stages:



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- Stage One – Site Preparation.
- Stage Two – Site Walkover.
- Stage Three (A) – Underground Storage Tank Removal and Validation
- Stage Three (B) - Additional Sampling (Post Demolition).
- Stage Four – Classification, removal, and validation of impacted areas.
- Stage Five – Validation of basement floor and landscape area.
- Stage Six – Validation Report Preparation.

Therefore, it is considered that the site will be ***suitable*** for the proposed development, subject to the implementation of the remediation and validation works in accordance with this RAP.



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2.0 INTRODUCTION

This Remediation Action Plan prepared by Foundation Earth Sciences on behalf of BWSLD Maroubra Pty Ltd is submitted to the Department of Planning, Housing and Infrastructure (DPHI) in support of a concurrent Rezoning Proposal and State Significant Development Application (Rezoning and SSDA) for a residential flat building and ground floor childcare facility at 251-257 Maroubra Road and 133-135 Garden Street, Maroubra NSW.

This concurrent Rezoning and SSDA seeks approval for:

- Site preparation works including demolition, bulk excavation and tree removal.
- Construction of a ten-storey residential flat building comprising four levels of basement parking, a childcare centre at ground level, communal open space on level 1, residential apartments on levels 1-9.
- Landscaping.
- Civil infrastructure works, and augmentation of utilities and services.

A detailed description of the proposed development is included in the Environmental Impact Statement and Rezoning Report prepared by Colliers Urban Planning, the Architectural Plans prepared by BKA Architecture, and the other accompanying technical documents that form part of the State Significant Development Application.

This RAP has been prepared to be part of the Development Application (DA) for this site. Work and reporting were conducted in general accordance with the FES proposal, FES environmental protocols and with reference to relevant environmental regulatory criteria including the guidelines issued or endorsed by the NSW EPA.



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3.0 OBJECTIVES, SCOPE & DEVIATIONS

3.1 Objectives

The primary objective of this RAP is to inform and guide site remediation and validation through the following:

- Summary of the current contamination status of the site.
- Providing a description of the remediation strategy(s) that will effectively manage the environmental concerns identified, in a manner that protects both human health and the environment.
- Provide a preliminary sampling and analytical quality plan to be used for site validation.
- Comply with DA Conditions for Development.

3.2 Scope

The scope is outlined below:

- Establish remediation goals and criteria.
- Evaluation of remedial technologies and selection of appropriate remedial strategy(s)
- Facilitate guidance on approvals, licences, contractor WHS Plan & any other site management plans required for the remedial works.
- Provide an outline of the additional investigations (if required) to be carried out to address the recommendations identified in the previous investigation.
- Develop sampling, analysis and quality plan for additional works, remedial works and proposed validation.



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- The area of impact is within the borehole location BH5 is within the fill soil profile to depth of 0.1m BGL.
- The UST areas are within 251-253 Maroubra Road.
- Additional sampling post removal of UST and infrastructure.
- Waste Classification.

3.3 Deviation from this RAP

It is recommended that an experienced and qualified Environmental Engineer / Scientist be appointed to the project to enable:

- Coordination and implementation of the staged approach to the proposed remediation / validation works.
- Any proposed deviations from the works specified in this RAP are documented and approved as required under NSW EPA "*Consultants Reporting on Contaminated Land* "dated 2020.
- The format of this report closely follows that recommended in the NSW EPA "*Consultants Reporting on Contaminated Land* "dated 2020.

Completion of remedial works without adequate supervision from a qualified Environmental Engineer / Scientist could leave to project delays and extra costs due to additional requirements imposed by a third party, to confirm the environmental status of site. Any waste material removed from site without sufficient characterisation and/ or waste classification may lead to regulatory actions.



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4.0 SITE IDENTIFICATION, SITE HISTORY, ENVIRONMENTAL SETTINGS AND BACKGROUND INFORMATION

4.1 Site identification and zoning

Table 1A: Site Identification

Site Identifier	Site Details	
Site Location	251-257 Maroubra Road & 133-135 Garden Street, Maroubra NSW	
Lot/DP	Lot A, B, C, D, E in DP14198 Lot D in DP320521	
Site Coordinates #	NE corner: Latitude: -33.942158, Longitude: 151.242225 SE corner: Latitude: -33.942683, Longitude151.242008 SW corner: Latitude: -33.942616, Longitude: 151.241531 NW corner: Latitude: -33.94208, Longitude: 151.241641	
Parish	Botany	
County	Cumberland	
Site Area #	Approximately 3,270m^2	
Local Government Area (LGA)	Randwick City Council	
Zoning##	R3 – Medium Density Residential	
Surrounding Land Uses	*North*	Maroubra Road then recreational / commercial
	South	Residential, then Maroubra Ln & residential
	East	Residential
	West	Commercial then Anzac Parade

Notes: # Six Maps

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4.2 Secretary's Environmental Assessment Requirements

In accordance with section 4.39 of the Environmental Planning & Assessment Act 1979 (EP&A Act), Secretary's Environmental Assessment Requirements (SEARs) for SSD-87865706 has been issued. This report has been prepared to respond to the issued SEARs, as set out in table below.

Table 2B: SEARs

SEARs	SEARs description	Report name and section
Contamination and Remediation	In accordance with Chapter 4 of the *State Environmental Planning Policy (Resilience and Hazards) 2021*, assess and quantify any soil and groundwater contamination and demonstrate that the site is suitable (or will be suitable, after remediation) for the development.	Preliminary Site Investigation Report If required: Detailed Site Investigation Remedial Action Plan Preliminary Long-term Environmental Management Plan.

4.3 Site description

The Site is located at 255–257 Maroubra Road and 133–135 Garden Street, Maroubra, within the Randwick Local Government Area (LGA). It is situated approximately 210m east of the intersection of Maroubra Road and Anzac Parade, which forms the core of the Maroubra Junction commercial centre.

It is bounded to the north by Maroubra Road, Garden Street to the west, Garden Lane to the south and a residential flat building development to the east. It is legally



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described as Lots Of A, B, C, D and E in DP 14198 and Lot D in DP 320521, is irregular in shape and is approximately 3,270m2 in area.

4.4 Proposed Development

The existing development on the site includes a mechanic's workshop and four (4) residential dwellings.

This concurrent Rezoning and SSDA seeks approval for:

- Site preparation works including demolition, bulk excavation and tree removal.
- Construction of a ten-storey residential flat building comprising four levels of basement parking, a childcare centre at ground level, communal open space on level 1, residential apartments on levels 1-9.
- Landscaping.
- Civil infrastructure works, and augmentation of utilities and services.

Refer to **Appendix B** – Proposed Development Plans.



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4.5 Site Conditions and Surrounding Environmental

Table 3: Environmental Settings

Site Information	Descriptions
Sensitive Receivers	The nearest sensitive human receptors are the current and future users of the site, construction workers during the site redevelopment and the public. The nearest watercourse is Maroubra Beach (Pacific Ocean), located approximately 1.6km to the south-east of the site.
Soil Landscape *Review of NSW Soil and Land Information website ESPADE.*	The Soil Landscape Map viewed on NSW ESPADE indicates that the site is located within the Tuggerah landscape area: gently undulating to rolling coastal dunefields. Local relief to 20m, slope gradients generally 1-10%, but occasionally up to 35%. North-south oriented dunes with convex narrow crests, moderately inclined slopes and broad gently inclined concave swales. Extensively cleared open-forest and eucalypt/apple woodland.
Topography	Gently undulating plains and rolling undulating rises of broad, level to very gently inclined, swales and dunes. Elevation is usually <20m. Dune sideslopes are gently to moderately inclined. Isolated steep rises with slopes up to 35% occur. Steep slopes are usually associated with undercutting of the toe of dunes or where wind-blown sand has been deposited at the base of obstacles such as outcrops of Hawkesbury Sandstone. Coastal hind-dunes run sub-parallel to the coast. With increasing distance from the coast, the dunes assume a north-south trend. Most rainfall infiltrates directly into the soil. Run off, when it occurs, collects in a series of depressions, lagoons and swamps.



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<table>
<tr><td>Geological Profile</td><td colspan="6">The Geological Map of Sydney (Geological Series Sheet 9130, Scale 1:100,00, 1983) published by the Department of Mineral Resources indicates the residual soils within the site to be underlain by Quaternary Age soils consisting of medium to fine grained “marine” sand with podsols.</td></tr>
<tr><td>Presence of Acid Sulphate Soils</td><td colspan="6">A review of the NSW DPIE “eSpade” map indicated that the site is in an area of “no known occurrence “of acid sulphate soils within the soil profile.</td></tr>
<tr><td rowspan="6">Localised Hydrogeology

Review of DPI (Office of Water) Database.</td><td>Number</td><td>Location from Site</td><td>Depth (m BGL)</td><td>SWL (m BGL)</td><td>Use</td><td>Water Bearing Zones</td></tr>
<tr><td>GW023261</td><td>60m N</td><td>5.40</td><td>-</td><td>General Use</td><td>4.50 – 4.50</td></tr>
<tr><td>GW023577</td><td>220m N</td><td>3.60</td><td>-</td><td>General Use</td><td>3.60 – 3.60</td></tr>
<tr><td>GW101330</td><td>320m NE</td><td>9.00</td><td>-</td><td>Domestic</td><td>-</td></tr>
<tr><td>GW109055</td><td>330m NW</td><td>15.86</td><td>7.93</td><td>Domestic</td><td>-</td></tr>
<tr><td>GW109001</td><td>350m NE</td><td>15.55</td><td>15.55</td><td>Domestic</td><td>-</td></tr>
<tr><td>Nearest Surface Water Body</td><td colspan="6">The nearest watercourse is Maroubra Beach (Pacific Ocean), located approximately 1.6km to the south-east of the site.</td></tr>
<tr><td>Nearest Active Service Station and Dry Cleaner
(Google Maps Search)</td><td colspan="6">Petrol Station – 980m north-east
Dry Cleaner – 233m north-east
The dry cleaner is considered a potential contamination risk due to the distance from the subject site.</td></tr>
</table>

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4.6 Previous environmental investigations

Three (3) previous investigation for the property is summarised at the time writing this report:

- Foundation Earth Sciences (2026), "Detailed Site Investigation" for 251-257 Maroubra Road & 133 and 135 Garden Street, Maroubra NSW, reference: E3382, dated: March 2026 Rev 2.
- Foundation Earth Sciences (2026), "Additional Detailed Site Investigation" for 251-257 Maroubra Road & 133 and 135 Garden Street, Maroubra NSW, reference: E3382-2 Rev 1, dated: March 2026.
- Foundation Earth Sciences (2026), "Hazardous Materials Assessment" for 251-257 Maroubra Road & 133 and 135 Garden Street, Maroubra NSW, reference: E3382-4 dated: March 2026.

4.7 FES DSI (March 2026)

Foundation Earth Sciences (FES) was appointed BWSLD Maroubra Pty Ltd to undertake a Detailed Site Investigation for the property situated at 251-257 Maroubra Road & 133 Garden Street, Maroubra NSW ("the site").

The proposed development includes the construction of a multistorey residential building with ground floor *childcare,* landscaped and deep soil areas and four (4) level basement carpark area.

The property located at 251-253 Maroubra Road is currently operational as a mechanical workshop with a two-storey commercial dwelling & workshop, as well as



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sealed carparking areas (including a two-storey parking structure). The other four properties are residential, with single-storey dwellings on each (except for No. 255 which has a two-storey dwelling), unsealed/landscaped areas and storage structures being noted.

The soil data concluded the following:

- The soil laboratory results were below the adopted detection limits and/or the relevant guideline criteria apart from BH3 (0.6-0.7m) & BH4 (0.2-0.3m) which exceed the ESL guidelines for Benzo(a)pyrene.
    - A review of the proposed development plans indicated that BH3 & BH4 are located within the proposed basement area, thus the ESL criteria do not apply to these locations.
- Borehole location BH5 is impacted with TRH, silica gel clean and statistical analysis was completed, BH5 is located outside the basement and in the proposed deep soil areas and therefore will require remediation. Refer to Figure 3.

The following lines of evidence support the MODERATE-risk groundwater conclusions in relation to site suitability:

- The minor elevated heavy metals of chromium, copper, nickel and zinc are related to offsite regional contaminant concentrations and/or background levels & therefore of limited concern in relation to the GIL as the site CSM does not identify any significant potential for heavy metal contamination within the site.
- Concentration of Benzo(a)pyrene, Anthracene, Phenanthrene and Fluoranthene from GW103 exceed the GILs for Marine Waters.
    - Additional monitoring wells to be installed to delineate the impacted groundwater onsite.



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- Soil Vapour investigation to assessment any potential human health risks associated with the PAH detected in groundwater surrounding BH3 /GW103.

- The site is not located in a catchment which contains the water quality objectives of drinking water (i.e. beneficial use) and therefore drinking water guidelines were not applied.

The land titles have indicated that 251-253 Maroubra Road (Lot C & D in DP14198) has been owned by Ampol Petroleum – service station company from 1952-1972 and TGAJ Pty Ltd is also noted as an automotive company from 1985-1996. Therefore, the potential for USTs to be buried onsite is possible.

Based on the historical review, environmental information, proposed development and laboratory results of the investigation, the site can be made ***suitable*** for the proposed development, subject to the following:

- Any soil requiring removal from the site, as part of future site works, should be classified in accordance with the "Waste Classification Guidelines, Part 1: Classifying Waste" NSW EPA (2014).
- An additional investigation is recommended to complete including further groundwater installation and assessment, soil vapour assessment and deeper soil sampling to further characterise the site prior to remediation works taking place.
- It is considered that the site would be deemed suitable for the proposed development subject to the implementation of a Remediation Action Plan (RAP) to manage the abovementioned environmental concerns and data gaps.



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4.8 FES ADDITIONAL DSI (March 2026)

This Additional Detailed Site Investigation prepared by Foundation Earth Sciences on behalf of BWSLD Maroubra Pty Ltd is submitted to the Department of Planning, Housing and Infrastructure (DPHI) in support of a concurrent Rezoning Proposal and State Significant Development Application (Rezoning and SSDA) for a residential flat building and ground floor childcare facility at 251-257 Maroubra Road and 133-135 Garden Street, Maroubra NSW. This report has been complied to assess the vapour intrusion risk to the proposed development.

The proposed development includes the construction of a multistorey residential building with ground floor *childcare,* landscaped and deep soil areas and four (4) level basement carpark area.

Soils sampled across the Site were assessed against the Site Acceptance Criteria (SAC) provided by the National Environment Protection (Assessment of Site Contamination) Measure (NEPM 2013) Table 1A - Residential A.

The property located at 251-253 Maroubra Road is currently operational as a mechanical workshop with a two-storey commercial dwelling & workshop, as well as sealed carparking areas (including a two-storey parking structure). The other four properties are residential, with single-storey dwellings on each (except for No. 255 which has a two-storey dwelling), unsealed/landscaped areas and storage structures being noted.

The soil data concluded the following:

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- The soil laboratory results were below the adopted detection limits and/or the relevant guideline criteria apart from BH3 (0.6-0.7m) & BH4 (0.2-0.3m) which exceed the ESL guidelines for Benzo(a)pyrene.
    - A review of the proposed development plans indicated that BH3 & BH4 are located within the proposed basement area, thus the ESL criteria do not apply to these locations.
- Borehole location BH5 is impacted with TRH, silica gel clean and statistical analysis was completed, BH5 is located outside the basement and in the proposed deep soil areas and therefore will require remediation.

The following lines of evidence support the low - moderate-risk groundwater conclusions in relation to site suitability:

- The minor elevated heavy metals of chromium, copper, nickel and zinc are related to offsite regional contaminant concentrations and/or background levels & therefore of limited concern in relation to the GIL as the site CSM does not identify any significant potential for heavy metal contamination within the site.
- Concentration of Benzo(a)pyrene, Anthracene, Phenanthrene and Fluoranthene from GW103 exceed the GILs for Marine Waters. Additional investigations did not identify any offsite contamination indicators and will be most likely removed as part of the future construction and remediation works.
- The site is not located in a catchment which contains the water quality objectives of drinking water (i.e. beneficial use) and therefore drinking water guidelines were not applied.

The following lines of evidence support the low-risk conclusions in relation to site suitability for soil vapour:

- The minor detections of soil vapour a below the relevant guidelines.



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- Investigations did not identify any potential offsite contamination indicators and will be most likely removed as part of the future construction and remediation works.

The land titles have indicated that 251-253 Maroubra Road (Lot C & D in DP14198) has been owned by Ampol Petroleum – service station company from 1952-1972 and TGAJ Pty Ltd is also noted as an automotive company from 1985-1996. Therefore, the potential for USTs to be buried onsite is possible and has been further confirmed as likely using GPR analysis.

Based on the historical review, environmental information, proposed development and laboratory results of the investigation, the site can be made ***suitable*** for the proposed development, subject to the following:

- Any soil requiring removal from the site, as part of future site works, should be classified in accordance with the "Waste Classification Guidelines, Part 1: Classifying Waste" NSW EPA (2014).
- It is considered that the site would be deemed suitable for the proposed development subject to the implementation of a Remediation Action Plan (RAP) to manage the abovementioned environmental concerns and data gaps.

4.9 FES HAZMAT (March 2026)

This Hazardous Materials Assessment prepared by Foundation Earth Sciences on behalf of BWSLD Maroubra Pty Ltd is submitted to the Department of Planning, Housing and Infrastructure (DPHI) in support of a concurrent Rezoning Proposal and State Significant

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Development Application (Rezoning and SSDA) for a residential flat building and ground floor childcare facility at 251-257 Maroubra Road and 133-135 Garden Street, Maroubra NSW.

Our findings have satisfied the DA requirements for a hazardous materials survey to be conducted at the property and have determined that the site, as it currently stands is impacted by the following hazardous materials:

- Bonded Asbestos Containing Material
- Synthetic Mineral Fibres
- Paint Containing Lead

Reference should be made to the Hazardous Materials Register for a detailed description of the hazardous materials described above.

4.10 Site History

The site history as listed in the DSI and/or Additional DSI is outlined below:

Aerials

The historical images of the site revealed it to be comprised of five separate lots, four of which were residential (with associated infrastructure) and the other vacant prior to 1943. The surrounding areas appeared to be a combination of recreational (church to the north & community hall to the west), residential (north, south, east & west) as well as commercial. By 1955, the vacant lot on the site appeared to be developed into a commercial property with a two-storey structure being constructed to be used as a



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mechanic, as well as a laneway to the rear of the property. Additional residential properties appeared to be constructed to the west at this time.

By 1970, residential properties in the surrounding areas appeared to be redeveloped, and commercial properties appeared to be constructed to the west of the site. By 1982, the top floor of the commercial property within the site appeared to be extended and converted into a carparking area. At this time, new commercial properties appeared to be developed to the south-west of the site.

By the early 1990s, no major changes were observed across the site, other than the construction of storage structures in the southern residential properties. The site has remained unchanged to the present time, except for an addition storage structure being constructed on the southern residential property prior to 2014. The surrounding areas remained unchanged until 2005, where residential apartments appeared to be constructed to the north, south and east of the site (as well as a retirement complex to the north), and commercial properties appeared to be developed to the south. By 2014, no other major changes were observed in the surrounding areas, and they have remained unchanged to the present time.

Titles

A summary of the review for each Lot is provided below:

- 251-253 Maroubra Road (Lot C & D in DP14198):
    - From 1926 to 1952 the property has been owned by private individuals and bank.
    - From 1952 to present date the property has been owned by various commercial entities including Ampol Petroleum – service station

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company from 1952-1972. TGAJ Pty Ltd is also noted as an automotive company from 1985-1996.

- 255 Maroubra Road (Lot E in DP14198):
    - From 1926 to 2010, the property has been owned by private individuals.
    - From 2010 to the present time, the property has been owned by several commercial entities.
- 257 Maroubra Road (Lot D in DP320521):
    - From 1927 to 1999, the property has been owned by private individuals.
    - From 1999 to the present time, the property has been owned by a commercial entity.
- 133 Garden Street (Lot A in DP14198):
    - From 1926 to 2020, the property has been owned by private individuals.
    - From 2020 to the present time, the property has been owned by a commercial entity.
- 135 Garden Street (Lot A in DP14198):
    - From 1926 to Current, the property has been owned by private individuals.

NSW EPA

A search of the contaminated lands database, list of notified sites, POEO Register revealed that the subject site is not listed.

SAFEWORK RECORDS

Records have been requested with requests for additional information also provided to Safework from FES. No records have been received to date. However, a GPR scan indicated a UST likely to be present on the site within 251-253 Maroubra Road, Maroubra NSW – this correlates with the land titles showing service station ownership.



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5.0 CONCEPTUAL SITE MODEL - CURRENT

5.1 Conceptual Site Model Components

5.1.1 Potential Contaminated Media

Table 4: Potential Contaminated Media

Known and potential contamination source	Associated Contaminants
Fill Material	There is TRH F3 contamination present in the upper fill material around BH5.
Groundwater	There is heavy metal and PAH contamination present in the monitoring well BH3 / GW103.
Soil Vapour	Given the site history and surrounding land uses, soil vapour is considered to a potential low risk for contamination



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5.2 Area of Concern

Table 4: Area of Concern

Known and potential contamination source	Associated Contaminants
Historical Site Uses (Mechanic Workshop, Service Station, Residential & Commercial)	Heavy Metals, TRH, BTEX, PAH, OCP, PCB & Asbestos
Surrounding Land Uses (Commercial, Residential, Recreational)	Heavy Metals, TRH, BTEX, PAH, OCP, PCB & Asbestos
USTs	TRH, BTEXN, PAH, VOC
Potential Pesticides Use	OCP, OPP
Imported Fill	Heavy Metals, TRH, BTEX, PAH, OCP, PCB & Asbestos
Car parking Areas	TRH, BTEX, PAH
Building degradation/ Demolition	Heavy Metals and Asbestos

5.3 Chemicals of Concern

Soils

The following chemicals of concern were identified in the FES DSI and are outlined as follows:

- Boreholes BH5 – contains TRH impacted fill soils to a depth of 0.1m BGL.

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The delineation of the impacted fill is proposed to be completed as part of the remediation works. Refer to section 8.2.

Groundwater

The following chemicals of concern were identified in the FES DSI and are outlined as follows:

- Boreholes BH3 /GW103 – contains Concentration of Benzo(a)pyrene, Anthracene, Phenanthrene and Fluoranthene that exceed the GILs for Marine Waters.
- Boreholes BH1 / GW101, BH2 / GW102 & BH3 /GW103 – contain concentrations of metals above the GILs for Marine Waters.

5.4 Sources

Soil

The most likely source of the contaminants of concern is the quality of the fill soil located on the site.

Groundwater

The most likely source of the contaminants of concern (PAH) is the potential USTs at the site. USTs likely located in 251-253 Maroubra Road.

5.5 Pathways (Transport of COC)

Potential exposure pathways include:



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- Dermal.
- Ingestion; and
- Inhalation.

Due to the limited exposure of potentially impacted soil/fill on ground surfaces, dermal exposure is considered low potential exposure pathway.

There is the potential for vapour to be present in the underlying profile within the site. As such, these gases potentially pose a risk to human health via the inhalation pathway.

The potential for ingestion of soil is considered as a potential exposure pathway.

Dermal and inhalation exposure pathways by potentially contaminated groundwater and/or vapour are considered as a concern based on historical land use.

5.6 Receptors

Human:

The site groundwater is not currently used for or planned to be used for drinking water as town water is provided by Sydney Water.

Ecological

The ecological receptors would be surface water and benthic organisms in Maroubra Beach.



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Potential receptors of environmental impact present within the site which will be required to be addressed with respect to the suitability of the site for the proposed use include:

- Excavation/construction/maintenance workers conducting activities at the site, who may potentially be exposed to COPCs through direct contact with impacted soils, Vapour Intrusion and/or groundwater present within excavations and/or inhalation of dusts/fibres associated with impacted soils.
- Future occupants/users of the site may potentially be exposed to COPCs through direct contact with impacted soils and/or ingestion of impacted soils and/or inhalation of dusts/fibres associated with impacted soils and/or exposure to vapour; and/or
- Offsite sensitive receptors of groundwater.
- Flora species to be established on vegetated areas of the site.
- Maroubra Beach.

5.7 Potential for Migration

Contaminants migrate from site via a combination of windblown dusts, rainwater infiltration, groundwater migration, and surface water runoff. The potential for contaminants to migrate is a combination of:

- The nature of the contaminants (solid/liquid and mobility characteristics).
- The extent of the contaminants (isolated or widespread).
- The location of the contaminants (surface soils or at depth); and
- The site topography, geology, hydrology, and hydrogeology.



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The potential contaminants identified as part of the site history review & site inspection are present in solid (e.g. impacted fill, asbestos), liquid (e.g. dissolved in water) and gaseous/vapour forms.

Aerial photography has indicated that there are unsealed ground surfaces and therefore there is a potential for the migration of contaminants via wind-blown dust.

Rainfall infiltration at the site is expected to occur in unsealed areas. As the site is mostly unsealed, there is a potential that soil contamination could result in impacts to shallow groundwater.

5.8 Preferential Pathways

For this assessment, preferential pathways have been identified as natural and/or man-made pathways that result in the preferential migration of COPCs as either liquids or gases.

Man-made preferential pathways are present throughout the site, associated with fill materials and services present beneath existing ground surface. Fill materials and service lines are anticipated to have a higher permeability than the underlying natural soil and/or bedrock.

5.9 Frequency of Exposure

As the potential for ingestion of soil is considered a potential exposure pathway during site development works as construction workers would be exposed to soil. The frequency of exposure will be occurring from removal of the existing hard standing surfaces until construction of the new surfaces across the proposed development area.

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5.10 Offsite Contamination

Impacted soil contamination could migrate off site during site development works with surface water run-off.

5.11 Data Gap Identification

The following data gaps remain:

- Vertical and lateral extent of impacted fill needs further delineation at BH5.
- Pending receipt of SafeWork NSW search for any records of dangerous goods.
- Soil and Groundwater testing directly below the potentially underground storage tanks.
- Additional locations within the deep soil and/or landscape areas of the proposed development – including deeper soil samples.
- Additional sampling is required to be completed post demolition of the existing building structures. The investigation is required to address the following.
    - Assess the soil beneath the existing building footprint.

The additional investigation works is proposed to be completed as part of the remediation works once the building has been demolished.



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6.0 REMEDIATION CRITERIA

6.1 Soil

6.1.1 Health Investigation Levels (HIL)

To assess the contamination status of soils at a site, the NSW EPA refers to the document entitled National Environmental Protection (Assessment of Site Contamination) Measure (NEPM) (Amendment 2013).

During any future soil investigations, the site will be assessed against the NEPM exposure scenario 'Residential A Health Investigation Levels of the above-mentioned guidelines and specifically refers to the following:

HIL 'A' Residential with garden / accessible soil (home grown produce <10% fruit and vegetable intake (no poultry), also includes childcare centres, preschools and primary schools.

The soil regulatory guidelines are presented in the table below.

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Table 5: Health Investigation Levels (HIL) Criteria for Soil Contaminants

FOUNDATION EARTH SCIENCES	Residential A	Reference
Heavy Metals		
Arsenic	100	NEPM 2013 - Table 1(A)1 HILs
Beryllium	60	NEPM 2013 - Table 1(A)1 HILs
Boron	4500	NEPM 2013 - Table 1(A)1 HILs
Cadmium	20	NEPM 2013 - Table 1(A)1 HILs
Chromium (VI)	100	NEPM 2013 - Table 1(A)1 HILs
Cobalt	100	NEPM 2013 - Table 1(A)1 HILs
Copper	6000	NEPM 2013 - Table 1(A)1 HILs
Lead	300	NEPM 2013 - Table 1(A)1 HILs
Manganese	3800	NEPM 2013 - Table 1(A)1 HILs
Mercury (Inorganic)	40	NEPM 2013 - Table 1(A)1 HILs
Methyl Mercury	10	NEPM 2013 - Table 1(A)1 HILs
Nickel	400	NEPM 2013 - Table 1(A)1 HILs
Selenium	200	NEPM 2013 - Table 1(A)1 HILs
Zinc	7400	NEPM 2013 - Table 1(A)1 HILs
Cyanide (Free)	250	NEPM 2013 - Table 1(A)1 HILs
Polycyclic Aromatic Hydrocarbons (PAHs)		
Carcinogenic PAHs (as Bap TEQ)	3	NEPM 2013 - Table 1(A)1 HILs
Total PAHs	300	NEPM 2013 - Table 1(A)1 HILs
Organochlorine Pesticides		
DDT + DDE + DDD	240	NEPM 2013 - Table 1(A)1 HILs
Aldrin + Dieldrin	6	NEPM 2013 - Table 1(A)1 HILs
Chlordane	50	NEPM 2013 - Table 1(A)1 HILs
Endosulfan	270	NEPM 2013 - Table 1(A)1 HILs
Heptachlor	6	NEPM 2013 - Table 1(A)1 HILs
HCB	10	NEPM 2013 - Table 1(A)1 HILs
Phenols		
Phenols	3000	NEPM 2013 - Table 1(A)1 HILs
Pentachlorophenol	100	NEPM 2013 - Table 1(A)1 HILs
Cresols	400	NEPM 2013 - Table 1(A)1 HILs
Polychlorinated Biphenyls (PCBs)		
PCBs	1	NEPM 2013 - Table 1(A)1 HILs
Other Pesticides		
Atrazine	320	NEPM 2013 - Table 1(A)1 HILs
Chlorpyrifos	160	NEPM 2013 - Table 1(A)1 HILs
Bifenthrin	600	NEPM 2013 - Table 1(A)1 HILs
Herbicides		
2,4,5-T	600	NEPM 2013 - Table 1(A)1 HILs
2,4-D	900	NEPM 2013 - Table 1(A)1 HILs
MCPA	600	NEPM 2013 - Table 1(A)1 HILs
MCPB	600	NEPM 2013 - Table 1(A)1 HILs
Mecoprop	600	NEPM 2013 - Table 1(A)1 HILs
Picloram	4500	NEPM 2013 - Table 1(A)1 HILs
Other Organics		
PDBE (Br1-Br9)	1	NEPM 2013 - Table 1(A)1 HILs

Note – All values are in mg/kg



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6.2 Health Screening Levels (HSLs) – HSL A & B

For selection of the health screening criteria an assessment of the in-situ soil profile should be undertaken. The soil criteria indicate that the upper soil profile is more consistent with **CLAY.**

Table 6: Health Screening Levels (HSL) Criteria

FOUNDATION EARTH SCIENCES	HSL A & HSL B	HSL A & HSL B	HSL A & HSL B	HSL A & HSL B	Soil Saturation Concentration (Csat)	Reference
	0m to <1m	1m to <2m	2m to <4m	4m+		
SAND						
Toluene	160	220	310	540	560	NEPM 2013 - Table 1(A) 3 HSLs
Ethylbenzene	55	NL	NL	NL	64	NEPM 2013 - Table 1(A) 3 HSLs
Xylenes	40	60	95	170	300	NEPM 2013 - Table 1(A) 3 HSLs
Naphthalene	3	NL	NL	NL	9	NEPM 2013 - Table 1(A) 3 HSLs
Benzene	0.5	0.5	0.5	0.5	360	NEPM 2013 - Table 1(A) 3 HSLs
F1	45	70	110	200	950	NEPM 2013 - Table 1(A) 3 HSLs
F2	110	240	440	NL	560	NEPM 2013 - Table 1(A) 3 HSLs
SILT						
Toluene	480	NL	NL	NL	640	NEPM 2013 - Table 1(A) 3 HSLs
Ethylbenzene	NL	NL	NL	NL	69	NEPM 2013 - Table 1(A) 3 HSLs
Xylenes	110	310	NL	NL	330	NEPM 2013 - Table 1(A) 3 HSLs
Naphthalene	5	NL	NL	NL	10	NEPM 2013 - Table 1(A) 3 HSLs
Benzene	0.7	1	2	3	440	NEPM 2013 - Table 1(A) 3 HSLs
F1	50	90	150	290	910	NEPM 2013 - Table 1(A) 3 HSLs
F2	280	NL	NL	NL	570	NEPM 2013 - Table 1(A) 3 HSLs
CLAY						
Toluene	480	NL	NL	NL	630	NEPM 2013 - Table 1(A) 3 HSLs
Ethylbenzene	NL	NL	NL	NL	68	NEPM 2013 - Table 1(A) 3 HSLs
Xylenes	110	310	NL	NL	330	NEPM 2013 - Table 1(A) 3 HSLs
Naphthalene	5	NL	NL	NL	10	NEPM 2013 - Table 1(A) 3 HSLs
Benzene	0.7	1	2	3	430	NEPM 2013 - Table 1(A) 3 HSLs
F1	50	90	150	290	850	NEPM 2013 - Table 1(A) 3 HSLs
F2	280	NL	NL	NL	560	NEPM 2013 - Table 1(A) 3 HSLs

Note - All values are in mg/kg



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Ecological Investigation Levels (EILs) -

Any validation samples in the future will be assessed against the site derived EILs. A copy of the site derived EILs is provided below.

Table 7: Site Derived EIL Criteria

	EIL Analytes (mg/kg)							
	ARSENIC	CHROMIUM (VI)[a]	COPPER	LEAD	NICKEL	ZINC	NAPHTHALENE	DDT
Site Derived Ecological Investigation Levels (EILs)								
FES DSI Fill BH1 (0.0-0.1m)	100	190	100	1,100	30	250	170	180
FES DSI Natural BH1 (0.6-0.7m)	100	190	100	1,100	30	230	170	180

Notes: a **Chromium VI has been used in lieu of Chromium III**

Ecological Screening Levels (ESLs) -

Ecological screening levels (ESLs) are presented based on a review of Canadian guidance for petroleum hydrocarbons in soil and application of the Australian methodology (Schedule B5b) to derive Tier 1 ESLs for BTEX, benzo(a)pyrene and F1 and F2 (Warne 2010a, 2010b).

The Canadian Council of the Ministers of the Environment (CCME) has adopted risk-based TPH standards for human health and ecological aspects for various land uses in the *Canada-wide standard for petroleum hydrocarbons (PHC) in soil* (CCME 2008) (CWS PHC). The standards established soil values including ecologically based criteria for sites affected by TPH contamination for coarse- and fine-grained soil types.

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Table 8: (EIL) and (ESL) Criteria

FOUNDATION EARTH SCIENCES	Contaminant Age/Soil Texture	National parks and areas of high conservation value	Urban residential and open public spaces	Commercial and industrial	Reference
Ecological Investigation Levels (EILs)					
Heavy Metals					
Arsenic	**Fresh**	20	50	80	NEPM 2013 - Table 1(B) 1-5 EILs
	Aged	40	100	160	NEPM 2013 - Table 1(B) 1-5 EILs
Chromium (III)	**Fresh**	Site Specific Calculation Required			NEPM 2013 - Table 1(B) 1-5 EILs
	Aged				NEPM 2013 - Table 1(B) 1-5 EILs
Copper	**Fresh**	Site Specific Calculation Required			NEPM 2013 - Table 1(B) 1-5 EILs
	Aged				NEPM 2013 - Table 1(B) 1-5 EILs
Lead	**Fresh**	110	270	440	NEPM 2013 - Table 1(B) 1-5 EILs
	Aged	470	1100	1800	NEPM 2013 - Table 1(B) 1-5 EILs
Nickel	**Fresh**	Site Specific Calculation Required			NEPM 2013 - Table 1(B) 1-5 EILs
	Aged				NEPM 2013 - Table 1(B) 1-5 EILs
Zinc	**Fresh**	Site Specific Calculation Required			NEPM 2013 - Table 1(B) 1-5 EILs
	Aged				NEPM 2013 - Table 1(B) 1-5 EILs
Polycyclic Aromatic Hydrocarbons (PAHs)					
Naphthalene	**Fresh**	10	170	370	NEPM 2013 - Table 1(B) 1-5 EILs
	Aged	10	170	370	NEPM 2013 - Table 1(B) 1-5 EILs
Organochlorine Pesticides					
Ecological Screening Levels (ESLs) and Management Limits					
F1 (C_6-C_{10})	**Coarse**				NEPM 2013 - Table 1(B) 6-7 EILs
	Fine	125*	180*	215*	NEPM 2013 - Table 1(B) 6-7 EILs
F1 (C_6-C_{10})	**Coarse**		700	700	NEPM 2013 - Table 1(B) 6-7 EILs
(Management Limits)	**Fine**	-	800	800	NEPM 2013 - Table 1(B) 6-7 EILs
F2 (>C_{10}-C_{16})	**Coarse**				NEPM 2013 - Table 1(B) 6-7 EILs
	Fine	25*	120*	170*	NEPM 2013 - Table 1(B) 6-7 EILs
F2 (>C_{10}-C_{16})	**Coarse**		1000	1000	NEPM 2013 - Table 1(B) 6-7 EILs
(Management Limits)	**Fine**	-	1000	1000	NEPM 2013 - Table 1(B) 6-7 EILs
F3 (>C_{16}-C_{34})	**Coarse**	-	300	1700	NEPM 2013 - Table 1(B) 6-7 EILs
	Fine	-	1300	2500	NEPM 2013 - Table 1(B) 6-7 EILs
F3 (>C_{16}-C_{34})	**Coarse**		2500	3500	NEPM 2013 - Table 1(B) 6-7 EILs
(Management Limits)	**Fine**	-	3500	5000	NEPM 2013 - Table 1(B) 6-7 EILs
F4 (>C_{34}-C_{40})	**Coarse**	-	2800	3300	NEPM 2013 - Table 1(B) 6-7 EILs
	Fine	-	5600	6600	NEPM 2013 - Table 1(B) 6-7 EILs
F4 (>C_{34}-C_{40})	**Coarse**		10000	10000	NEPM 2013 - Table 1(B) 6-7 EILs
(Management Limits)	**Fine**	-	10000	10000	NEPM 2013 - Table 1(B) 6-7 EILs
Benzene	**Coarse**	10	50	75	NEPM 2013 - Table 1(B) 6-7 EILs
	Fine	10	65	95	NEPM 2013 - Table 1(B) 6-7 EILs
Toluene	**Coarse**	10	85	135	NEPM 2013 - Table 1(B) 6-7 EILs
	Fine	65	105	135	NEPM 2013 - Table 1(B) 6-7 EILs
Ethylbenzene	**Coarse**	1.5	70	165	NEPM 2013 - Table 1(B) 6-7 EILs
	Fine	40	125	185	NEPM 2013 - Table 1(B) 6-7 EILs
Xylenes	**Coarse**	10	105	180	NEPM 2013 - Table 1(B) 6-7 EILs
	Fine	1.6	45	95	NEPM 2013 - Table 1(B) 6-7 EILs
Benzo(a)pyrene	**Coarse**	0.7	0.7	0.7	NEPM 2013 - Table 1(B) 6-7 EILs
	Fine	0.7	0.7	0.7	NEPM 2013 - Table 1(B) 6-7 EILs

Notes

1 Urban residential/public open space is broadly equivalent to the HIL-A, HIL-B and HIL-C land use scenarios in Table 1A(1) Footnote 1 and as described in Schedule B7.

2 Aged values are applicable to arsenic contamination present in soil for at least two years. For fresh contamination refer to Schedule B5c.

3 Insufficient data was available to calculate aged values for DDT and naphthalene, consequently the values for fresh contamination should be used.

4 Insufficient data was available to calculate ACLs for As, DDT and naphthalene. The EIL should be taken directly from Table 1B(5).

5 ESLs are of low reliability except where indicated by * which indicates that the ESL is of moderate reliability.

6 '-' indicates that insufficient data was available to derive a value.

7 To obtain F1, subtract the sum of BTEX concentrations from C6-C10 fraction and subtract naphthalene from >C10-C16 to obtain F2.

8 Management limits are applied after consideration of relevant ESLs and HSLs

9 Separate management limits for BTEX and naphthalene are not available hence these should not be subtracted from the relevant fractions to obtain F1 and F2.

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6.3 Asbestos – Residential A, FA & AF + All forms

Health screening for asbestos in soil, which are based on scenario-specific likely exposure levels, are adopted from the WA DoH guidelines and are referred in Table 7 in Schedule B1. The following health screening levels for asbestos can be seen below:

Table 9: Health Screening Levels for Asbestos

	Health Screening Levels (w/w)			
Form of Asbestos	**Residential A**	Residential B	Recreational C	Commercial/Industrial D
Bonded ACM	**0.01%**	0.04%	0.02%	0.05%
FA and AF (Friable Asbestos)	**0.001%**			
All forms of asbestos	**No visible asbestos for surface soil**			

6.4 Export of waste

Any additional soil material requiring offsite disposal will be analysed against the NSW EPA refers to the NSW EPA (2014) "*Waste Classification Guidelines, Part 1: Classifying Waste".*

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6.5 Aesthetic Considerations

Schedule B1 in NEPC (2013) requires the consideration of aesthetic issues arising from soils and groundwater within the site. The following assessment criteria were adopted when considering aesthetics:

- no persistently malodourous soils or extracted groundwater.
- no persistent hydrocarbon sheen on surface water.
- no staining or discolouration in soils, taking into consideration the natural state of the soil; and
- no large or frequently occurring anthropogenic materials present (to the extent practicable).

6.6 Groundwater

The NSW DECC has endorsed the use of the Groundwater Investigation Levels (GILs) given in the 1999 NEPM '*Schedule B (1) Guideline on the Investigation Levels for Soil and Groundwater'* (Amendment 2013) and the water quality trigger levels given in the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZECC & ARMCANZ, 2000). These Guidelines provide criteria for:

- Aquatic ecosystems – both marine and fresh waters



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The NEPM advises that 'when assessing groundwater contamination, the GILs are to be applied at the point of extraction and as response levels at the point of use, or where there is a likelihood of an adverse environmental effect at the point of discharge'.

For assessing groundwater quality, it is first necessary to assess the potential uses of groundwater downgradient of the site being assessed.

Potential uses of groundwater downgradient of the site include:

- Discharge to water bodies sustaining aquatic ecosystems particularly Fresh Water.
- Extraction of groundwater by local users.

The threshold concentrations presented in the ANZECC (2000) Fresh and Marine Waters Quality Guidelines are considered applicable for the protection of aquatic ecosystems of the receiving waters. As these guidelines apply to receiving waters, it is generally conservative to apply these to groundwater discharging to receiving waters. It is important to note that these are not threshold values at which an environmental problem is likely to occur if exceeded, rather, if the trigger values are exceeded, then further action is required which may include either further site-specific investigations to assess whether or not there is an actual problem or management / remedial action should be undertaken.

It is considered that *Marine* ***Water trigger*** values are applicable for investigating chemical concentrations in groundwater at the site. The nearest watercourse is Maroubra Beach (Pacific Ocean) located approximately 1.6km to the southeast of the



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site. It is understood that the NSW EPA policy is that the trigger values for the protection of 95% of aquatic ecosystems should be used as groundwater assessment criteria when considering moderately or highly disturbed receiving environments. The receiving waters for groundwater at the site are moderately disturbed ecosystems and the ANZECC (2000) 95% protection values are therefore considered appropriate groundwater assessment criteria for the site.

Table 9B: GILs

FOUNDATION EARTH SCIENCES	GIL-Marine Low Reliability 95% (µg/L)	Reference
Heavy Metals		
Arsenic	-	NEPM 2013 - Table 1C GILs & ANZECC & ARMCANZ (2000)
Cadmium	0.7	NEPM 2013 - Table 1C GILs & ANZECC & ARMCANZ (2000)
Chromium, Cr (III)	27.4	NEPM 2013 - Table 1C GILs & ANZECC & ARMCANZ (2000)
Chromium, Cr (VI)	4.4	NEPM 2013 - Table 1C GILs & ANZECC & ARMCANZ (2000)
Copper	1.3	NEPM 2013 - Table 1C GILs & ANZECC & ARMCANZ (2000)
Lead	4.4	NEPM 2013 - Table 1C GILs & ANZECC & ARMCANZ (2000)
Mercury (Total)	0.1	NEPM 2013 - Table 1C GILs & ANZECC & ARMCANZ (2000)
Nickel	7	NEPM 2013 - Table 1C GILs & ANZECC & ARMCANZ (2000)
Zinc	15	NEPM 2013 - Table 1C GILs & ANZECC & ARMCANZ (2000)
Polycyclic Aromatic Hydrocarbons (PAHs)		
Naphthalene	50	NEPM 2013 - Table 1C GILs & ANZECC & ARMCANZ (2000)
Benzo[a]pyrene	-	NEPM 2013 - Table 1C GILs & ANZECC & ARMCANZ (2000)
Monocyclic Aromatic Hydrocarbons		
Benzene	500	NEPM 2013 - Table 1C GILs & ANZECC & ARMCANZ (2000)
Toluene	-	NEPM 2013 - Table 1C GILs & ANZECC & ARMCANZ (2000)
Etylbenzene	-	NEPM 2013 - Table 1C GILs & ANZECC & ARMCANZ (2000)
Xylenes	-	NEPM 2013 - Table 1C GILs & ANZECC & ARMCANZ (2000)
Phenols		
Phenols	400	NEPM 2013 - Table 1C GILs & ANZECC & ARMCANZ (2000)
Chlorinated Alkanes		
Dichloromethane	-	NEPM 2013 - Table 1C GILs & ANZECC & ARMCANZ (2000)
Tetrachloromethane (carbon tetrachloride)	-	NEPM 2013 - Table 1C GILs & ANZECC & ARMCANZ (2000)
Trichloromethane (chloroform)	770	NEPM 2013 - Table 1C GILs & ANZECC & ARMCANZ (2000) & ANZG 2018
Trihalomethanes (total)	-	NEPM 2013 - Table 1C GILs & ANZECC & ARMCANZ (2000)
1,2-Dichloroethane	-	NEPM 2013 - Table 1C GILs & ANZECC & ARMCANZ (2000)
1,1,2-Trichloroethane	1900	NEPM 2013 - Table 1C GILs & ANZECC & ARMCANZ (2000)
Chlorinated Alkenes		
Chloroethene (vinyl chloride)	-	NEPM 2013 - Table 1C GILs & ANZECC & ARMCANZ (2000)
1,1-Dichloroethene	-	NEPM 2013 - Table 1C GILs & ANZECC & ARMCANZ (2000)
1,2-Dichoroethene	-	NEPM 2013 - Table 1C GILs & ANZECC & ARMCANZ (2000)
Trichloroethene	330	NEPM 2013 - Table 1C GILs & ANZECC & ARMCANZ (2000)
Tetrachloroethene (PCE)	70	NEPM 2013 - Table 1C GILs & ANZECC & ARMCANZ (2000)
Chlorinated Benzenes		
Chlorobenzene	-	NEPM 2013 - Table 1C GILs & ANZECC & ARMCANZ (2000)
1,2- Dichlorobenzene	-	NEPM 2013 - Table 1C GILs & ANZECC & ARMCANZ (2000)
1,3- Dichlorobenzene	-	NEPM 2013 - Table 1C GILs & ANZECC & ARMCANZ (2000)
1,4- Dichlorobenzene	60	NEPM 2013 - Table 1C GILs & ANZECC & ARMCANZ (2000)
1,2,3- Trichlorobenzene	-	NEPM 2013 - Table 1C GILs & ANZECC & ARMCANZ (2000)
1,2,4- Trichlorobenzene	20	NEPM 2013 - Table 1C GILs & ANZECC & ARMCANZ (2000)

The adopted GILS in Marine Water.

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Table 9C: Groundwater HSLs

FOUNDATION EARTH SCIENCES	HSL A & B	HSL A & B	HSL A & B	Solubility Limit	Reference
	2m to <4m	4m to <8m	8m+		
SAND					
Toluene	NL	NL	NL	61	NEPM 2013 - Table 1(A) 3 HSLs
Ethylbenzene	NL	NL	NL	3.9	NEPM 2013 - Table 1(A) 3 HSLs
Xylenes	NL	NL	NL	21	NEPM 2013 - Table 1(A) 3 HSLs
Naphthalene	NL	NL	NL	0.17	NEPM 2013 - Table 1(A) 3 HSLs
Benzene	0.8	0.8	0.9	59	NEPM 2013 - Table 1(A) 3 HSLs
F1	1	1	1	9	NEPM 2013 - Table 1(A) 3 HSLs
F2	1	1	1	3	NEPM 2013 - Table 1(A) 3 HSLs
SILT					
Toluene	NL	NL	NL	61	NEPM 2013 - Table 1(A) 3 HSLs
Ethylbenzene	NL	NL	NL	3.9	NEPM 2013 - Table 1(A) 3 HSLs
Xylenes	NL	NL	NL	21	NEPM 2013 - Table 1(A) 3 HSLs
Naphthalene	NL	NL	NL	0.17	NEPM 2013 - Table 1(A) 3 HSLs
Benzene	4	5	5	59	NEPM 2013 - Table 1(A) 3 HSLs
F1	6	6	6	9	NEPM 2013 - Table 1(A) 3 HSLs
F2	NL	NL	NL	3	NEPM 2013 - Table 1(A) 3 HSLs
CLAY					
Toluene	NL	NL	NL	61	NEPM 2013 - Table 1(A) 3 HSLs
Ethylbenzene	NL	NL	NL	3.9	NEPM 2013 - Table 1(A) 3 HSLs
Xylenes	NL	NL	NL	21	NEPM 2013 - Table 1(A) 3 HSLs
Naphthalene	NL	NL	NL	0.17	NEPM 2013 - Table 1(A) 3 HSLs
Benzene	5	5	5	59	NEPM 2013 - Table 1(A) 3 HSLs
F1	NL	NL	NL	9	NEPM 2013 - Table 1(A) 3 HSLs
F2	NL	NL	NL	3	NEPM 2013 - Table 1(A) 3 HSLs



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7.0 REMEDIATION STRATEGY

7.1 General

All works undertaken during the remediation program must be monitored by a suitably qualified person experienced in the assessment and remediation of contaminated sites. The RAP must be adhered to by all personnel and sub-contractors involved in the remediation program.

7.2 NSW EPA preferred hierarchy of options for site remediation

The NSW EPA has a preferred hierarchy of options for site remediation and/or management which is outlined below:

- If practicable, on-site treatment of the contamination so that it is destroyed and the associated risk is reduced to an acceptable level; and
- Off-site treatment of excavated soil, so that the contamination is destroyed or the associated risk is reduced to an acceptable level.

If the above is not practicable:

- Consolidation and isolation of the soil on-site by containment with a properly designed barrier; and
- Removal of contaminated material to an approved facility followed, if necessary, by replacement with appropriate materials; or
- Where the assessment indicates remediation would have no net environmental benefit or would have a net adverse effect, implementation of an appropriate management strategy.



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7.3 Remediation option review

7.3.1 Available remediation / management technologies

There is a range of different remediation technologies that are available for remediation of contaminated sites. Some of these technologies are proven while others have not been successfully implemented, particularly in Australia and / or there is limited local expertise for implementation.

A review of the available soil remediation methods and technologies indicated that the following strategies may be applicable to the remediation of fill material contaminated at concentrations exceeding health-based threshold concentrations:

- Excavation and off-site disposal of contaminated soil to landfill.
- Bioremediation.
- Thermal treatment.
- Cap and contain.

7.3.2 Excavation and off-site disposal

This method involves the excavation of contaminated materials and disposal of the materials off-site to a landfill licensed by the NSW EPA. Excavated soils must be classified before disposal to an appropriate landfill. Depending on the levels of contamination, soil may require pre-treatment (to reduce contaminant levels or immobilise contaminants) prior to off-site disposal to the licensed landfill.



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7.3.3 Treatment

There is a range of soil treatment technologies available depending on the type of contaminant including in-situ and ex-situ remediation methods. Most commonly, for contamination, the technologies adopted are ex-situ, requiring excavation of the contaminated material. In-situ remediation technologies generally require a longer timeframe for completion than ex-situ technologies. Most of the treatment technologies that require excavation of the contaminated material could be undertaken on or off-site, subject to obtaining licences. Some possible treatment methods for heavy metals include soil washing and stabilisation of soil.

7.3.4 Managing risks by preventing any direct exposure pathway between contaminated soil and site users (through capping)

On-site capping is used to isolate areas in the subsurface from the surrounding uncontaminated environment. A physical barrier such as a layer of clean soil, synthetic material liners, asphalt and concrete layers may be installed to cap the contaminated material. A cap is typically used where it is required to remove exposure to the contaminated soils and where the contaminated soils are not mobile or there is no contact with groundwater and / or groundwater is not contaminated.

A site management plan is required with any cap and contain strategy. The site management plan identifies the party responsible for adhering to the plan and includes commitments for ongoing monitoring and maintenance of the cap as well as control of future excavations, which must be minimised or if required, the appropriate occupational health and safety procedures are adopted and permits acquired before work is carried out. Any SMP will require public notification and need to have a mechanism for legal enforcement.



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7.4 Rationale for selection of remedial strategy

Usual considerations in selecting and implementing a remediation strategy for a site include:

- **Proven technology**: the remediation method should have a proven track record of success/failure.
- **Reliability**: this is a measure of the degree of certainty that the remediation method will succeed in meeting the site remediation goals in the short and long term.
- **Regulatory approvals**: the remediation method needs to be endorsed by the relevant regulatory authorities. The difficulty in obtaining regulatory approvals will be largely dependent upon the nature of the remediation method proposed.
- **Cost**: provides an indication as to the likely costs involved in implementing each type of remediation method.
- **Implementation time:** provides an indication as to the likely time frame involved in implementing each type of remediation strategy.
- **Land use restrictions:** if contaminated material is left on-site, the regulatory authority may place restrictions on the land use and/or require notification of the contamination on the property title.
- **Ongoing liabilities (maintenance and monitoring requirements):** a remediation strategy that does not involve the complete removal of all contaminants from the site will necessitate some form of ongoing maintenance and/or monitoring to ensure the longer-term integrity of the remediation strategy adopted.



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- **Future liability:** any remediation strategy that does not involve the complete removal of all contaminants from the site will result in future liability for the contamination.
- **Local contractor experience:** the success and cost effectiveness of any remediation method will be at least partially dependent upon the experience local contractors have in undertaking the type of remediation works proposed.
- **On-site space requirements:** some remediation techniques (e.g. land farming) require relatively large amounts of space to spread soil and will only be feasible if sufficient land is available.
- **Disruptions to site structures and activities:** remediation of the site is likely to create some disturbance, both to the existing site operations and structures, as well as to underground services which may pass through the remediation area (e.g. any work involving excavation of the contaminated soil mass will involve the removal of any structures located atop the excavation zone).
- **Human health risks during remediation:** the remediation workers, site users and the general public may be exposed to hazards posed by contamination during the remediation (e.g. significant levels of vapours may be released when disturbing soil contaminated with volatile organic compounds); and
- **Availability of appropriate disposal sites (for remediation techniques involving excavation and off-site disposal)**: landfill disposal of contaminated soil will only be feasible if a landfill licensed to accept the contaminated soils excavated from the site is available at a reasonable distance from the site.



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The table below presents an evaluation of the various options for general remediation projects in Australia based on the above. The table also includes a number of limitations and risks associated with each method.

Table 10A: Remediation options

Technical Characteristics	Option 1 Excavation – Off-Site Disposal	Option 2 Bioremediation	Option 3 Thermal Treatment	Option 4 Cap and contain
Cost	Low- Medium	Medium	High	Low
Technical feasibility	Possible for a range of contaminants including those encountered at the site during the investigations (PAH)	Not possible for heavy metal contaminated material (COPC at this site is PAH – therefore possible)	Not possible for heavy metal contaminated material (COPC at this site is PAH – therefore possible)	Possible for a wide range of contaminants including those encountered at the site (PAH)
Human Health Risks	Relatively low – excavation and direct offsite disposal will minimise personal contact	Variable – relatively low risk associated with in-situ bioremediation but greater with ex-situ, as soil needs to be excavated	Significant – excavation and handling of contaminated materials will create a volatile contaminant release hazard	Relatively low – only minimal soil disturbance involved

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Technical Characteristics	Option 1 Excavation – Off-Site Disposal	Option 2 Bioremediation	Option 3 Thermal Treatment	Option 4 Cap and contain
Reliability	Excellent – system ensures the removal of all contaminated materials	Variable – in-situ bioremediation presents only a low potential to adequately remediate all organic species. Ex-situ is more reliable, due to the more complete mixing of organisms, nutrients and oxygen with the contamination	Moderate – thermal processes have been successfully implemented on most organic contaminant species	Moderate – some potential may exist for contaminant breakthrough if containment wall not properly keyed into bedrock. Care also needs to be taken to prevent preferential gas venting.
Regulatory Approval	Satisfactory – Compliance with Regulatory Authorities. Licensed landfills available for day cover	Satisfactory – on-site treatment is generally the EPA's preferred strategy for site remediation	May be difficult. May require an EIS	Generally satisfactory – whilst on-site containment is not the EPA's preferred option, it is often accepted as a feasible option



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Technical Characteristics	Option 1 Excavation – Off-Site Disposal	Option 2 Bioremediation	Option 3 Thermal Treatment	Option 4 Cap and contain
Disruption to Site Structures and Activities	Significant – all existing site structures need to be demolished or relocated to allow excavation of contaminated soils	Variable – disturbance relatively minor for in-situ bioremediation, but ex-situ would require existing structures to be demolished or relocated	Significant – all existing site structures need to be demolished or relocated to allow excavation of contaminated soils	Moderate – some disruption likely to proposed underground services
Ongoing Liabilities	Minimal – all heavily contaminated materials removed	Variable – need for ongoing monitoring will be largely dependent upon the success of bioremediation in destroying contaminants	Variable – need for ongoing monitoring will be largely dependent upon the success of thermal desorption in destroying contaminants	Moderate to high – capping system need to be maintained, and ongoing monitoring necessary to ensure the integrity of the cap and cut-off wall
Contractor Experience	Good – relatively simple strategy involving only basic technologies	Very Limited – technology is still developing, and only a limited number of trials undertaken in Australia	Very Limited – technology is still developing, and only a limited number of trials undertaken in Australia	Moderate – contractors available with experience in the implementation of cap and contain systems



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Technical Characteristics	Option 1 Excavation – Off-Site Disposal	Option 2 Bioremediation	Option 3 Thermal Treatment	Option 4 Cap and contain
Availability of Disposal Sites	Good – landfills available to accept solid waste	Not Applicable	Not Applicable	Not Applicable (assuming all materials excavated to form the cut-off wall are retained on-site)
Implementation Time Frame	Short	Long	Short to Moderate	Short to Moderate

7.5 Preferred remediation strategy

For this site, on- and off-site treatment of contaminants, which are the most preferred remedial strategies of the NSW EPA, were ruled out for the following reasons:

- Materials have to be removed from site so if land farming took place, materials would ultimately be removed; and
- The costs of reuse and treatment for more sensitive sites would be substantially higher than off-site disposal to landfill.

The next most preferred strategy of on-site containment was ruled out for the following reasons:

- The site requires a reduction of soils as excavation is required within the site.

The next most preferred remedial option strategy is removal of contaminated material to a licensed landfill and is the selected strategy for the following reasons:

- The costs of off-site disposal to landfill are considerably less than treatment costs.

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- The method fits in with the proposed development.

Relative benefits of the "excavate and dispose" strategy are as follows:

- The costs associated with the 'excavate and dispose' remediation method is low to medium.
- The 'excavate and dispose' remediation method is a proven technology for the type of contaminants identified at the site, likely to be approved by the regulatory bodies.
- The 'excavate and dispose' remediation method is dependent upon the cost and availability of suitable landfill disposal sites. These are readily available and cost-effective.
- After completion of the remediation works by the 'excavate and dispose' remediation method, the site would continue to be suitable for the proposed use, and there would be no ongoing liabilities, and very limited (if any) ongoing maintenance / monitoring required.
- As part of the site development, a net reduction of soils is required thus fitting into this remediation strategy; and
- The timeframe for implementation of the 'excavate and dispose' remediation method is relatively short compared to other possible remediation methods.



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7.6 Excavation Risk – Offsite Disposal

Prior to commencement of any excavation works, the remediation contractor should refer to the ***engineering report to limit any undermining risks to the adjacent properties.*** An assessment by a suitable qualified contractor / engineering is required to identify a suitable excavation method prior to start of excavation works to ensure integrity of adjacent structures remain.

Removal of waste materials from the site shall only be carried out by a licensed contractor holding appropriate licence, consent and/ or approvals to dispose of the waste materials according to the assigned waste classification, and with the appropriate approvals obtained from the EPA, if required. ***Details of all soils removed from the site (including VENM) shall be documented by the Contractor with source location, volume/tonnage, waste classification, disposal date, disposal destination, copies of weighbridge slips, landfill receipts/disposal docket, tip tickets and consignment disposal confirmation (where appropriate) provided to the Environmental Consultant and/or the NSW EPA Accredited Site Auditor.***

Material tracking needs to include information on source location, volume /tonnage, waste classification, disposal date, disposal destination, disposal docket, including waste locate consignment number of any asbestos soil waste disposed, transporters details (including EPL No) and a tally of estimated versus actual volume disposed.



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8.0 REMEDIATION WORKS

8.1 Remediation Goal & Objectives

The remediation goal is to render the site suitable for the proposed development upon completion of the remediation and validation works. This would be achieved by remediating and completing:

- Borehole BH5 – contains TRH impacted fill to a depth of 0.1m BGL. The delineation of the impacted fill is proposed to be completed as part of the remediation works.
- The RAP also requires the additional sampling to be completed post demolition of site structures to assess beneath the former building footprints, beneath the UPSS area and further define the extent of the required soil remediation works at the site.

The delineation of the impacted fill soil (BH5) is proposed to be completed as part of the remediation works. Refer to section 8.2.

8.2 Remediation program

Assuming appropriate permits have been granted, the remediation of the site is to take place in the following stages:

<u>Stage One - Site Preparation</u>

- Notice should be given to council at least 30 days prior to the commencement of remediation works. The site developer needs to prepare and implement a Construction Environmental Management Plan (CEMP) and site Work Health and Safety Plan prior to any site works.



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Stage Two - Site Walkover

- Post demolition of structures and removal of hardstand pavements, an appraisal of the prevailing site conditions is to be performed by a suitable qualified environmental scientist / engineer.
- The purpose of the site walkover is to observe any signs / evidence of potential contamination including fibro cement fragments, ACM, heavy staining, odours, presence of waste.
- Unexpected finds protocol will be implemented if signs / evidence of contamination is encountered.

Stage Three (A)– Underground Storage Tank Removal & Validation

- Decommission the UST's and associated piping in accordance with AS4976-2008, UPSS Regulation 2008, NSW EPA Technical Guidance 2014, and WorkCover requirements.
- As described above the preferred remediation strategy for the site is excavation and off-site disposal of the fill materials / bedding sands and the USTs.
- GPR scan indicate approximately two UST Areas may exist within the site that requires removal followed by remediation and validation. Any soil requiring removal from the site, as part of future site works, should be classified in accordance with the "Waste Classification Guidelines, Part 1: Classifying Waste" NSW EPA (2014).
- It is noted that the total void space occupied by the UST is expected to reduce the amount of soil requiring excavation. If contaminated material is found during the remediation works, these materials will be chased up and removed.



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Stage Three - Additional Sampling & Delineation Works (Post demolition)

Soil Delineation – including BH5

- Works to occur prior to offsite removal of soil.
- Boreholes BH5 will be delineated laterally and vertically comprising of four (4) step out locations around each location. Initially the step out locations will be located North, South, East & West approximately 1-2m from the existing location and samples collected in both fill and natural profiles.
    - One test pit to be excavated within the original hotspot to delineate the vertical extent of contamination.
    - One fill sample from each test pit. If the fill is greater than 1m deep, additional fill samples to be analysed and collected in each soil horizon.
    - Soil samples will be analysed in a NATA-accredited laboratory under Chain of Custody. Laboratory analysis for HM, TRH, BTEXN, PAH.
- Delineation locations to be test pitted to allowed sufficient soil collection for asbestos analysis of the collected samples.
- Note if the step out location is impacted, further step out sampling will be required and delineation sampling will cover the entire fill profile.

Soil – Additional Locations – building footprints

- Works to occur prior to offsite removal of soil.
- An additional EIGHT locations are proposed to be investigated to target the former building footprints.
    - One fill sample from each *test pit*. If the fill is greater than 1m deep, additional fill samples to be analysed and collected in each soil horizon.

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- Soil samples will be analysed in a NATA-accredited laboratory under Chain of Custody. Laboratory analysis for HM, TRH, BTEXN, PAH, OCP, PCB & Asbestos.

- Locations to be test pitted to allowed sufficient soil collection for asbestos analysis of the collected samples if required.

Groundwater – Additional Locations

- Installation and sampling of up to four new groundwater wells beneath the removed UST areas, **subject to access on the day of drilling.**
- Installation and sampling of two offsite groundwater wells once the removed UST areas have been finalised**.**
- Sampling of all existing wells to review the groundwater quality on the site and migrating from the site.
- Analysis for Heavy metals, TRH, BTEX, PAH, VOC
- Allowance for collection and laboratory analysis of groundwater QA/QC samples, including field duplicates, field/rinsate blanks and trip spikes as relevant.
- Provision of qualified and experienced scientists/engineers to supervise and conduct the fieldwork component.

This RAP is based on current information and may need to be updated once the additional sampling is finalised.

Stage Four - Classification, Removal, and Validation of Impacted Area

Refer to Section 11.1 for validation sampling frequency and listed of analytes to be tested.

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Impacted Areas – include BH5

- BH5 - contains TRH impacted fill soil materials to a depth of 0.1m BGL. The material is to be classified in accordance with the NSW EPA Waste Classification Guidelines and can be disposed of at EPA licenced landfill facility that can accept the waste. The area to be excavated will be based on the delineation sampling. However, an estimated amount is 5m x 5m x 0.5m deep = 12.5m3 per impacted borehole.
- The impacted areas will be validated to ensure the successful removal of contaminated fill soils. Chasing up of contaminants may be required during this stage of works if levels are found over site criteria.
- The current maximum depth of removal works is 0.5m BGL and this may be amended based on results of the delineation sampling and this will be included in the Remediation Validation report.

The lateral and vertical extent of the above location may be extended pending results of the validation sampling. The material is to be classified in accordance with the NSW EPA Waste Classification Guidelines and can be disposed of at EPA licenced landfill facility that can accept the waste.

The fill and natural layer have already been sampled as part of the previous works, and these samples will be included within the sampling density for characterisation. Further samples will be recovered either in-situ or from stockpiles. Any excavated fill will be temporarily stockpiled on a heavy-duty plastic sheet or a sealed surface such as concrete and covered with an impermeable plastic sheet to prevent rain infiltration.

Waste classified for offsite disposal should be loaded onto EPA licensed waste vehicles for transport to designated landfill. Waste classification ex-situ at rate of 1 per 25m3 up



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to 250m3 for waste classification purposes. Minimum of 3 samples per stockpile. Stockpiles greater than 250m3 up to 2500m3, sampling frequency is minimum of 10 samples plus 95%UCL. Stockpiles greater than 2500m3 will have sampling frequency of 1 sample per 250m3.

- Collection of QA/QC
- Analysis includes HM, TRH, BTEXN, PAH, OCP, PCBs and Asbestos
- TCLP Analysis of heavy metals and benzo(a)pyrene is required to facilitate waste classification and offsite disposal.

Stockpile Footprint Validation

Validation of stockpile footprints to occur	1 floor sample per 25m2 1 inter-laboratory duplicate 1 intra-laboratory duplicate Spikes / blanks	HM, TRH, BTEX, PAH, OC, PCB and Asbestos

Stage Five – Validation of basement floor and landscape areas

The floors of the basement floor and landscape areas will be sampled by taking twenty (20) floor samples plus QA/QC samples to validate the areas.

Stage Six– Validation Report Preparation

- Remediation will occur by managing soil for offsite disposal to landfill for contaminated soils.
- A validation report will be prepared to present the remediation works undertaken and confirm that the objectives of the remediation works have been attained.

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The extent of the remediation works would be extended whether any USTs, associated infrastructure &/or any further contaminated material via unexpected finds are identified during remediation works.

8.3 Extent of remediation works required

As described above the preferred remediation strategy for the site is excavation and off-site disposal of the fill materials. If contaminated material is found during the remediation works, these materials will be chased up and removed.

8.4 Regulatory requirements such as licenses and approvals

Approval from a licensed disposal facility will be required prior to removal of any contaminated material from the site.

8.5 Disposal of excavated contaminated material

The contaminated fill or soil excavated from the site will be disposed of at a licensed landfill facility. If disposal of contaminated liquids is required, this will be undertaken by a licensed contractor. The weighbridge and truck dockets will be retained by the contractor and made available to the principal's environmental representative.

Details of all soils removed from the site (including VENM) shall be documented by the Contractor with source location, volume/tonnage, waste classification, disposal date, disposal destination, copies of weighbridge slips, landfill receipts/disposal docket, tip



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tickets and consignment disposal confirmation (where appropriate) provided to the Environmental Consultant and/or the NSW EPA Accredited Site Auditor.

Material tracking needs to include information on source location, volume /tonnage, waste classification, disposal date, disposal destination, disposal docket, including waste locate consignment number of any asbestos soil waste disposed, transporters details (including EPL No) and a tally of estimated versus actual volume disposed.

8.6 Contingencies during Remedial Works

8.6.1 Contaminated Soils

Follow the unexpected finds protocol as detailed in Section 16.2 & Appendix A. Works to be suspended until the environmental project manager can further assess impacted soils / materials.

8.6.2 Contaminated Groundwater

During remediation works if any other form of contamination is noticed during excavation works, such as buried drums, waste pits, unexpected USTs etc, a review of groundwater conditions will be required.

8.6.3 Primary Source Removal

During demolition works the removal of any infrastructure involved with the source of the potential contaminated groundwater will be completed.



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8.6.4 Contamination Identified near Heritage Items or Significant Trees

Stop work. Review contaminant concentrations and risks to heritage items / flora. Assess human health and environmental risks if contamination remains in place. Review natural attenuation options.

8.6.5 Contamination Identified near underground services

Stop work, inform the principal environmental consultant and relevant site auditor. Review contaminant concentrations and assess human health and environmental risks if contamination remains in place. Possible longer term environmental management plan to be considered.

8.6.6 Contamination Identified near neighbouring structure

Stop work, inform the principal environmental consultant and relevant site auditor. Review contaminant concentrations and assess human health and environmental risks if contamination remains in place. Engage suitably qualified engineer to assess the structural risk. Possible longer term environmental management plan to be considered.



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9.0 VALIDATION PLAN (DATA QUALITY OBJECTIVES)

The DQOs have been developed for the validation assessment using Appendix IV of the Site Auditor Guidelines. These require 7 steps. The steps being:

a. State the problem.
b. Identify the decisions.
c. Identify inputs to decision.
d. Define the study boundaries.
e. Develop a decision rule.
f. Specify limits on decision errors.
g. Optimise the design for obtaining data.

The following table outlines each of these steps and the approaches taken for this investigation.

Table 11: DQOs for the Validation Assessment

DQO's		Considerations
1	**State the problem** – assemble an effective planning team, describe the problem and examine the resources for investigating the problem	
1.1	Write a summary of the contamination problem.	During the FES DSI – BH5 is above the adopted site criteria for TRH and PAH impacted GW. An irregular shaped area of land of approximately 3,270m^2 in area requires validation to determine the land use suitability or the appropriate waste classification
1.2	Identify members of the planning team.	Landowner/developer, planning consultant and site contamination assessment consultant.
1.3	Develop/refine the conceptual site model (CSM), including a summary	Contaminants –TRH at BH5 & PAH IN GW. Sources – buried building and demolition wastes AND UPSS

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	of the exposure scenarios.	Receptors – site maintenance workers and trespassers, as the site is fenced and secured. If developed, site workers (surface and sub-surface), residents and visitors (adults and children). Pathways – dermal contact, inhalation of dust and ingestion have been identified as the pathways of concern. Further assessment of groundwater and/or soil gas will be considered based on the findings of this investigation.
1.4	Specify the available resources and constraints, such as relevant deadlines for the study, budget, availability of personnel and schedule.	The site contamination assessment consultant has the available capacity to conduct the investigation using appropriate subcontractors (drill rig and laboratory). While the developer seeks close out of the issue within the next three months, there are no practical constraints, as the land is identified as high-value and sufficient budget is available. Additional investigations, or remediation will be conducted as required.
2	**Identify the goals of the study** – identify the principal study question(s) and potential alternative actions (with implications) and combine these to make statements of the decision problem.	
2.1	Identify the principal study question(s).	Is the material suitable for a residential land use based on contaminant levels and aesthetic concerns? If not, what disposal options are available, i.e. what is the waste classification?
2.2	Identify the alternative outcomes or actions that could result from resolution of the principal study question(s).	The alternative outcomes will be: • The material is suitable for residential and recreational land use (HIL-A), or • The material is not suitable for the proposed land use and needs to be partially or fully removed from the site to allow for development.

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2.3	For decision problems, combine the principal study questions and the alternative actions into decision statements.	If the contamination status of the material is acceptable, the material can remain on-site. If the contamination status of the material is unacceptable, consider the remediation hierarchy.
3	**Identify information inputs** – identify the information needed to formulate and investigate the problem and confirm that appropriate sampling and analytical methods are available.	
3.1	Identify the information that will be required to resolve the decision statements/estimation, including existing information and new environmental data, and identify the sources for each item of information required.	Soil data to be collected as part of the validation assessment, including field samples and analytical samples. A previous FES DSI in September 2025 and Additional DSI in November 2025 indicated remediation works are required at BH5 and UPSS Area.
3.2	Identify the information needed to establish the action level.	Investigation criteria will be sourced from: • NEPM 2013, Schedule B1, HILs A for residential with access to soil; and • NSW EPA 2014c, Waste Classification Guidelines
3.3	Confirm that appropriate sampling and analytical methods exist to provide the necessary data.	Sampling and analytical methods will be consistent with existing guidance, including NEPM 2013, B2 and B3. Analytical laboratories will be NATA accredited and/or subject to proficiency testing and use analytical methods based on NEPM, USEPA and APHA methods.

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4	**Define the boundaries of the study** – define the target population and the spatial and temporal boundaries associated with the population; examine any practical constraints to collecting data, and factors that affect the selection of the unit that defines the scale of sampling and the scale of decision making or estimation.	
4.1	Define the target population of interest and its relevant spatial boundaries.	The impacted area is at BH5 and prior to delineation works the proposed area to remove is 5m x 5m x 0.5m deep =12.5m3 per impacted location.
4.2	Define what constitutes a sampling unit.	Sampling units will consist of: • Field samples of appropriately described and logged samples which are field screened. • Analytical samples of the laboratory-specified sample jar quantity.
4.3	Specify temporal boundaries and other practical constraints associated with sample/data collection.	To achieve the three-month schedule for problem resolution, the field investigation should start within two weeks of the investigation plan (SAQP and commercial) being accepted. There are no site access restrictions for personnel once they are inducted, and the project is approved. The decision area is open with a light grass covering only and directly accessible without obstructions.
4.4	Specify the smallest unit on which decisions or estimates will be made.	The decision is to be based on the complete decision area. However, following data analysis, some form of segregation may be considered, i.e. some of the decision area may be suitable for HIL-A and some may require offsite disposal.
5	**Develop the analytic (statistical) approach** – develop a logical 'if…, then… or…' statement that defines the conditions that would cause the decision maker to choose among alternative actions.	
5.1	Specify the statistical parameter that characterises the population of interest, such as mean, median,	The 95% UCL of the arithmetic mean will be the key statistical parameter. The data evaluation will include: • The 95% UCL arithmetic mean to be ≤

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	maximum, 95% upper confidence limit (UCL) of the arithmetic mean or proportion.	criterion. • No individual sample to exceed 250% of the criterion. • The sample standard deviation to be ≤50% criterion. Additional considerations will include aesthetic requirements, including no odours or staining, no waste materials and no monolithic deposits as per NEPM 2013, B2.
5.2	Specify the action level for the decision.	To determine if the material is suitable for the HIL-A land use, analytical action levels are to be based on the NEPM HILs (2013, B1). If the material is not suitable for the HIL-A land use, the material will be classified in accordance with EPA 2014c for offsite disposal. Samples will be held at the laboratory for additional analyses, including leachate analysis following TCLP extraction, if required.
5.3	Confirm that measurement detection will allow reliable comparisons with the action level.	Samples will be submitted to NATA-accredited laboratories. The laboratories' analytical LORs are suitably below the adopted criteria. Note: to achieve an acceptable limit of reporting for asbestos fines and fibrous asbestos, the method may not be NATA-accredited but undertaken using in-house methods for quantification.
5.4	Combine the outputs from the previous DQOs steps and develop an 'if…, then…, else…' theoretical decision rule based on the chosen action level.	**If** the statical parameters (or aesthetics) of the sampling data exceed the applicable action levels, **then** offsite disposal of the fill material will be required, **otherwise, if** the statistical (and aesthetic) parameters are below the applicable action levels, **then** the fill material will be determined to be suitable for a HIL-A land use.



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6	**Specify performance or acceptance criteria** – specify probability limits for false rejection and false acceptance decision errors.	
6.1	Specify the decision rule as a statistical hypothesis test.	The null hypothesis is that the material is contaminated and exceeds the adopted criteria. The alternative hypothesis is that the material is not contaminated above the adopted criteria.
6.2	Examine consequences of making incorrect decisions from the test.	Possible decision errors include: • The material being accepted as suitable for a HIL-A land use when it is not, thereby potentially risking human health or environmental impacts. • Unnecessary disposal of the material offsite, imposing needless financial and resource burdens on the development project and resulting in an inappropriate waste classification.
6.3	Place acceptable limits on the likelihood of making decision errors, including acceptable alpha (α) and beta (β) risk levels.	Stated hypotheses: • Null hypothesis (H0): the 95% UCL, and other requirements, are > the action level. • Alternate hypothesis (HA): the 95% UCL, and other requirements, are ≤ the action level. Potential outcomes include Type I and Type II errors: ○ Type I error of determining the material is acceptable for the proposed HIL-A land use when it is not (wrongly rejects true H0). ○ Type II error of determining the material is unacceptable for the proposed HIL-A land use when it is acceptable (wrongly accepts false H0). For performance criteria, the acceptable limits on the likelihood of making decision errors to be applied are:



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		▪ Alpha risk (Type I error) of $\alpha = 0.05$ ▪ Beta risk (Type II error) of $\beta = 0.2$ The above acceptance criteria are required.
7	**Optimise the design for obtaining data** – identify a resource-effective sampling and analysis design for generating data that is expected to satisfy the DQOs.	
7.1	Document the final sampling and analysis design, along with a discussion of the key assumptions underlying this design.	*Soil Delineation area* Borehole BH5 will be delineated laterally and vertically comprising of four (4) step out locations around each location. Initially the step out locations will be located North, South, East & West approximately 1-2m from the existing location and samples collected in fill profiles. Additional Locations An additional SEVEN locations are proposed to be investigated to target the former building footprint at the site. Validation Site Surfaces To allow statistical inference, a probabilistic strategy is to be adopted. As the remedial works is limited to site and is based on residential use within an area of 3,270m^2, 20 sample locations were selected so the density equates to one sample location per 163.5m2. Using a stratified sampling using a medium density systematic sampling strategy. Boreholes are proposed to be drilled at each location to the underlying natural material as identified by the remnant A-horizon, at a approx. depth of 0-1m. One validation sample is proposed to be collected at each sample location at the surface (a depth of 0.0-0.3m bgl).

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		Based on the size of the decision area, this sampling design results in: • One sample location per 163.5m2
7.2	Detail how the design should be implemented, together with contingency plans for unexpected events.	The field methods for sample collection, handling, and analysis (at analytical laboratories) are described in the project-level standard operating procedures (SOPs). Contingencies include collecting additional samples from material that is significantly difference from the reworked natural material, and conducting additional analyses where field indicators (staining, odours, field screening results) suggest other contaminants.
7.3	Determine the quality assurance and quality control (QA/QC) procedures that are to be performed to detect and correct problems to ensure defensible results.	The required field QA, and the field and laboratory QC, are described in the project-level SOPs. These include both the data quality indicators (DQIs) and the associated measurement quality objectives (MQOs).
7.4	Document the operational details and theoretical assumptions of the selected design in the SAQP.	Theoretical assumptions include: • Surficial impacts from overland flow from the adjacent facility and burial of wastes are the modes of contamination expected. • The material is homogenous. • The remnant A-horizon will be readily discernible from buried grass and organic soil.



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10.0 VALIDATION SAQP & METHODOLOGY

Remediation of the impacted area will be considered validated following the achievement of the two validation objectives.

- Validation of the remedial excavations will continue to the extent of the impacts and resulting samples are within the adopted criteria.
- In the event of backfilling, validation of the imported fill materials used is required to confirm the suitability for the intended land use.

10.1 Soil Validation Methodology

Soil sampling and handling is outlined in the table below:

Table 12: Sampling and Handling

Action	Outline
Sample collection	Soil validation sampling will be collected directly from exposed surface of excavation, or from the material scraped from the excavator bucket. Data shall be recorded in accordance with COC requirements
Sampling, handling, transport and tracking	1.Validation soil samples to be transferred directly into appropriately labelled clean laboratory supplied containers. 2.Validation soil samples to be transferred into chilled eskies for sample preservation. 3.All equipment used in the sampling program was decontaminated prior to use and between samples to prevent cross contamination. Decontamination of equipment involved the following procedures: -Cleaning equipment in potable water to remove gross



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	contamination. -Cleaning in a solution of Decon 90. -Rinsing in clean demineralised water then wiping with clean lint free cloths. 5.A Chain of Custody to be completed and forwarded to the laboratory to ensure sample tracking.
Sampling Frequency	*Validation sampling* Refer to table 13 *Stockpile sampling:* Small Volumes (<250m^3)- 1 sample every 25m^3 Large Volumes (>250 <2500 m$^{3)}$ minimum of 10 samples with 95%UCL >2500m3 minimum sampling rate should be 1 per 250m3
Laboratory Quality Assurance and Quality Control	The contracted laboratory to conduct in-house QA/QC procedures involving by not limiting to: Blanks, spike recoveries, laboratory duplicates & analysis.
Assessment of DQOs	Provide analysis of the QA/QC samples and procedures & provide assessment of the overall data quality.

10.2 Soil Validation Reporting

All fieldwork, chemical analysis, discussions, conclusions and recommendations will be provided in the final validation report for the site. The validation report will be prepared in accordance with the *NSW EPA, Consultants Reporting on Contaminated Land, 2020* and *NSW DEC (2017) Guidelines for the NSW Site Auditor Scheme* and will confirm the site is suitable for the proposed development. Waste tracking documentation and disposal details will be provided in the validation report.



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11.0 VALIDATION WORKS

11.1 Objectives

The objective of the validation program is to ensure that at completion of the remediation works, the site is suitable for continued use and the proposed redevelopment.



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Table 13: Soil Validation Sampling Program

Item	Sampling Frequency	Analytes
Impacted location BH5	Excavation Floor • 1 sample every 25m2 Excavation wall • 1 sample every 5m (from each distinct horizon / material type) 1/20 inter-laboratory duplicates 1/20 intra-laboratory duplicates Spikes / blanks Per location	HM, TRH, BTEXN & PAH
USTs – Likely – two areas	The minimum sampling protocols to be used for each UST area includes: -1 sample per 25m3 backfill UST sands or minimum 3 samples per backfill UST sands per UST pit; -1 sample per 5m of pipework or vent trench; 1 sample per spill box 2 base samples and 8 walls (2 samples per wall face) of each tank pit 1 inter-laboratory duplicate 1 intra-laboratory duplicate Spike / Blanks	Heavy Metals, TRH, BTEX, PAHs.



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Validation basement floors and any landscape areas	20 floor samples inter-laboratory duplicate intra-laboratory duplicate Spikes / blanks	HM, TRH, BTEX, PAH, OCP, PCB and Asbestos
Validation stockpile footprints	1 floor sample per 25m2 1 inter-laboratory duplicate 1 intra-laboratory duplicate Spikes / blanks	HM, TRH, BTEX, PAH, OC, PCB and Asbestos
Backfill Material (if required)	Certified VENM or 1 sample per 25m^3 Certified ENM as per NSW EPA Resource Recovery Order 2014	HM, TPH, BTEX, PAH, OCP, PCB, Phenol, Cyanide & Asbestos. Additional COPC may need to be included in the testing suite depending on the source site. HM, TPH, BTEX, PAH, EC, PH & Foreign Materials & Asbestos
Unexpected Finds	Excavation Floor 1 sample every 25m2 Excavation Wall	Dependent on the location, type and characteristic of the unexpected find.

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	1 sample every 5m (from each distinct horizon / material type)	

11.2 Waste classification of the fill

During excavation works a suitable qualified environmental consultant / hygienist should be present to confirm no unexpected finds arise during the removal works. If unexpected find arises, then refer to section 16.2 for procedures.

Any excavated fill will be temporarily stockpiled (prior to disposal) on a heavy-duty plastic sheet or a sealed surface such as concrete and covered with an impermeable plastic sheet to prevent rain infiltration.

- Asbestos transporters and facilities receiving asbestos waste in NSW weighing more than 100 kilograms or consisting of more than 10m2 of asbestos sheeting in one load must track and report this waste to NSW EPA using Waste Locate.
- Tracking of asbestos waste is to be done via the NSW EPA's online system known as Waste Locate.
- Refer to Section 13.12 for more details.

A preliminary soil classification on the sampling completed during the DSI has been completed by FES. This preliminary soil classification refers to nine (9) FILL borehole from the FES DSI (2025), designated as BH1 to BH9 plus QA/QC.

With reference to a site walkover, the attached site plans, following the laboratory analysis and with reference to NSW EPA guidelines, the in-situ fill materials found within the site have been classified as follows:



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- *Soil fill material located within the borehole locations BH1, BH2, BH3, BH5, BH6, BH7 & BH9, BH10 & BH11 are classified as* ***General Solid Waste (non-putrescible).***
- *Soil fill material located within the borehole location BH4 & BH8 is classified as* ***Restricted Solid Waste.***
- Additional soil sampling and TCLP analysis is recommended to be completed to further characterise the preliminary waste classification at the time of bulk removal works.

Removal of waste materials from the site shall only be carried out by a licensed contractor holding appropriate licence, consent and/ or approvals to dispose of the waste materials according to the assigned waste classification, and with the appropriate approvals obtained from the EPA, if required. ***Details of all soils removed from the site (including VENM) shall be documented by the Contractor with copies of weighbridge slips, landfill receipts, tip tickets and consignment disposal confirmation (where appropriate) provided to the Environmental Consultant and/or the NSW EPA Accredited Site Auditor.***

For material handling and tracking the following is required to be considered:

Waste Classification

- Material source and description of material.
- Sampling density, pattern and COPCs.
- Results summary, including appropriate table with comparison to acceptance criteria.

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For Offsite Disposal

- Source location.
- Estimate volume (based on excavation size).
- Transporter details and licence.
- Reconciliation of actual disposal volume and the estimated volume of disposal (based on excavation size).

Actual volume of Disposal

- The waste classification document,
- Final destination and the POEO licence.
- Reconciliation of waste dockets with actual disposal volume.

For Imported Material

- Source site.
- Volume of imported material.
- Placement location.
- Transporter.
- VENM certificate or certificate applicable for NSW EPA exemptions (e.g. ENM/ROO certificate).

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11.3 Validation of Impacted Boreholes BH5

Following removal of soils from location BH5, photographic records of the floor and wall of the excavation will be taken for reference in the Validation Report. Soil validation samples will be collected as per Table 13. Where contaminant concentrations in validation samples exceed the site remediation criteria, further excavation must be carried out, until new validation samples return concentrations below the site validation criteria.

11.4 Validation of UST Area

Following the removal of any USTs and associated visibly stained or odorous soils, in samples should be collected from the walls and floor of the tank-pits/hotspots and submitted to a NATA accredited laboratory for analysis. The targeted analytes should be, but not be limited to, heavy metals, TPH, BTEX, PAH.

The minimum sampling protocols to be used for unexpected UST areas include:

- 3 samples per backfill UST sands per UST pit;
- 1 sample per tank line;
- 1 sample per vent pipe area;
- 1 sample per spill box (currently not present but may be found);
- 2 base samples and 8 walls (2 samples per wall face) of each tank pit



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11.5 Validation of basement floor and landscape area

General site validation samples are proposed to be collected from the site surfaces and landscape areas. Sampling is to follow a systematic pattern and be analysed for the contaminants of concern identified at these locations, including heavy metals, TRH, BTEX, PAH, OCP, PCB & Asbestos. The soil samples will be collected from between 0-150 mm depth from freshly excavated surfaces.

Samples will be recovered from approx. Twenty (20) locations. Where contaminant concentrations in validation samples exceed the site remediation criteria, further excavation must be carried out, until new validation samples return concentrations below the site validation criteria.

11.6 Validation Results

In the event that validation criteria exceedances are encountered, statistical analysis will be applied to the dataset. The 95% UCL of the mean concentrations of the COPC will be calculated, the standard deviation is required to be less than 50% of the adopted criteria and no single concentration exceeded the criteria by more than 250%.

11.7 Validation of areas where fill has been temporarily stockpiled

The excavated contaminated fill will be temporarily stockpiled on a plastic sheet and covered with an impermeable plastic sheet to prevent rain infiltration. In order to confirm that cross-contamination of the soil underneath has not occurred during stockpiling; testing of the soil's underneath stockpiles will be required after disposal of the stockpile off-site (where necessary).



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11.8 Validation of imported fill

If importation of fill is required, it must be ***certified VENM or ENM*** material. Certified VENM must be tested in accordance with the requirements of the NSW EPA waste classification guidelines (including testing for asbestos). Certified ENM material is also acceptable and will be tested in accordance with the NSW EPA Resource Recovery Order 2014 for ENM. VENM and/or ENM will also be visually assessed for fibro sheeting and samples analysed for asbestos if detected.

11.9 Duration of remediation and validation works

Based on the proposed scope of the remediation and validation works, it is expected that the works should be completed within approximately four to eight weeks following receipt of the regulatory approvals. This timeframe does not include reporting which should be completed approximately three to five weeks after completion of the remediation and validation works.

11.10 Validation Reporting

The following information will be included in the final validation report to order to render the site suitable for the proposed and development and/or satisfy any NSW EPA Site Audit condition:

- Summarise the contamination assessments carried out and the remediation recommendations provided in previous reports.
- Describe the remediation works carried out on-site and subsequent validation.
- Classify soils within the site for suitable disposal.
- Representative soil sampling and testing to validate site areas.



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- Assessment of laboratory analytical results, based on currently accepted and applicable guidelines.
- Assessment of field and laboratory quality assurance (QA) and quality control (QC).
- Assessment of the resultant suitability of the site for the proposed development.
- The preparation of a validation report.
- Provide a statement on the resultant contamination status of the site and suitability for the proposed development.



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12.0 QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)

The quality assurance/quality control (QA/QC) program aims at ensuring that the data collected is sufficiently accurate, precise and reproducible to be used for the purpose of the validation report. QA/QC should be in accordance with the NEMP 2013 and with the Australian Standard AS4482.1-2005.

12.1 General QA/QC

The frequency required for each field quality assurance / quality control (QA/QC) sample is presented in the table below.

Table 14: QA/QC Frequencies

	Intra Lab	Inter Lab	Rinsate	Spikes	Blanks
Sampling Frequency	1 in 20	1 in 20	1/day	1/day	1/day

During the contamination assessment the integrity of data collected is considered vital. With the assessment of the site, a number of measures were taken to ensure the quality of the data. These are as follows:

12.2 Sample Containers

Soil samples to be collected remediation work are to be placed immediately into laboratory prepared glass jars with Teflon lid inserts. Standard identification labels are



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to be used for each individual container and labelled according to depth, date, sampling team and media collected.

12.3 Decontamination

All equipment used in the proposed sampling program are to be decontaminated prior to use and between samples to prevent cross contamination. Decontamination of equipment involved the following procedures:

- Cleaning equipment in potable water to remove gross contamination.
- Cleaning in a solution of Decon 90.
- Rinsing in clean demineralised water then wiping with clean lint free cloths.

FES adopts a sampling gradient of lowest to highest potential contamination to minimise the impact of cross contamination. This gradient is determined from the historical review and the on-site inspection that was carried out prior to sampling.

12.4 Sample Tracking, Identification and Holding Times

All samples are to be forwarded to NATA Accredited laboratories under recognised chain of custodies with clear identification outlining the date, location, sampler and sample ID. All samples are required to comply with the laboratories respective holding times. The sample tracking system is considered adequate for the purposes of sample collection.



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12.5 Sample Transport

All samples are to be packed into an esky with ice from the time of collection. A trip blank and trip spike are collected where appropriate. Samples were kept below 4°C at all times, soil samples submitted for asbestos analysis are not required to be kept below 4°C.

12.6 Data Quality Indicators

The pre-determined data quality indicators for the validation program are discussed below in relation to precision, accuracy, representativeness, comparability and completeness and are summarised in the table below:

Table 15: Data Quality Indicator for the proposed Validation Program

Data Quality Indicator	Frequency	DQI Indicator
Completeness		
Data from critical samples is considered valid	All samples	All samples
Satisfactory frequency / result for QC samples	All samples	95%
Field documentation completed	All samples	All samples
Boreholes logs & COCs completed and holding times complied with.	All samples	All samples
Comparability		
Standard operating procedures	All samples	All samples

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Data Quality Indicator	Frequency	DQI Indicator
used		
Consistent field conditions, sampling staff and laboratory analysis	All samples	All samples
Same analytical methods used	All samples	All samples
Limit of reporting appropriate and consistent	All samples	All samples
Representativeness		
Sampling appropriate for media and analytes	All samples	All samples
Samples adequately preserved	All samples	All samples
Precision		
SOPs appropriate and complied with in relation to field duplicates	All samples	All samples
RPDs of the field duplicates within control limits	1/20 samples	<50% RPD
RPDs of the laboratory duplicates within control limits	All samples	All samples
Accuracy		
SOPs appropriate and complied with in relation to field blanks	All samples	All samples
Rinsate Blanks, trip blanks & laboratory blanks free of	Laboratory blanks (LB) = 1 per batch	LB = <LOR RB= <LOR

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Data Quality Indicator	Frequency	DQI Indicator
contaminants	Rinsate Blanks (RB) = 1 / day Trip Blank (TB)= 1/day	TB= <LOR
Surrogate spikes within control limits	All organic analytes	70-130%
Laboratory control spikes within control limits	Yes	Yes
Matrix Spike recoveries within control limits	1 /20 samples	70-130%
Trip spike recoveries within control limits	1/day	>70%

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13.0 CONSTRUCTION ENVIRONMENTAL MANAGEMENT PLAN

A site-specific Construction Environmental Management Plan (CEMP) should be prepared for the construction phase for the proposed development. The CEMP should set out the requirements for environmental management during the works including:

- Management structure and responsibilities.
- Approval and licensing requirements.
- Environmental induction and training.
- Emergency contacts.
- Environmental incident response.
- Implementation of the plan.
- Community consultation process consistent with council requirements; and
- Monitoring required during the works and the process for review of the CEMP, if required.
- Unexpected Finds Protocol.



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14.0 SITE MANAGEMENT PLAN

Adherence to the SMP will be monitored by an on-site Environmental Scientist who will be present during all critical remediation / validations works. The Site Management Plan (SMP) for the remediation will address:

- Site access.
- Working hours.
- Stormwater and soil management.
- Traffic management.
- Noise, dust and odour control; and
- Work health and safety.
- Unexpected Finds Protocol

Each of the issues to be addressed in the site management plan is briefly discussed in the following sections.

14.1 General

The remediation and validation works must be undertaken in accordance with applicable statutory requirements. The site manager/foreman of the remediation contractor should have a thorough understanding of the contents of the RAP, corresponding Site Management Plan (SMP), Work Health & Safety Plan (WHS) and should ensure that each employee or sub-contractor is familiarised with the requirements of these plans.



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The remediation and validation works will be undertaken under the monitoring of the principal's environmental representative, who will be represented on-site by a field environmental scientist.

14.2 Site access

The contractor will ensure that adequate barriers have been placed around the site to prevent access of unauthorised personnel to areas where contaminated material is exposed. The contractor will also place adequate warning signs around the site.

14.3 Working hours

The working hours for the remediation / validation works will be stipulated by the DA consent.

14.4 Demolition (including Asbestos Management)

Demolition works are to be completed in accordance with SafeWork NSW Standards and Codes of Practice. Any asbestos identified within the building materials should be managed in accordance with the SafeWork NSW Codes of Practice and Australian Standards.

14.5 Surface water and soil management

The contractor will put in place adequate stormwater runoff, run-on and sediment control measures for the remedial works. These requirements are outlined in Schedule B (9) of the (*site contamination*) NEPM (2013).



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These include stockpiling excavated soil in a manner that will prevent contamination from being transported off-site by stormwater, and include the following measures:

- Divert stormwater runoff outside the site so that it does not flow through the site.
- Control drainage on the site by intercepting and redirecting runoff in a controlled manner.
- Stormwater collected at the site in trenches and sumps should be appropriately managed; and
- Silt stop fences should be erected at locations where stormwater may flow outside the site.

The presence of sediment in surface water or runoff must be minimised by the use of sediment controls such as diversion drains, hay bales and silt fencing.

Soils that require stockpiling must be managed in such a manner that these materials remain well contained and easily identifiable and that the effects of wind and rain have minimal impact on their integrity. Subsequently, if adverse weather conditions are anticipated, or if the stockpile is to remain on-site for an extended period, stockpiles must be protected and covered. Stockpile records must be maintained to track the re-use of soils at the site (if any).

Any plant or equipment that comes into contact with soils must be inspected prior to leaving the site and cleaned as necessary.



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14.6 Groundwater management

If groundwater is encountered during excavation works, the groundwater is to be directed to and collected in trenches and sumps. No discharge of groundwater will occur without approval of appropriate regulatory bodies.

14.7 Traffic management

The management of the material leaving the site will be under the monitoring of the principal's environmental representative, who will record the details of these materials.

Vehicular movement is to be conducted in accordance with Council requirements. The contractor will install a vehicle wheel washing or shaking facility and will manage all vehicles as indicated by the principal's environmental representative (FES) to minimise tracking of any materials onto public roads. The wheels of the vehicles will be washed and brushed prior to leaving the site. Loads leaving the site should be maintained moist and must be covered to prevent materials from the site being spilled or left on public or private roadway or adjacent areas. Particular care should be taken if UST or any unexpected material have been encountered and are to be removed from the site.

14.8 Noise Control

The contractor should keep noise levels to a minimum, and levels should not exceed limits indicated in AS 2436 1981. Noise levels must also comply with Council and NSW EPA requirements. It is expected that the equipment to be used in the remediation works will not generate noise levels above these requirements.



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14.9 Dust control

Works must comply with the requirements listed in Schedule B (9) of the NEPM (2013), Council and the NSW EPA. The generation of dust should be kept to a minimum. Stockpiled contaminated material should be bunded and covered. Water sprays may be used to minimise dust. Water used for this purpose should not be allowed to flow off-site through the stormwater system, sewer, or any other way.

14.10 Odour control

The level of odours generated during remedial activities must be monitored and local Council and NSW EPA requirements must be complied with. Due to the nature of contamination, odours may be encountered. It is noted however that it is expected only small volumes of fill will be excavated at one time and this should minimise the generation of significant odours.

Should odorous compounds be encountered, the remediation contractor should take measures to mitigate them and to prevent their migration outside the site boundaries. This may involve placing the odorous materials as soon as possible in a bunded area, covered with plastic membrane, and spraying with an odour suppressant approved by the environmental consultant.

14.11 Work Health and Safety Plan

As personnel on-site may be exposed to potentially toxic or hazardous compounds, the Contractor will prepare a site-specific Work Health and Safety Plan (WHS) prior to commencement of remediation and validation work in accordance with relevant



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legislation. The WHS will identify hazards, assess the risks posed by the hazards and recommend measures to control the hazards. This should include detailed descriptions of vehicle decontamination, protective clothing, equipment and appropriate safety controls that will be adopted during remediation and validation works carried out at the site.

If odours are detected at areas around the site PID measurements will be collected by the on-site Environmental Scientist. If PID readings >30 ppm is recorded breathing masks should be worn by workers in the vicinity of the odour and >300 ppm odour suppressants as well as controlled excavations should be applied.

Personnel working on the site are required to read, understand and apply the requirements of the WHS. All staff working on the site must be inducted by an authorised induction trainer and must sign the relevant induction form.

14.12 Waste / Soil Management Plan (Importation, stockpiles, tracking & disposal)

14.12.1 Imported Soil

Importation of any soil, rock or aggregate is required to meet the following requirements:

- They must be legally able to be imported onto the site in accordance with the Protection of the Environment Operations (Waste) Regulation 2014 and any required consent approvals.
- The soils must meet the remediation criteria for the site (refer to Section 4).
- The soils must be classified as Virgin Excavated Natural Material (VENM), Excavated Natural Material (ENM) or other materials legally able to be imported



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onto the site based on a Resource Recovery Exemptions. Where available VENM should be imported in preference to ENM. Soils must be assessed in accordance with the EPA requirements.

  - Asbestos analysis to be included in suite of analysis for soil classified as VENM and ENM to be imported to the site.

- Prior to importation appropriate documentation needs to be provided to, and approved by, the Environmental Consultant and the materials must be inspected at the source site to confirm that there are no signs of contamination.
- The material must be inspected during importation by the Contractor, and any materials not meeting the description given in the provided documentation or displaying signs of contamination will be rejected.

14.12.2 Stockpiles

Stockpiles should be managed to minimise the risk of dust generation, erosion and leaching. The measures required to achieve this should include:

- Restrict the height of stockpiles to reduce dust generation.
- Construct erosion, sediment and runoff control measures.
- Cover stockpiles of contaminated soils to be left on site for more than 24 hours, or if windy conditions are expected.
- Manage the potential for leaching



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14.12.3 Waste Tracking

All transport of waste and disposal of materials must be conducted in accordance with the requirements of the POEO Act. All licences and approvals required for disposal of the material will be obtained prior to removal of the materials from the site.

Removal of waste materials from the site shall only be carried out by a licensed contractor holding appropriate licence, consent and/ or approvals to dispose of the waste materials according to the assigned waste classification, and with the appropriate approvals obtained from the EPA, if required. Details of all soils removed from the site (**including VENM**) shall be documented by the Contractor with copies of weighbridge slips, tip tickets and consignment disposal confirmation (where appropriate) provided to the Environmental Consultant and the contractor.

A site log shall be maintained by the Contractor to track disposed loads against on-site origin. Transport of spoil shall be via a clearly delineated, pre-defined haul route. The proposed waste transport route will be notified to the local Council and truck dispatch shall be logged and recorded by the Contractor for each load leaving the site. A record of the truck dispatch will be provided to the contractor.

Details of all soils removed from the site (including VENM) shall be documented by the Contractor with source location, volume/tonnage, waste classification, disposal date, disposal destination, copies of weighbridge slips, landfill receipts/disposal docket, tip tickets and consignment disposal confirmation (where appropriate) provided to the Environmental Consultant and/or the NSW EPA Accredited Site Auditor.

Material tracking needs to include information on source location, volume /tonnage, waste classification, disposal date, disposal destination, disposal docket, including waste



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locate consignment number of any asbestos soil waste disposed, transporters details (including EPL No) and a tally of estimated versus actual volume disposed.

For material handling and tracking the following is required to be considered:

Waste Classification

- Material source and description of material.
- Sampling density, pattern and COPCs.
- Results summary, including appropriate table with comparison to acceptance criteria.

For Offsite Disposal

- Source location.
- Estimate volume (based on excavation size).
- Transporter details and licence.
- Reconciliation of actual disposal volume and the estimated volume of disposal (based on excavation size).

Actual volume of Disposal

- The waste classification document,
- Final destination and the POEO licence.
- Reconciliation of waste dockets with actual disposal volume.

For Imported Material

- Source site.
- Volume of imported material.
- Placement location.
- Transporter.



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- VENM certificate or certificate applicable for NSW EPA exemptions (e.g. ENM/ROO certificate).

14.13 Special Waste (Asbestos Waste)

All transport of waste and disposal of materials must be conducted in accordance with the requirements of the POEO Act. All licences and approvals required for disposal of the material will be obtained prior to removal of the materials from the site.

Asbestos transporters and facilities receiving asbestos waste in NSW weighing more than 100 kilograms or consisting of more than 10m2 of asbestos sheeting in one load must track and report this waste to NSW EPA using Waste Locate.

Tracking of asbestos waste is to be done via the NSW EPA's online system known as Waste Locate.

Removal of waste materials from the site shall only be carried out by a licensed contractor holding appropriate licence, consent and/ or approvals to dispose of the waste materials according to the assigned waste classification, and with the appropriate approvals obtained from the EPA, if required. Details of all soils removed from the site shall be documented by the Contractor with copies of weighbridge slips, tip tickets and consignment disposal confirmation (where appropriate) provided to the Environmental Consultant and the contractor.

A site log shall be maintained by the Contractor to track disposed loads against on-site origin. Transport of spoil shall be via a clearly delineated, pre-defined haul route. The proposed waste transport route will be notified to the local Council and truck dispatch



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shall be logged and recorded by the Contractor for each load leaving the site. A record of the truck dispatch will be provided to the contractor.

14.14 Waste Disposal

All off-site disposal of wastes, where appropriate, will be undertaken in accordance with the POEO Act.

Any soil and rock to be removed from the site will be classified in accordance with either:

- The NSW EPA Waste Classification Guidelines 2014; or
- A General or Specific Exemption under the Protection of the Environment Operations (Waste) Regulation 2014.

No soils should leave the site without a formal waste classification.

All materials excavated and removed from the site shall be disposed in accordance with the POEO Act to a facility/site legally able to accept the material. Copies of all necessary approvals from the receiving site shall be given to the contactor prior to any contaminated material being removed from the site.

A record of the disposal of materials will be maintained. Copies of all consignment notes for the transport, receipt, landfill receipts and disposal of all materials (**including VENM**) will be maintained as part of the site log and made available to the Environmental Consultant for inspection and reporting purposes upon request.



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Removal of waste materials from the site shall only be carried out by a licensed contractor holding appropriate licence, consent and/ or approvals to dispose of the waste materials according to the assigned waste classification, and with the appropriate approvals obtained from the EPA, if required. ***Details of all soils removed from the site (including VENM) shall be documented by the Contractor with copies of weighbridge slips, landfill receipts, tip tickets and consignment disposal confirmation (where appropriate) provided to the Environmental Consultant and the NSW EPA Accredited Site Auditor.***

14.15 Community Engagement

Community engagement should be consistent with council requirements in relation to the development application conditions. The client as listed in Section 16.1 is responsible for implementing community consultation and complaint handling.

14.16 Unexpected Finds Protocol

The sampling strategy for each "unexpected find" shall be designed by a suitably qualified environmental consultant. The strategy will, however, be aimed at determining the nature of the substance – that is, is it hazardous and, if so, at concentrations which pose an unacceptable risk to human health or the environment.

Refer to Section 16.2 for more details on Unexpected Finds Protocol.



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15.0 OPERATIONAL CONTROLS

15.1 Fire and explosion hazard

Explosive atmospheres may be present where any petroleum products or other potentially flammable or explosive substance is encountered / used, including machinery. Therefore, the contractor will put into place measures to prevent fires and explosions, which include:

- pumping and degassing of tanks prior to removal:
- preventing access to the site by unauthorised persons.
- forbidding smoking or using naked flame at the site.
- cutting of concrete to be carried out under a blanket of water in proximity to any underground storage tanks.
- approved fire extinguishers to be maintained in proximity to excavations.
- ensuring that no free product or fuel used for refuelling equipment enters a confined space or drainage/sewer system; and
- using only certified flameproof equipment in proximity to locations where free petroleum fuel is present or is expected to be present.

15.2 Public complaints registry

Given the nature of the remediation and validation works, it is considered that community consultation should be consistent with council requirements in relation to the development application conditions.



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15.3 Duties of the on-site environmental scientist

The duties of the on-site environmental scientist include:

- ensure adherence to the Remediation Action Plan, the Work Health and Safety Plan and other plans applicable to the site.
- monitor the excavation of contaminated material undertaken at the site.
- ensure environmental compliance of contractors.
- monitoring with a PID the areas adjacent to open excavated pits at least three times throughout the day, and at additional times if strong or unusual odours or if unusual substances are encountered during the excavations part of the remediation works.
- inspection of the integrity of the sediment controls placed around the site.
- inspection at approximately two hourly intervals of the roadway in the vicinity of the site used by the vehicles leaving the site to ensure that no significant amounts of materials have been tracked off-site by vehicles.
- immediately report actual or potential non-compliances to the principal's environmental representative who will report those to appropriate regulatory bodies.
- note weather conditions, approximate temperature, direction and velocity of the wind, and rainfall at the commencement of work, at about midday and at the end of the day.
- collect samples for validation or other purposes as required by the principal's environmental representative.
- maintain a site diary which will record the following information:
    - date
    - weather conditions
    - presence of odours at the site and at the site boundaries



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- PID measurements
- details of materials excavated during the remediation works, and details of actions taken if unexpected materials are encountered
- details of accidents, near misses or incidents, which may have resulted in injury, and the actions taken to prevent their recurrence
- details of environmental issues, which may result in environmental incidents and measures taken to correct them
- details of visitors to the site or other matters relating to environmental or health issues

15.4 Unexpected occurrences

If during remediation works, significant odours and/or evidence of gross contamination not previously detected are encountered, or any other significant unexpected occurrence, site works should cease in that area, at least temporarily, and immediate action taken to abate the odours or prevent / manage cross-contamination occurring. If required, the administering authority will be notified in writing within two working days of significant unexpected occurrence and informed of the remediation actions implemented.

15.5 Non-compliances

If the on-site environmental scientist suspects that some works carried out at the site do not comply with the requirements of the RAP, the WHS or other plans applicable to the site, this should be reported immediately to the principal's environmental representative. If the principal's environmental representative cannot be contacted or if immediate action is required, the on-site environmental scientist has authority to stop



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the work or request appropriate action to be taken. This is particularly the case under the following circumstances:

- injury to person due to exposure to materials excavated from the site.
- spillage of materials at the site or on areas adjacent to the site; and
- other events that the environmental scientist believes could give rise to unacceptable risk to human health or to adverse impact to the site or to areas adjacent to the site.



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16.0 CONTINGENCY MANAGEMENT

The conditions that may be encountered when excavating is uncertain. As unknown and variable subsurface conditions impose a degree of uncertainty for the project a set of anticipated conditions has been assumed in developing the excavation plan. However, because field conditions vary, flexibility has been built into the excavation plan to adapt to differing conditions.

Table 16: Contingency Management

Anticipated Problem	Corrective Action by Contractor
Asbestos cement sheeting, lagging, pipping etc.	Stop excavations if there is the potential for people to inhale airborne asbestos fibres. Contact FES immediately to assess whether the material is asbestos. Cover the area with plastic and suppress dust by wetting down if needed. Place a warning sign at the entrance to the site where asbestos removal or site remediation is taking place. Adhere to WHS regulations and follow the unexpected finds protocol outlined in 16.2 & Appendix A.
Discovery of USTs	Stop excavations, contact FES immediately. Follow the unexpected finds protocol and UST finds protocol outlined in section 16.2 & 16.3 & Appendix A.
Chemical spill / exposure	Stop work, refer to Occupational Health, Safety and Rehabilitation Plan and immediately contact FES.
Excessive rain	Maintain access roads, cover high-traffic areas with gravel; or cover working areas/stockpiles with plastic during off-shifts; or shut down operations until runoff is more manageable. Inspect & maintain sediment control pond & filter fences.
Unmanageable mud in excavation zone	Improve drainage collection system; add geotextile/gravel in problem areas; or strip off mud/slurry materials; or excavate from the top of the fill.



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Excessive drainage	Minimise active/contaminated work area; or improve diversion clean run-on; or maintain sufficient on-site wastewater storage capacity; or mobilise additional storage and/or treatment systems as needed.
Excessive dust	Use water sprays or biodegradable dust sprays or cease dust-generating activity until better dust control can be achieved or apply interim capping systems.
Sediment pond water for discharge – analytical results exceed site response levels	Perform in-situ treatment, e.g. flocculants dosing, until response levels are met. Alternatively arrange off-site disposal by a licensed Contractor.
Excessively wet materials	Stockpile and dewater on-site; or add absorbents.
Equipment failures	Maintain spare equipment or parts; or maintain alternate rental options; or shut down affected operations until repairs are made.
Release of fuel/oil from machinery	Remove source, use absorbent booms to remove oil and make any repairs as required.
Silt fence fails	Stop work and repair fence to specifications.
Excessive noise	Identify source and review noise attenuation equipment and as necessary provide silencers on noisy equipment.



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Excessive odours / vapours	If excessive organic odours / vapours are generated, stop works and monitor for volatiles at the site boundaries using PID and upgrade PPE if necessary. Implement control measures including respirators for on-site workers, wetting down excavated material, use of odour and volatile suppressing agents to eliminate or reduce odours as required and/or cover odorous material if practicable. FES notes that no nuisance odours shall be detected at any site boundary as part of the remedial works. If odours/vapours are detected then it is recommended, as part of the CEMP & community consultation procedure, that the project manager, client and remediation contractor: 1. Notify the owners / occupiers of the adjoining premises in writing regarding the potential odour issues. Include contact details for any concerns in relation to the odour emissions during remediation. 2. Temporarily pause site works to allow excessive odour to subside whilst implementing the control measures. 3. Record logs for volatile emissions and odours.
Excavation extends below water table into natural materials which are assessed and confirmed to comprise potential acid sulphate soils (PASS).	Implement Acid Sulphate Soils management plan. This will include on-site treatment of the soils in the excavation area. Treatment would likely involve lime addition at a rate to be calculated using methods specified in the ASS Manual (1998).
Unearthing drummed material	Isolate and contact Superintendent. Arrange temporary storage in a secure part of the remediation site (to be nominated).
Identification of cultural or building heritage items	Stop work and notify project manager. Follow the unexpected finds protocol as detailed in section 16.2 & Appendix A.



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Complaint Management	Notify client, project managers, and environmental consultant following complaint. Report complaint as per internal procedures, implement control measures to address complaint and notify complainant of the results of the remedial actions.

In addition to the above listed contingencies, the following steps may need to be undertaken should non-spadable sludge's or buried drums be discovered during the remediation works:

- upgrade of personal protective equipment (PPE), for workers within the active work zone, in accordance with the site Occupational Health, Safety and Rehabilitation Plan.
- segregation and bunding of discovered material.
- use of odour suppressants (where appropriate).
- cover the discovered material with plastic sheeting.
- appropriate sampling and analysis to assess potential contaminants; and
- appropriate off-site disposal of the materials following receipt of analytical results and any associated regulatory approvals required.



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16.1 Contact Persons

Table 17: Contact Persons

Responsible Party	Details
Principal Environmental Representative	Foundation Earth Sciences PO Box 4405, East Gosford NSW 2250 Benjamin Buckley 0466 385 221
Project Manager and Client	**BWSLD Maroubra Pty Ltd** William Lee

16.2 Unexpected Finds Protocol

The sampling strategy for each "unexpected find" shall be designed by a suitably qualified environmental consultant. The strategy will, however, be aimed at determining the nature of the substance – that is, is it hazardous and, if so, at concentrations which pose an unacceptable risk to human health or the environment.

The sampling frequency of the identified substance / materials shall meet the following minimum requirements:

- Excavation Floor
  - 1 sample every 25m^2
  - Samples should be analysed for the chemicals of concern.
- Excavation Wall
  - 1 sample every 5m (from each distinct horizon / material type)
  - Samples should be analysed for the chemicals of concern.

All additional works should be documented by the use of field notes, site photographs, site plans and reporting.

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Refer to **Appendix A** for a copy of the Unexpected Finds Protocol.

16.3 USTs

Any unexpected USTs found within the site should be removed in accordance with SafeWork NSW & UPSS Regulation 2014 requirements, and AS4897-2008: The design, installation and operation of underground petroleum storage systems. In the event of conflict between the guidance documents, the latter shall prevail. Due to the volatile nature of petroleum storage tanks, it is recommended that the USTs be excavated and disposed of by an experienced contractor and with an environmental representative present.

Following the removal of any USTs and associated visibly stained or odorous soils, in samples should be collected from the walls and floor of the tank-pits/hotspots and submitted to a NATA accredited laboratory for analysis. The targeted analytes should be, but not be limited to, heavy metals, TPH, BTEX & PAH.

The minimum sampling protocols to be used for unexpected UST areas include:

- 3 samples per backfill UST sands per UST pit.
- 1 sample per tank line.
- 1 sample per vent pipe area.
- 1 sample per spill box (currently not present but may be found).
- 2 base samples and 8 walls (2 samples per wall face) of each tank pit



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16.4 Groundwater Contingency

If groundwater contamination is observed during the remediation process, it is recommended to assess the potential impact on the proposed development.

Refer to Sections 8.2, 11.6 & Table 18 for further contingency management.

17.0 REGULATORY APPROVALS AND LICENSES

17.1 SEPP (Resilience and Hazards) 2021

Chapter Four of the SEPP Resilience and Hazards 2021 refers to the planning approach to the remediation of contaminated land. The SEPP defines the regulations for Category 1 and Category 2 remediation works. The remedial works to be undertaken at the site constitute Category 2 works (as defined in SEPP). Appropriate permissions for remediation should be obtained prior to commencement.

17.2 State Protection of the Environmental Operations (UPSS) Regulation 2014

UPSS Regulation requires if a storage system is decommissioned, a report for the storage system must be served on the relevant authority within 60 days of decommissioning or remediation is completed. The report must be prepared by a duly qualified person in accordance with EPA guidelines and must describe the processes used to decommission the storage system and assess contamination at the storage site.



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17.3 NSW WHS Regulation 2017

The Work Health and Safety Regulation 2017 (WHS Regulation) is a legal document that outlines the requirements for work health and safety in New South Wales, Australia. It is designed to protect the health, safety, and welfare of all workers and the health and safety of other people who may be affected by the work.

The WHS Regulation applies to all workplaces in New South Wales, including businesses, organizations, and individuals who employ workers or engage contractors. It covers a wide range of topics, including hazard identification, risk assessment, risk control, and the management of incidents and emergencies.

The WHS Regulation is part of a broader framework of Australia's work health and safety laws, including the Work Health and Safety Act 2011 (WHS Act) and other state and territory regulations. Together, these laws form the basis for work health and safety in Australia.

17.4 Duty to Report

Under Section 60 of the Contaminated Land Management Act 1997, the owner of the land is required to notify contamination in circumstances as indicated in the NSW EPA (2015) *Guidelines on Duty to Report Contamination under the Contaminated Land Management Act 1997*.

Sites that are significantly impacted by soil, groundwater and ground gases are likely to require notification to the NSW EPA under section 60 of the CLM Act. A decision process for use by site owners or responsible persons considering reporting contamination under section 60 is provided in Appendix 1 (Figure 1) of the guidelines.



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No notification to NSW EPA is recommended based on the sampling and investigation to date.

17.5 Development Consent and Control Plans

All works should be in accordance with the local Council Development Control Plans and any development consent issued by the local Council for the development.

17.6 Asbestos Removal Regulations / Work Health Safety Regulations

17.6.1 General

The removal and disposal of asbestos will be managed in accordance with the Work Health and Safety Act (2011) and Work Health and Safety Regulation (2011), "How to Safely Remove Asbestos: Code of Practice (WorkCover 2012), the, SafeWork NSW Guidelines and the NSW EPA Waste Classification Guidelines.

Health screening for asbestos in soil, which are based on scenario-specific likely exposure levels, are adopted from the WA DoH guidelines and are referred in Table 7 in Schedule B1.

The WHS Regulations require a person conducting a business or undertaking who commissions the removal of asbestos at the workplace must also ensure asbestos removal work is carried out only by a licensed asbestos removalist who is appropriately licensed to carry out the work, unless specified in the WHS Regulations that a licence is not required.



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If asbestos is non-friable, is more than 10m² and has been determined that it should be removed, it must be removed by a licensed asbestos removalist as soon as reasonably practicable. Where it is not reasonably practicable to remove it, control measures must be put in place to eliminate any exposure, so far as is reasonably practicable, or to minimise exposure so far as is reasonably practicable, but always ensuring the exposure standard is not exceeded.

Class A License can remove any amount or quantity of asbestos or ACM, including:

- any amount of friable asbestos or ACM
- any amount of ACD
- any amount of non-friable asbestos or ACM

Class B Licence can remove:

- any amount of non-friable asbestos or ACM
    - Note: A Class B licence is required for removal of more than 10 m^2 of non-friable asbestos or ACM but the licence holder can also remove up to 10 m^2 of non-friable asbestos or ACM)

- ACD associated with the removal of non-friable asbestos or ACM
    - Note: A Class B licence is required for removal of ACD associated with the removal of more than 10 m² of non-friable asbestos or ACM, but the licence holder can also remove ACD associated with removal of up to 10m² of non-friable asbestos or ACM

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17.6.2 Notification of Asbestos Removal Works

WorkCover must be notified five days before licensed asbestos removal work is commenced.

Asbestos removalists licensed in NSW can lodge the notification electronically using WorkCover's Asbestos and demolition online notification system or complete the form.

Interstate asbestos removalists who hold an asbestos removal licence issued under another Work Health and Safety Regulation must lodge the notification by completing the notification form.

17.6.3 Notification of Respirable Asbestos Fibre Levels at more than 0.02 fibres / ml

WorkCover must be notified within 5 days when the respirable asbestos fibre levels exceed 0.02 fibres/ml in the removal area.

NSW licensed asbestos removalists and interstate asbestos removalists who hold an asbestos removal licence issued under a work health and safety regulation must lodge the notification by completing the notification form.

17.6.4 Notification of the Emergency Demolition of a Structure or plant involving Asbestos

Notification of the demolition or refurbishment of a structure or plant is required for the following:



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- that was constructed or installed before 31 December 2003.
- is located in either a workplace or a residential premise where an emergency has occurred.
- the structure or plant must be demolished; and
- asbestos is fixed or installed in the structure or plant before the emergency has occurred.

Demolition or refurbishment does not include minor or routine maintenance work or other minor work.

An emergency is defined if:

- a structure or plant is structurally unsound
- collapse of the structure or plant is imminent.

The person with management or control of the workplace or, if in residential premises, the licensed asbestos removalist must notify WorkCover by completing the notification form.

Interstate asbestos removalists who hold an asbestos removal licence issued under another work health and safety regulation must also notify WorkCover if the work is located in NSW.

Completed notification forms can be lodged by:

- contact (02) 8260 5885
- email to adu@safework.nsw.gov.au



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- delivery to 92-100 Donnison Street, Gosford 2250 or any Safework office

Asbestos notifications are free, and the asbestos and demolition hotline number are (02) 8260 5885.

17.7 Protection of the Environment Operations (Waste) Regulations 2005

The regulations make requirements relating to non-licensed waste activities and waste transporting.

Section 42 of the Regulation stipulates special transportation, re-use or recycling requirements relating to asbestos waste and must be complied with regardless of whether the activity is licensed.

The requirements for the transportation of asbestos waste include:

- bonded asbestos material must be securely packaged at all times,
- friable asbestos material must be kept in a sealed container,
- asbestos-contaminated soils must be wetted down,
- all asbestos waste must be transported in a covered, leak-proof vehicle.

The requirements relating to the off-site disposal of asbestos waste are as follows:

- asbestos waste in any form must be disposed of only at a landfill site that may lawfully receive the waste,
- when asbestos waste is delivered to a landfill site, the occupier of the landfill site must be informed by the person delivering the waste that the waste contains asbestos,



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- when unloading and disposing of asbestos waste at a landfill site, the waste must be unloaded and disposed of in such a manner as to prevent the generation of dust or the stirring up of dust,
- asbestos waste disposed of at a landfill site must be covered with virgin excavated natural material or other material as approved in the facility's environment protection licence.

Section 48 of the Regulation requires that wastes are stored in an environmentally safe manner. It also stipulates that vehicles used to transport waste must be covered when loaded.

17.8 Other licences required

Transporters of contaminated waste are required to be licensed to transport contaminated waste to licensed landfills. Landfills are required to be licensed for the category of waste they are scheduled to receive.

Waste classification documentation and waste dockets from the receiving landfill should be kept on file for site validation purposes.

If water is discharged as part of any dewatering activities, the relevant discharge consents must be obtained.

The appointed site contractor should prepare appropriate Construction Environmental Management Plans CEMP, work health safety plans & other plans required by the Council DA and DCPs. Where asbestos removal is required, the contractor must be appropriately licensed to carry out the designated works.



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18.0 CONCLUSION AND MITIGATION MEASURES

The remediation goal is to render the site suitable for the proposed development upon completion of the remediation and validation works. This would be achieved by remediating and actioning the following:

- Borehole BH5 – contains TRH impacted fill to a depth of 0.1m BGL. The delineation of the impacted fill is proposed to be completed as part of the remediation works.
- The RAP also requires the additional sampling to be completed post demolition of site structures to assess beneath the former building footprints, beneath the UST areas and further define the extent of the required soil remediation works at the site.

Therefore, it is considered that the site will be made ***suitable*** for the proposed development, subject to the implementation of the remediation and validation works in accordance with this RAP. No recommendations for further works are proposed pending successful implementation of the RAP.



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The following assumptions have been utilised in concluding the site will be considered **suitable**:

- Collection and assessment of the following
    - delineation of the impacted area around BH5,
    - building footprint sampling
- Removal of the soil material from the impacted area and two potential USTs areas and dispose of appropriately. Collection and assessment of the following:
    - soil and groundwater beneath the USTs.
- Collection of validation samples from the impacted area (BH5) & UST Areas.
- Contaminant concentrations in the validation samples are shown be below the adopted site validation criteria.
- Data collected and generated during the project is considered appropriate to allow decisions to be made with confidence. Specific limits for the project have been applied in accordance with the appropriate guidance documents from the NSW EPA, NEPM 2013, appropriate indicators of data quality (DQIs used to assess quality assurance / quality control) and standard operating FES procedures for field sampling and handling.



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19.0 REFERENCES

- National Environmental Protection Council (NEPC) (1999) – *National Environmental Protection (Assessment of Site Contamination) Measure. Amendment 2013*
- NSW EPA (2014) "*Technical Note: Investigation of Service Station Sites*".
- NSW EPA (2020), "Consultants Reporting on Contaminated Land". NSW Environment Protection Authority, Parramatta
- NSW DEC "Guidelines for the NSW Site Auditor Scheme" (2017, 3rd edition). NSW Environment Protection Authority, Sydney.
- NSW EPA (2014) – "Waste Classification Guidelines, Part 1: Classifying Waste".
- NSW EPA (2015) "Guidelines on the Duty to Report Contamination under the Contaminated Land Management Act 1997".
- NSW EPA "Sampling Design Guidelines" (2022) Part 1 and Part2. NSW Environment Protection Authority, Sydney.



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20.0 LIMITATIONS

Whilst to the best of our knowledge, information contained in this report is accurate at the date of issue, although subsurface conditions, including groundwater levels and contaminant concentrations, can change in a limited time. This should be borne in mind if the report is used after a protracted delay.

There is always some disparity in subsurface conditions across a site that cannot be fully defined by investigation. Hence it is unlikely that measurements and values obtained from sampling and testing during environmental works carried out at a site will characterise the extremes of conditions that exist within the site.

There is no investigation that is thorough enough to preclude the presence of material that presently or in the future, may be considered hazardous at the site. Since regulatory criteria are constantly changing, concentrations of contaminants presently considered low may, in the future, fall under different regulatory standards that require remediation.

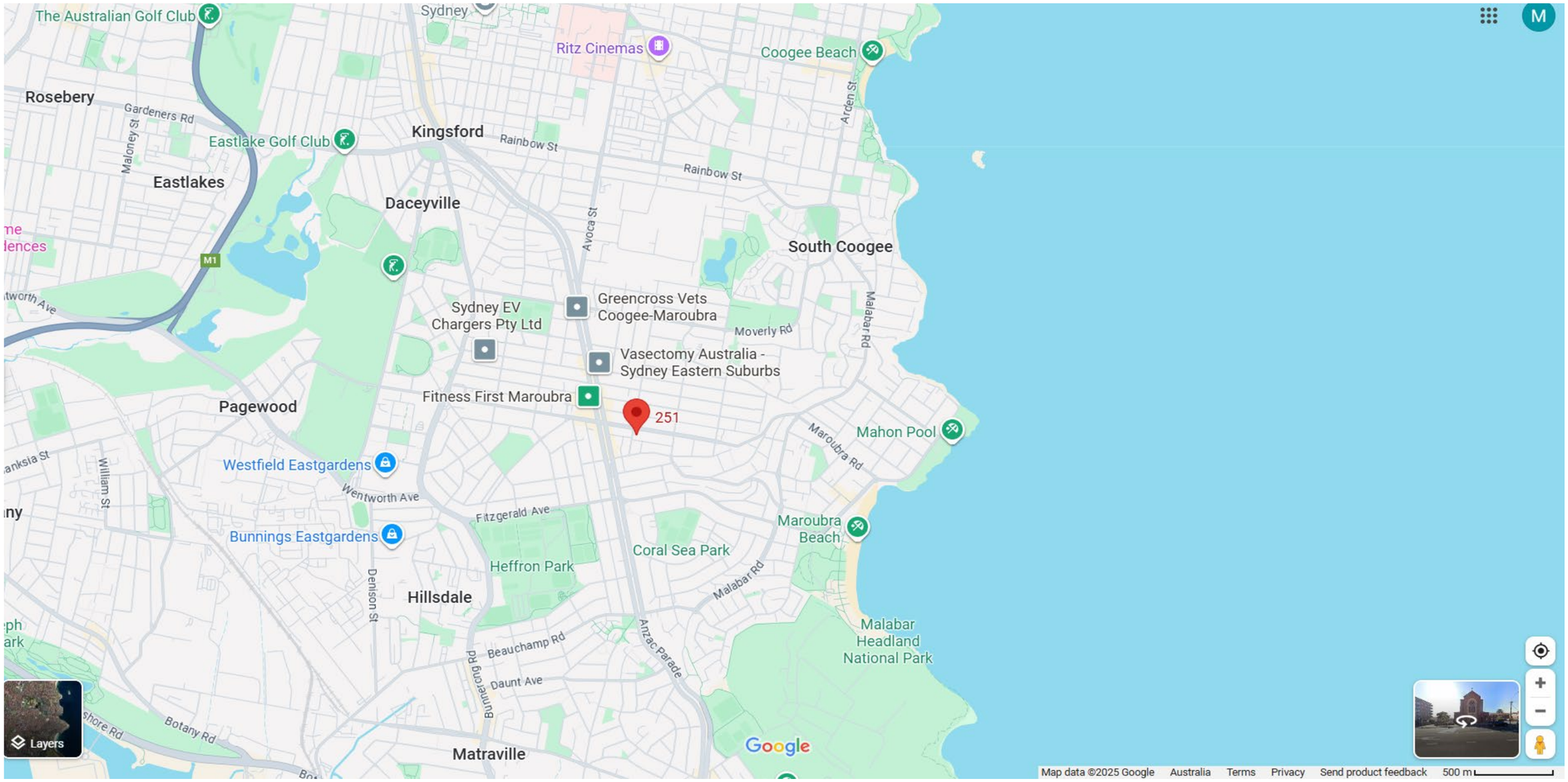
Opinions are judgements, which are based on our understanding and interpretation of current regulatory standards, and should not be construed as legal opinions.



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FIGURE 1: SITE LOCALITY

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Key Site Location	FOUNDATION EARTH SCIENCES	**DRAWN** MS	**Site Location**
		Figure 1	Remediation Action Plan
		E3382-3	251-257 Maroubra Road & 133-135 Garden Street, Maroubra NSW

FIGURE 2: SITE FEATURES, BOREHOLES, IMPACTED AREAS AND ADDITIONAL LOCATIONS

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Impacted Soil Area

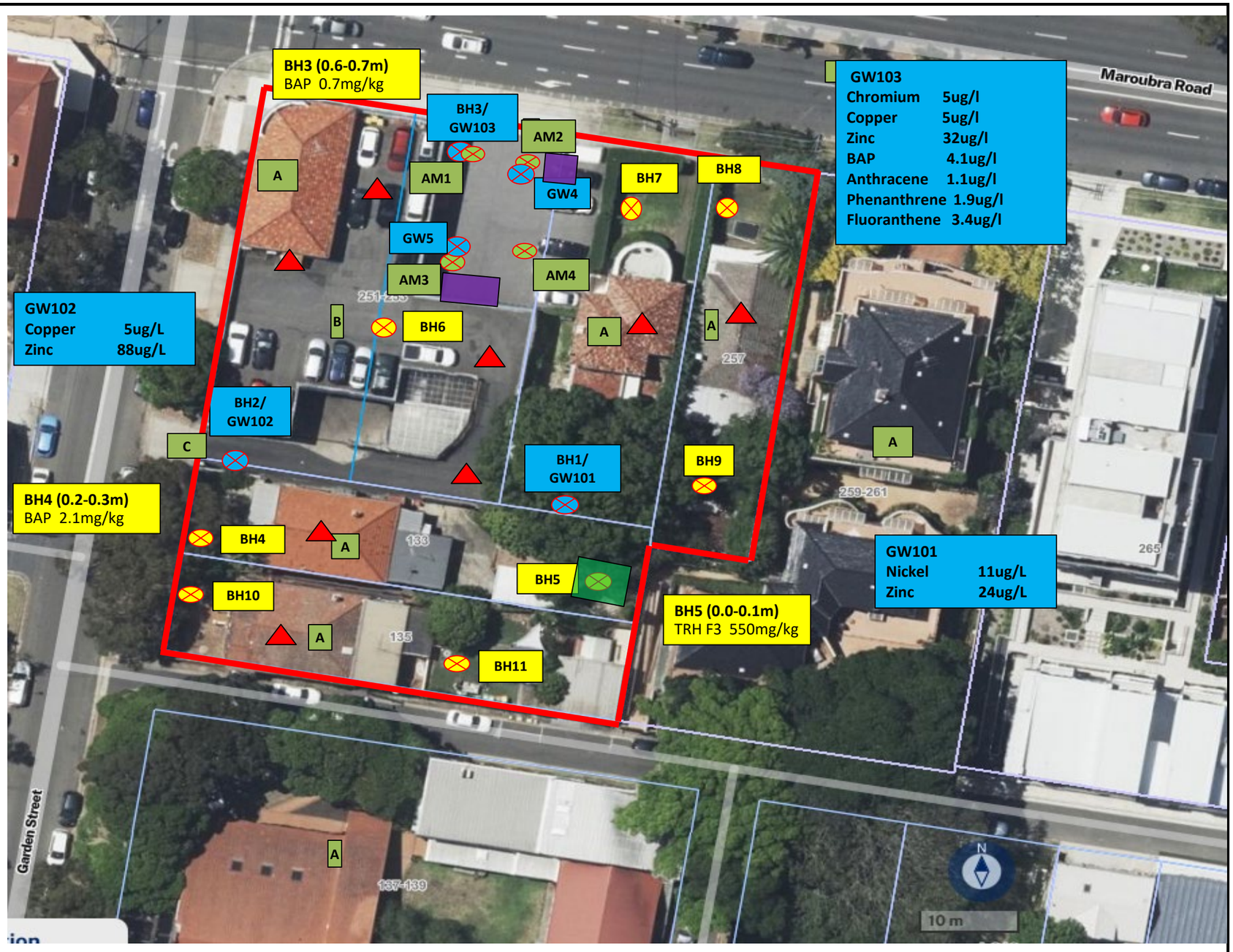
Likely UST Areas

Building footprint - additional bhs

Groundwater Exceedence

Soil Exceedence

No.	Site Features
a	Residential
b	Car Mechanic
c	Access Point



Key Site Boundary & Location FES 2025 Borehole Locations FES 2025 GW Sampling Locations Soil Vapour Probe Potential UST	FOUNDATION EARTH SCIENCES	DRAWN BB	**Site Features, Boreholes, Impacted Areas and Additional Locations**
		Figure 2	BWSLD Maroubra Pty Ltd
		E3382-2	251-257 Maroubra Road & 133-135 Garden Street, Maroubra NSW

FIGURE 3: BOREHOLES OVER BASEMENT FLOOR

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Groundwater Exceedence
Soil Exceedence

No.	Site Features
a	Residential
b	Car Mechanic
c	Access Point

Key

Site Boundary & Location
FES 2025 Borehole Locations
FES 2025 GW Sampling Locations
Soil Vapour Probe
Potential UST

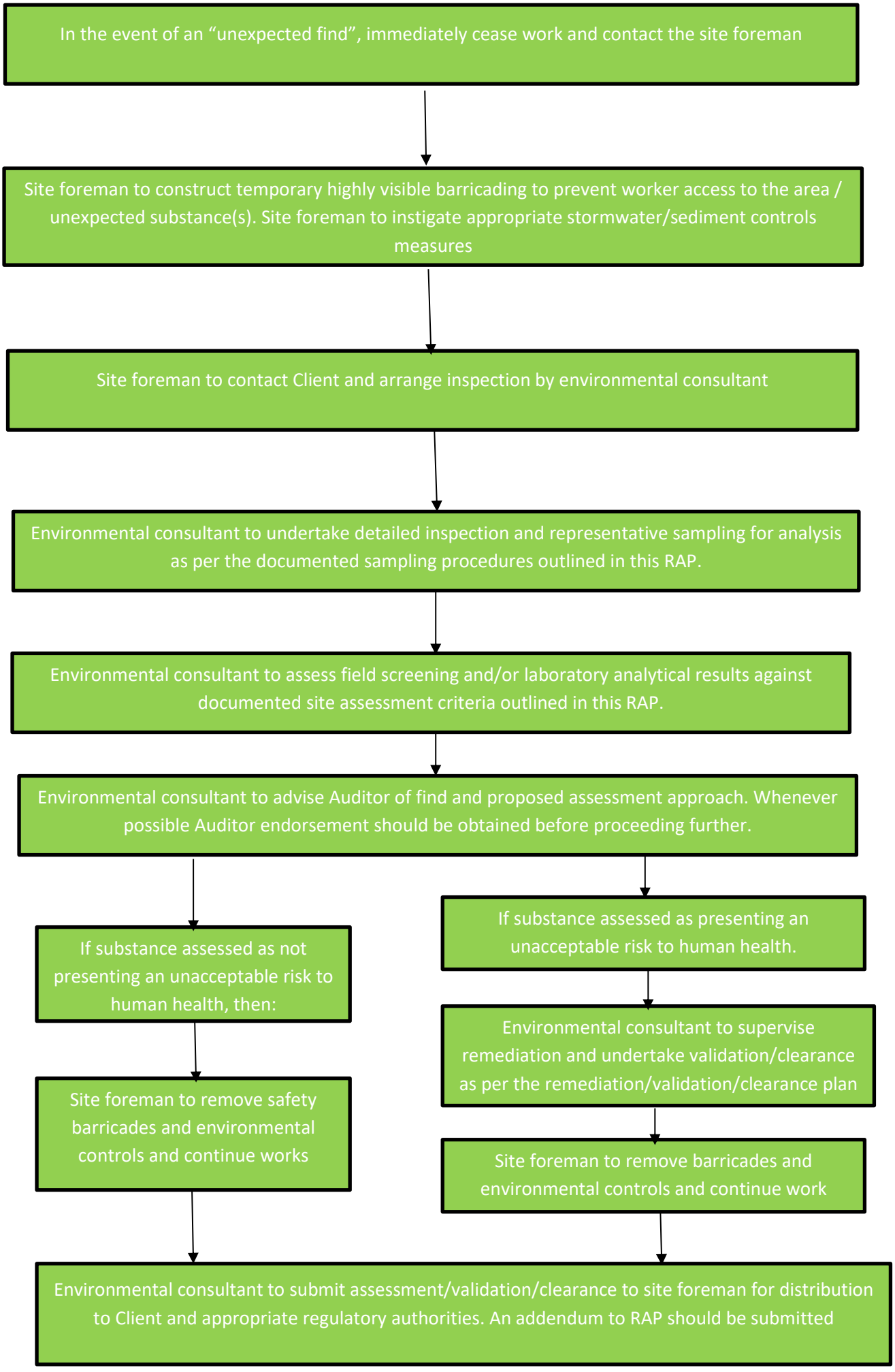
FOUNDATION EARTH SCIENCES

DRAWN KV	**Borehole Locations over Basement Plan**
Figure 3	BWSLD Maroubra Pty Ltd
E3382-3	251-257 Maroubra Road & 133-135 Garden Street, Maroubra NSW

APPENDIX A: UNEXPECTED FINDS PROTOCOL

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APPENDIX B: PROPOSED DEVELOPMENT PLANS

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Residential Flat Building & Childcare Development

251-257 Maroubra Rd & 133-135 Garden St, Maroubra NSW



Perspective View - CGI Artist Impression



Location Map

LEP ZONES

SP2 INFRASTRUCTURE
R2 LOW DENSITY RESIDENTIAL
R3 MEDIUM DENSITY RESIDENTIAL

ARCHITECTURAL DRAWINGS		
Drawing No.	**Drawing Name**	**Scale**
DA 000	Cover Sheet	
DA 001	GFA Diagrams - Overall	1:500
DA 002	GFA Diagrams - Affordable Housing & Childcare	1:500
DA 003	Solar Access Diagrams	1:500
DA 004	Natural Ventilation Diagrams	1:500
DA 005	ADG Compliance	
DA 006	Existing Site Photos	
DA 007	Existing Site Analysis	1:300
DA 008	Demolition Plan	1:150
DA 009	Excavation Plan	1:150
DA 010	Site Plan	
DA 011	Analysis - Deep Soil and Landscaped Area	
DA 012	Analysis - Communal Open Space	
DA 013	Analysis - Setbacks	1:500
DA 014	Analysis - Height Plane	
DA 015	Analysis - Future Character of the Area	
DA 016	Analysis - Tree Canopy Coverage	1:150
DA 017	Analysis - Typical Floor Plan	1:200
DA 090	Basement 04 Floor Plan	1:150
DA 091	Basement 03 Floor Plan	1:150
DA 092	Basement 02 Floor Plan	1:150
DA 093	Basement 01 Floor Plan	1:150
DA 100	Ground Floor Plan	1:150
DA 101	Level 01 Floor Plan	1:150
DA 102	Level 02-03 Floor Plan	1:150
DA 103	Level 04 Floor Plan	1:150
DA 104	Level 05-07 Floor Plan	1:150
DA 105	Level 08 Floor Plan	1:150
DA 106	Level 09 Floor Plan	1:150
DA 107	Roof Plan	1:150
DA 108	Adaptable Units	1:100
DA 200	Streetscape Elevation	1:250
DA 201	North Elevation - Maroubra Road	1:150
DA 202	East Elevation	1:150
DA 203	South Elevation - Maroubra Lane	1:150
DA 204	West Elevation - Garden Street	1:150
DA 300	Section 1	1:150
DA 301	Section 2	1:150
DA 302	Section 3	1:150
DA 303	Section 4	1:150
DA 304	Section 5	1:150
DA 600	External Finishes Schedule	
DA 601	Materiality	
DA 700	Eye of the Sun Diagram - 9am	
DA 701	Eye of the Sun Diagram - 10am	
DA 702	Eye of the Sun Diagram - 11am	
DA 703	Eye of the Sun Diagram - 12pm	
DA 704	Eye of the Sun Diagram - 1pm	
DA 705	Eye of the Sun Diagram - 2pm	
DA 706	Eye of the Sun Diagram - 3pm	
DA 710	Shadow Diagrams 1	1:1000
DA 711	Shadow Diagrams 2	1:1000
DA 712	Shadow Diagrams 3	1:1000
DA 713	Shadow Diagrams 4	1:1000
DA 800	3D Views - Sheet 1	
DA 801	3D Views - Sheet 2	
DA 802	3D Views - Sheet 3	

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North

Scale at A1

Status
SSDA

Drawn
CM, SA, RD

Print Date
12/2/2026

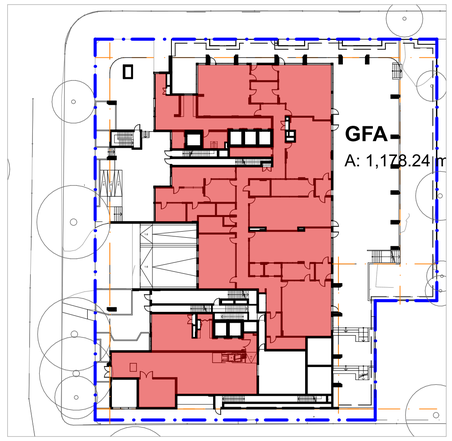
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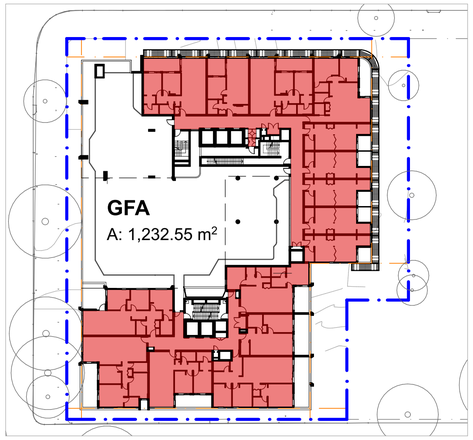
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Cover Sheet

Project No. **24029**
Revision **A**
Drawing No. **DA 000**

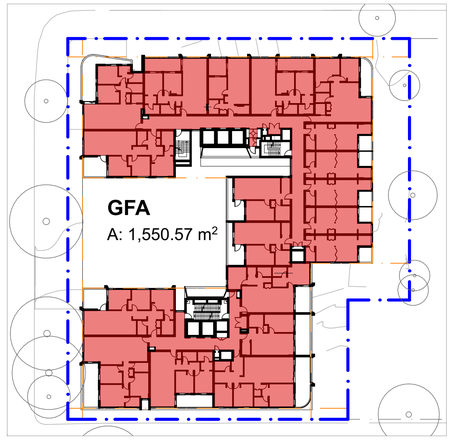
GFA Diagrams & Calculations



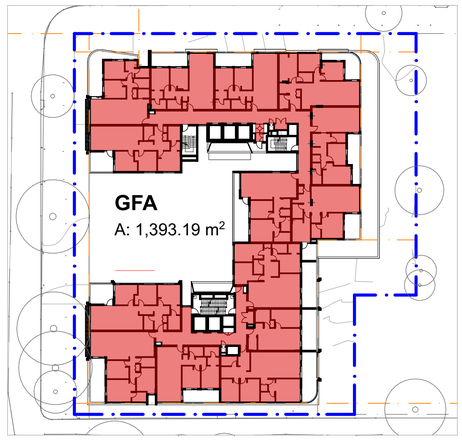
1 Ground Level 1:500



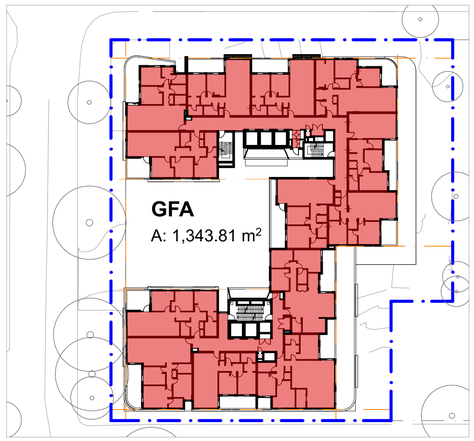
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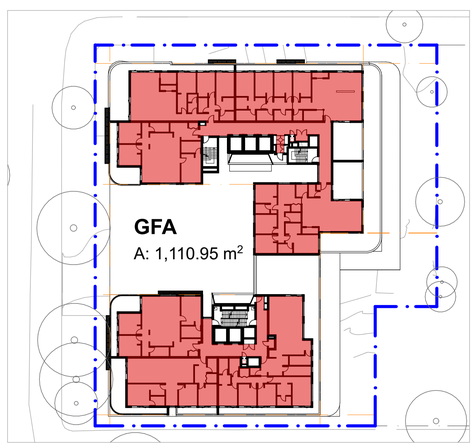
3 Level 02-03 1:500



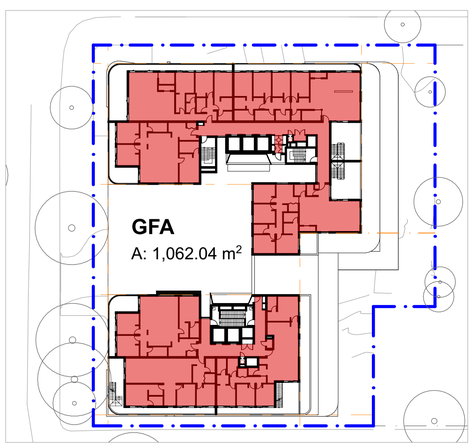
4 Level 04 1:500



5 Level 05-07 1:500



6 Level 08 1:500



7 Level 09 1:500

Site Area	A (DP 14198)	486.9 m2
	B(DP 14198)	486.9 m2
	C (DP 14198)	619.7 m2
	D (DP 14198)	619.7 m2
	E (DP 14198)	619.7 m2
	D (DP 320521)	429 m2
	TOTAL (BY TITLE)	3261.9 m2
	TOTAL (BY CALCULATION)	**3270.1** m2

Control Data	
Note: Council controls overruled by SEPP & SSD	
LEP Zoning	R3 Medium Density Residential
Proposed Building Height	35.6m
Proposed FSR	4.02:1

Overall GFA Calculations (m2) approx.

Storey	Gross Floor Area (m2)
Basement 4	0
Basement 3	0
Basement 2	0
Basement 1	40.17
Ground Floor	1,178.24
Level 1	1,232.55
Level 2	1,550.57
Level 3	1,550.57
Level 4	1,393.19
Level 5	1,343.81
Level 6	1,343.81
Level 7	1,343.81
Level 8	1,110.95
Level 9	1,062.04
Roof	0
TOTAL GFA	13149.71
TOTAL FSR (x:1)	**4.02 :1**

Ground	327.20
Level 1 - 9	11,931.30
TOTAL GFA	12,258.50

Apartment Mix	**PROPOSED YIELD**			
	Standard	Adaptable	**Total**	**%**
Studio	15	0	**15**	13%
1 Bed	3	8	**11**	9%
2 Bed	45	0	**45**	38%
3 Bed	27	16	**43**	36%
4 Bed (Penthouses)	6	0	**6**	5%
TOTAL UNITS	96	24	**120**	

Apartment Type DCP Requirements	**Required No. of Units**	**Proposed No. of Units**
Adaptable Units - 20% of all units	24	24

Car Parking Rates - RESIDENTIAL

	Required Spaces								**Proposed Spaces**
	NSW Housing SEPP Non-Affordable (Standard Units)		NSW Housing SEPP In-fill Affordable (Affordable Units)		ADG - Guide to Traffic Generating Developments		DCP B7 Table 1 (maximum)		
	rate per unit	total required	rate per unit	total required	rate per unit	total required	rate per unit	total required	
Studio	0.5	0	0.4	6	0.4	6	0.5	7.5	N/A
1 Bed	0.5	2.0	0.4	2.8	0.4	4.4	1	11	N/A
2 Bed	1	36.0	0.5	4.5	0.7	31.5	1.2	54	N/A
3+ Bed	1.5	73.5	1	0	1.2	58.8	1.5	73.5	N/A
TOTAL	111.5		13.3		100.7		146		**145**
Visitors	N/A				1 space per 7 units	17.1	1 space per 4 units	30	30
TOTAL RESIDENTIAL	**124.8**				**117.8**		**176.0**		**175 (incl. accessible)**
Accessible Parking	N/A				N/A		1 per adaptable unit	24	**24**
Car Wash Bay	N/A				N/A		N/A	N/A	**1**
Motorcycle / Scooter	N/A				N/A		5% of parking requirement	8.8	**14**
Bicycle Parking	N/A				N/A		1 space per 2 units	60	**80**
Bicycle Parking - Visitors	N/A				N/A		1 space per 10 units	12	
Service / Loading Bays	N/A				N/A		1 space per 50 units	2.4	**3**
On-Street Bicycle Parking	N/A				N/A		N/A		**5**

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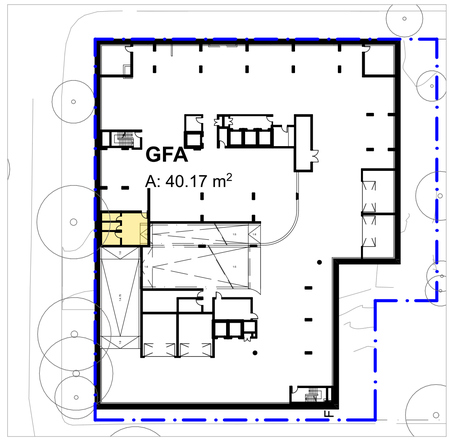
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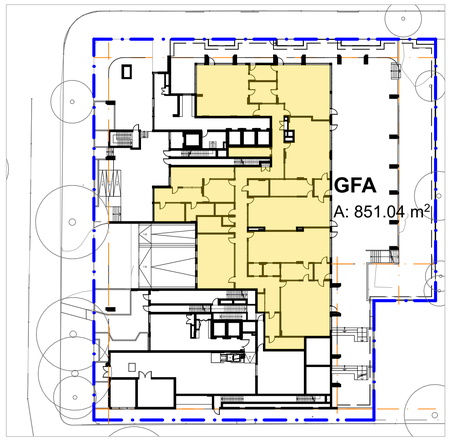
Drawing
GFA Diagrams - Overall

Project No. **24029**
Revision **A**
Drawing No. **DA 001**

Childcare Calculations



1 Basement 1
1:500



2 Ground Level
1:500

Car Parking Rates - CHILDCARE					
	Required Spaces				Proposed Spaces
	ADG - Guide to Traffic Generating Developments		DCP B7 Table 1		
	rate	total required	rate	total required	
Drop-off (per children)	1 in 4	30	1 in 8	15	**15**
Staff	N/A	N/A	1 in 2	11	**11**
	NCC 2022 D4D6		Childcare Planning Guideline		
	rate	total required	rate	total required	
Accessible Parking	1 per 100 car spaces	1	1 in 100 for staff and children (separately)	2	**2**
TOTAL CHILDCARE	**31.0**		**28.0**		**28**
Bicycle Parking	N/A		1 bike space per 10 car spaces	2.8	**12**
Service / Loading Bays	N/A		1 space per 2000sqm GFA	0.4	**1**

Childcare Places*	**Proposed**
Children (years 0-2)	40
Children (years 2-3)	40
Children (years 3-5)	40
TOTAL CHILDREN	**120**
Staff (for years 0-2) Rate: 1 in 4	10
Staff (for years 2-3) Rate: 1in 5	8
Staff (for years 3-5) Rate: 1 in 11	4
TOTAL STAFF	**22**

* under the Education and Care Services National Regulations (2011 SI 653)

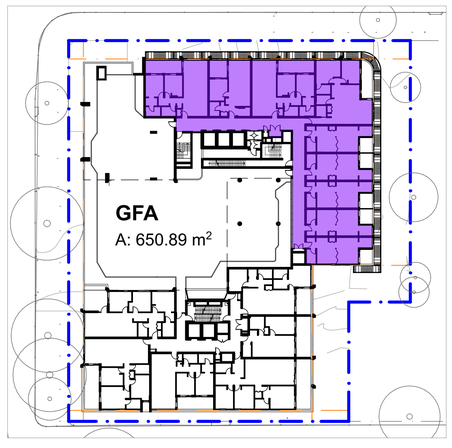
Childcare Storage*	**Required**	**Proposed**
Internal (minimum 0.2m3 per child)	24	129.98
External (minimum 0.3m3 per child)	36	37.29
TOTAL	**60**	**167.27**

* under the Education and Care Services National Regulations (2011 SI 653)

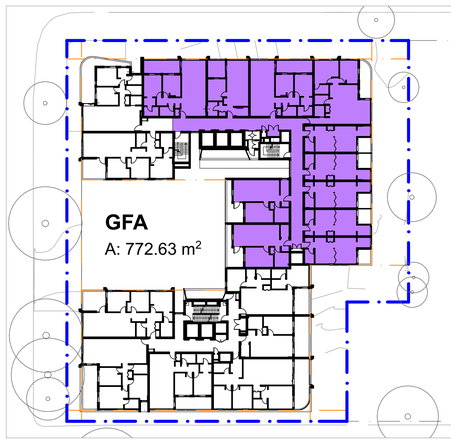
Childcare GFA Calculations (m2) approx.		
	Required*	**Proposed**
Unencumbered indoor space (3.25m2 per child)	390	405.33
Other Areas (Indoor Only)	485.88	
TOTAL GFA	891.21	
Unencumbered outdoor space (7m2 per child)	840	868.67

* DPIE Child Care Planning Guideline 2021

Affordable Housing Calculations



2 Level 01
1:500



3 Level 02
1:500



2 Level 03
1:500

Legend

- Childcare GFA
- Affordable Housing GFA

TOTAL NO. OF UNITS :	**120**
TOTAL RES. GFA	**12258.50**
TOTAL GFA (incl. CCC)	**13149.71**

ADG COMPLIANT

PROPOSED AFFORDABLE UNITS					
LEVEL	UNIT	BEDS	GFA (m2)	SOLAR - LIVING h min. 2h	SOLAR - POS h min. 2h
Level 01	B1.01	2	92.92	6	2
	B1.02	1 + STUDY	61.25	6	4
	B1.03	2	93.04	6	3
	B1.04	2 + STUDY	84.29	1	2
	B1.05	STUDIO	40.23	2	2
	B1.06	STUDIO	40.28	2	2
	B1.07	STUDIO	40.28	2	2
	B1.08	STUDIO	40.28	2	2
	B1.09	STUDIO	40.28	2	0
	Circulation/Other Area		118.04		
Level 02	B2.03	2	92.92	6	2
	B2.04	1 + STUDY	61.25	6	4
	B2.05	2	93.04	6	3
	B2.06	2 + STUDY	84.29	1	2
	B2.07	STUDIO	40.23	2	2
	B2.08	STUDIO	40.28	2	2
	B2.09	STUDIO	40.28	2	2
	B2.10	STUDIO	40.28	2	2
	B2.11	STUDIO	40.28	2	0
	B2.12	1 + STUDY (ADAPT)	57.45	0	0
	B2.13	1 + STUDY (ADAPT)	57.60	0	0
	Circulation/Other Area		124.73		
Level 03	B3.07	STUDIO	40.23	2	2
	B3.08	STUDIO	40.28	2	2
	B3.09	STUDIO	40.28	2	2
	B3.10	STUDIO	40.28	2	2
	B3.11	STUDIO	40.28	2	0
	B3.12	1 + STUDY (ADAPT)	57.45	0	0
	B3.13	1 + STUDY (ADAPT)	57.60	0	0
	Circulation/Other Area		100.38		
TOTAL	**27**		**1840.30**	**21**	**20**
TOTAL %:	**23%**		**15%**	**78%**	**74%**

AFFORDABLE HOUSING

15% OF RESIDENTIAL GFA IS ALLOCATED TO AFFORDABLE HOUSING (27 UNITS)

ADG COMPLIANCE

78% AFFORDABLE APARTMENT LIVING AREAS RECEIVE 2HRS OF SOLAR (9-3pm WINTER SOLSTICE)

74% AFFORDABLE APARTMENT PRIVATE OPEN SPACES RECEIVE 2HRS OF SOLAR (9-3pm WINTER SOLSTICE)

LEGEND:	**STUDIO**		**15**	48.39%
	1 BEDROOM		**7**	22.58%
	2 BEDROOM		**9**	29.03%

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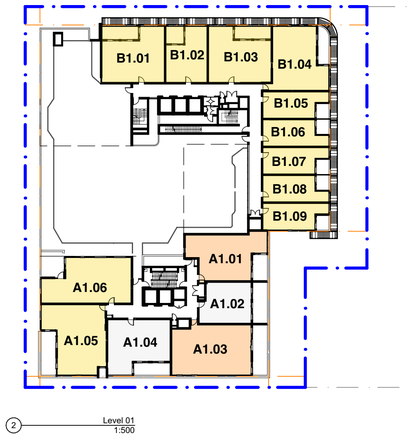
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Project
251 - 257 Maroubra Road & 133 Garden Street Maroubra NSW 2035 Australia

Drawing
GFA Diagrams - Affordable Housing & Childcare

Project No. **24029**
Revision **A**
Drawing No. **DA 002**

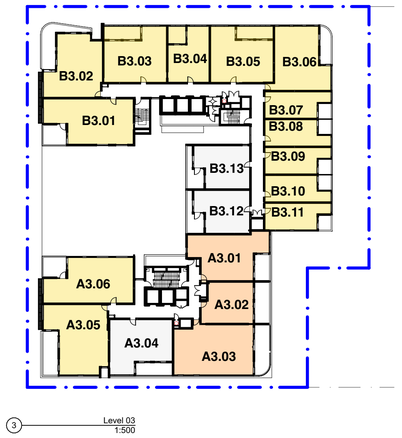
Solar Access Diagrams



2 Level 01
1:500



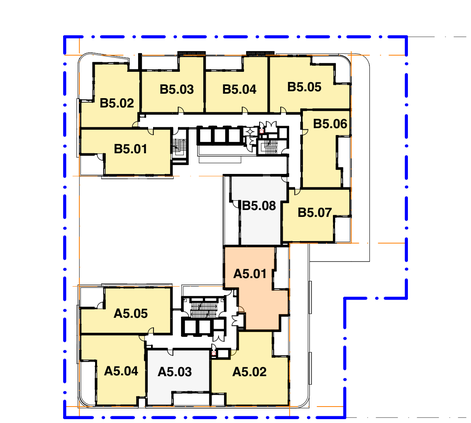
2 Level 02
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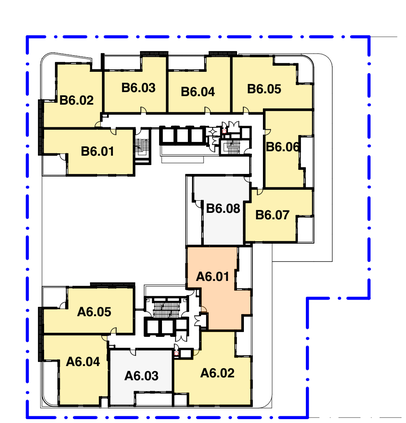
3 Level 03
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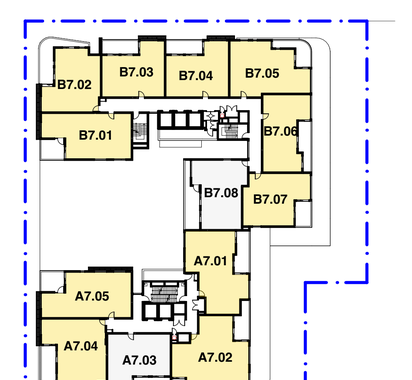
4 Level 04
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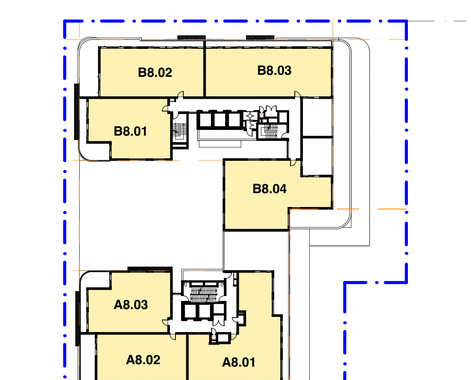
5 Level 05
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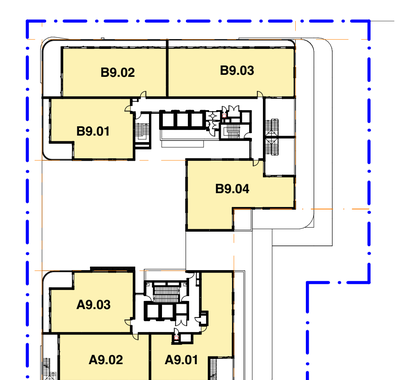
6 Level 06
1:500



7 Level 07
1:500



8 Level 08
1:500



9 Level 09
1:500

2 OR MORE HRS

LESS THAN 2 HRS

NO DIRECT SUNLIGHT

104 OF 120 UNITS (87%) RECEIVE DIRECT SOLAR BETWEEN 9-3PM (WINTER SOLSTICE)

General Notes

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Nominated Architect (NSW) - John Baker 3552

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A	12/2/2026	SSDA Submission

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Claire Burdett
T : 0423 066 002

2. Surveyor
RGM
Huy Thai
T : 02 9712 0238

3. Arborist
Seasoned Tree Consulting
David Gowenlock
T : 0415 961 074

4. Landscape
Conzept
Robert Frew
T : 02 9922 5312

5. Civil and Stormwater
Smart Structures
Kamyar Eivazzadeh
T : 02 9052 6466

6. BCA and Access
Building Innovations
Mardiros Tatian
T : 02 9099 0370

7. Acoustic
Koikas Acoustics
Rowan Frizell
T : 02 9587 9702

8. Traffic and Parking
Genesis Traffic
Bernard Lo
T : 02 7255 8198

9. Waste Management
Elephants Foot
Ruban Jayaratnam
T : 02 9780 3506

10. Photomontage
Platypus Digit
Gordon Kam
T : 0404 866 018

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NSW 2480

T: +61 2 9318 9200 E: bka@bka.com.au W: www.bka.com.au

North

Scale at A1
1:500

Status
SSDA

Drawn
CM, SA, RD

Print Date
12/2/2026

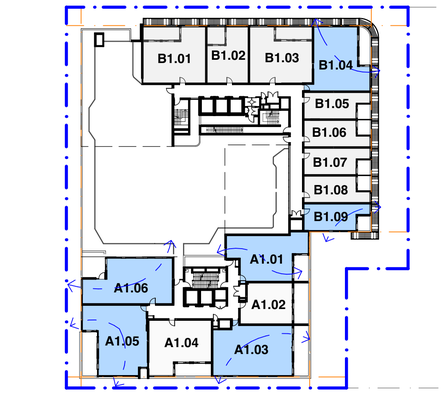
Checked
JG, JB

Project
251 - 257 Maroubra Road & 133 Garden Street Maroubra NSW 2035 Australia

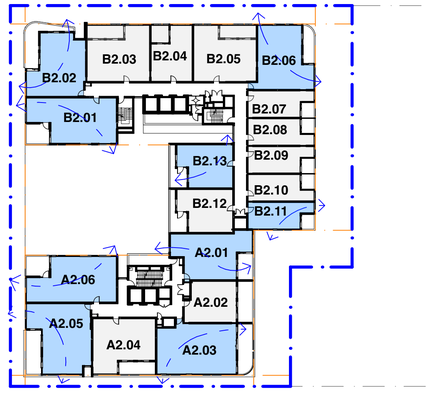
Drawing
Solar Access Diagrams

Project No. **24029**
Revision **A**
Drawing No. **DA 003**

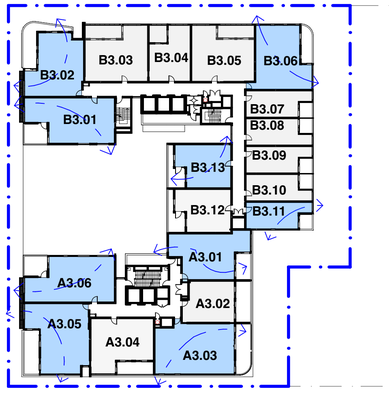
Natural Ventilation Diagrams



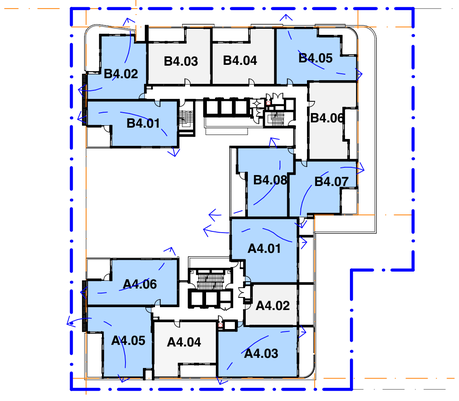
1 Level 01 1:500



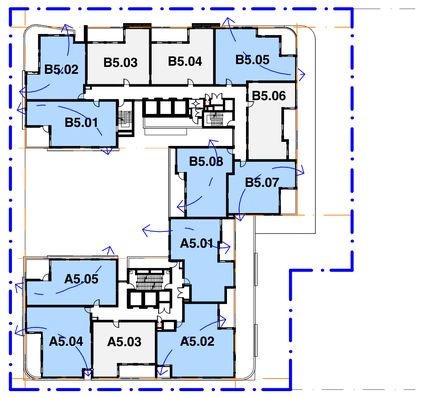
2 Level 02 1:500



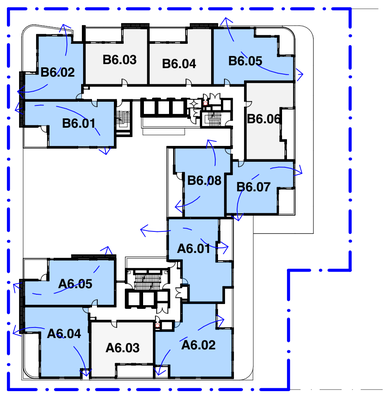
3 Level 03 1:500



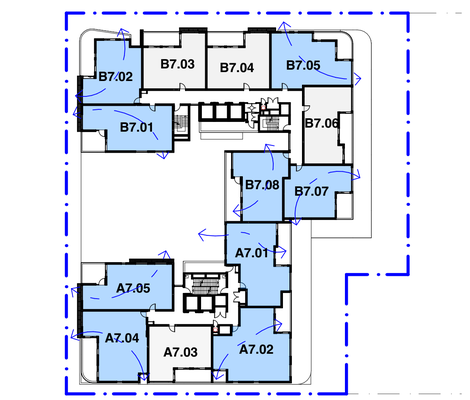
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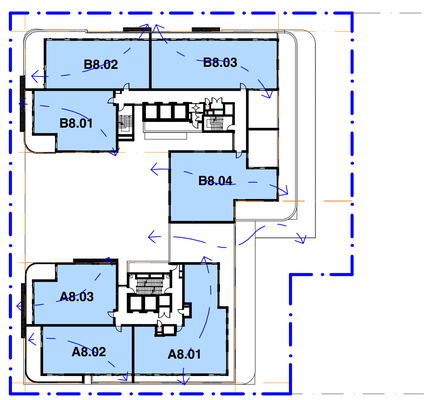
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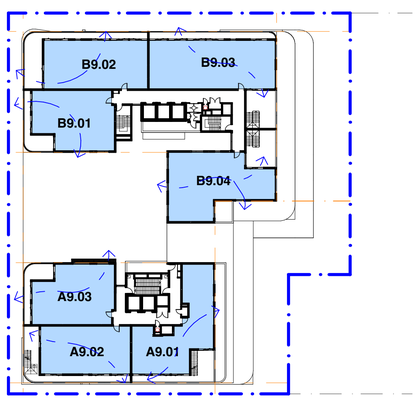
6 Level 06 1:500



7 Level 07 1:500



8 Level 08 1:500



9 Level 09 1:500

ACHIEVE CROSS VENTILATION

77 OF 120 UNITS ACHIEVE CROSS VENTILATION (64.17%)

General Notes

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North

Scale at A1
1:500

Status
SSDA

Drawn
CM, SA, RD

Print Date
12/2/2026

Checked
JG, JB

Project
251 - 257 Maroubra Road & 133 Garden Street Maroubra NSW 2035 Australia

Drawing
Natural Ventilation Diagrams

Project No. **24029**
Revision **A**
Drawing No. **DA 004**

ADG Compliance Table

PROPOSED UNITS			INTERNAL AREA		SOLAR & VENTILATION				PRIVATE OPEN SPACE		STORAGE m3		
LEVEL	UNIT	BEDS	ADG min. m2	PROPOSED GFA m2	SOLAR - LIVING h min. 2h	SOLAR - POS h min. 2h	DIRECT SOLAR min. 85%	CROSS-VENT min. 60%	ADG min. m2	PROPOSED POS m2	ADG min. m3	STORAGE (INT) min. 50% of Total Req.	STORAGE (EXT) min. Basement Provision
Level 01	A1.01	2 + STUDY	75	81.49	0	0	✓	✓	10	10.22	8	4.62	3.38
	A1.02	1 + STUDY (ADAPT)	50	53.35	0	0			8	16.08	6	3.01	2.99
	A1.03	3 + STUDY (ADAPT)	95	104.33	0	1	✓	✓	12	19.19	10	6.22	3.78
	A1.04	2	75	78.16	0	0			10	11.6	8	4.01	3.99
	A1.05	3	95	99.17	3	2	✓	✓	12	16.69	10	6.1	3.90
	A1.06	3 (ADAPT)	95	95.00	3	3	✓	✓	15	15.39	10	5.27	4.73
	B1.01	2	75	92.92	6	2	✓		10	12.61	8	4.01	3.99
	B1.02	1 + STUDY	50	61.25	6	4	✓		8	8.22	6	3.61	2.39
	B1.03	2	75	93.04	6	3	✓		10	12.07	8	4.37	3.63
	B1.04	2 + STUDY	75	84.29	2	2	✓	✓	10	10.54	8	4.49	3.51
	B1.05	STUDIO	35	40.23	2	2	✓		4	4.8	4	2.8	1.20
	B1.06	STUDIO	35	40.28	2	2	✓		4	4.82	4	2.8	1.20
	B1.07	STUDIO	35	40.28	2	2	✓		4	4.82	4	2.8	1.20
	B1.08	STUDIO	35	40.28	2	2	✓		4	4.82	4	2.8	1.20
	B1.09	STUDIO	35	40.28	2	0	✓	✓	4	4.92	4	2.8	1.20
	Circulation/Other Area			188.2									
Level 02	A2.01	2 + STUDY	75	81.49	0	0	✓	✓	10	10.22	8	4.74	3.26
	A2.02	1 + STUDY (ADAPT)	50	53.35	0.5	0	✓		8	16.08	6	3.01	2.99
	A2.03	3 + STUDY (ADAPT)	95	104.33	0	1	✓	✓	12	19.02	10	6.22	3.78
	A2.04	2	75	78.16	0	0			10	11.9	8	4.01	3.99
	A2.05	3	95	99.17	3	2	✓	✓	12	17.16	10	6.1	3.90
	A2.06	3 (ADAPT)	95	95.00	3	3	✓	✓	12	12.05	10	5.27	4.73
	B2.01	3 (ADAPT)	95	95.00	3	2	✓	✓	12	12.05	10	5.27	4.73
	B2.02	2	75	83.02	3	2	✓	✓	10	21.51	8	4.19	3.81
	B2.03	2	75	92.92	6	2	✓		10	12.61	8	4.01	3.99
	B2.04	1 + STUDY	50	61.25	6	4	✓		8	8.22	6	3.6	2.40
	B2.05	2	75	93.04	6	3	✓		10	12.07	8	4.37	3.63
	B2.06	2 + STUDY	75	84.29	2	2	✓	✓	10	10.54	8	4.49	3.51
	B2.07	STUDIO	35	40.23	2	2	✓		4	4.8	4	2.8	1.20
	B2.08	STUDIO	35	40.28	2	2	✓		4	4.82	4	2.8	1.20
	B2.09	STUDIO	35	40.28	2	2	✓		4	4.82	4	2.8	1.20
	B2.10	STUDIO	35	40.28	2	2	✓		4	4.82	4	2.8	1.20
	B2.11	STUDIO	35	40.28	2	0	✓	✓	4	4.92	4	2.8	1.20
	B2.12	1 + STUDY (ADAPT)	50	57.45	0	0			8	12.06	6	3.01	2.99
	B2.13	1 + STUDY (ADAPT)	50	57.60	0	0		✓	8	12.06	6	3.01	2.99
	Circulation/Other Area			213.15									
Level 03	A3.01	2 + STUDY	75	81.49	0	0	✓	✓	10	10.22	8	4.74	3.26
	A3.02	1 + STUDY (ADAPT)	50	53.35	0.5	0	✓		8	16.08	6	3.01	2.99
	A3.03	3 + STUDY (ADAPT)	95	104.33	0	1	✓	✓	12	19.02	10	6.22	3.78
	A3.04	2	75	78.16	0	0			10	11.9	8	4.01	3.99
	A3.05	3	95	99.17	3	2	✓	✓	12	17.16	10	6.1	3.90
	A3.06	3 (ADAPT)	95	95.00	3	3	✓		12	12.05	10	5.27	4.73
	B3.01	3 (ADAPT)	95	95.00	3	2	✓	✓	12	12.05	10	5.27	4.73
	B3.02	2	75	83.02	3	2	✓	✓	10	21.51	8	4.19	3.81
	B3.03	2	75	92.92	6	2	✓		10	12.61	8	4.01	3.99
	B3.04	1 + STUDY	50	61.25	6	4	✓		8	8.22	6	3.6	2.40
	B3.05	2	75	93.04	6	3	✓		10	12.07	8	4.37	3.63
	B3.06	2 + STUDY	75	84.29	2	2	✓	✓	10	10.54	8	4.49	3.51
	B3.07	STUDIO	35	40.23	2	2	✓		4	4.8	4	2.8	1.20
	B3.08	STUDIO	35	40.28	2	2	✓		4	4.82	4	2.8	1.20
	B3.09	STUDIO	35	40.28	2	2	✓		4	4.82	4	2.8	1.20
	B3.10	STUDIO	35	40.28	2	2	✓		4	4.82	4	2.8	1.20
	B3.11	STUDIO	35	40.28	2	0	✓	✓	4	4.92	4	2.8	1.20
	B3.12	1 + STUDY (ADAPT)	50	57.45	0	0			8	12.06	6	3.01	2.99
	B3.13	1 + STUDY (ADAPT)	50	57.60	0	0		✓	8	12.06	6	3.01	2.99
	Circulation/Other Area			213.15									
Level 04	A4.01	3	95	104.30	0	0	✓	✓	12	17.92	10	7.1	2.90
	A4.02	1 + STUDY (ADAPT)	50	53.35	0.5	0	✓		8	16.08	6	3.01	2.99
	A4.03	3 + STUDY (ADAPT)	95	104.33	0	1	✓	✓	12	19.02	10	6.21	3.79
	A4.04	2	75	78.16	0	0			10	11.9	8	4.01	3.99
	A4.05	3	95	99.17	3	1	✓	✓	12	17.16	10	6.18	3.82
	A4.06	3 (ADAPT)	95	95.00	3	3	✓	✓	12	12.05	10	5.27	4.73
	B4.01	3 (ADAPT)	95	95.00	3	2	✓	✓	12	12.05	10	5.27	4.73
	B4.02	2	75	83.02	3	2	✓	✓	10	21.51	8	4.19	3.81
	B4.03	2	75	78.39	6	4	✓		10	12.9	8	4.01	3.99
	B4.04	2	75	78.28	6	4	✓		10	12.95	8	4.01	3.99
	B4.05	3 + STUDY	95	97.74	2	2	✓	✓	12	14.14	10	6.01	3.99
	B4.06	2 + STUDY	75	81.08	2	2	✓	✓	10	13.9	8	4.98	3.02
	B4.07	2 + STUDY	75	82.26	2	2	✓	✓	10	16.72	8	5.76	2.24
	B4.08	2 + STUDY	75	84.48	0	0		✓	10	20.56	8	4.97	3.03
	Circulation/Other Area			178.63									
Level 05	A5.01	3 + STUDY	95	101.16	0	0	✓	✓	12	14.8	10	6.13	3.87
	A5.02	3 + STUDY	95	116.75	2	0	✓	✓	12	16.44	10	6.77	3.23
	A5.03	2	75	78.16	0	0			10	11.9	8	4.01	3.99
	A5.04	3	95	99.17	3	2	✓	✓	12	16.46	10	6.18	3.82
	A5.05	3	95	95.00	3	3	✓	✓	12	12.05	10	5.27	4.73
	B5.01	3 (ADAPT)	95	95.00	3	3	✓	✓	12	12.05	10	5.27	4.73
	B5.02	2	75	83.02	3	2	✓	✓	10	21.51	8	4.19	3.81
	B5.03	2	75	78.35	6	4	✓		10	12.93	8	4.01	3.99
	B5.04	2	75	78.33	6	4	✓		10	12.95	8	4.01	3.99
	B5.05	3 + STUDY	95	97.76	2	2	✓	✓	12	14.14	10	6.01	3.99
	B5.06	2 + STUDY	75	81.08	2	2	✓	✓	10	13.9	8	4.98	3.02
	B5.07	2 + STUDY	75	80.47	2	2	✓	✓	10	10.12	8	5.11	2.89
	B5.08	2 + STUDY	75	84.48	0	0		✓	10	20.55	8	4.97	3.03
	Circulation/Other Area			175.08									
Level 06	A6.01	3 + STUDY	95	101.16	0.5	0	✓	✓	12	14.8	10	6.13	3.87
	A6.02	3 + STUDY	95	116.75	2	1	✓	✓	12	16.44	10	6.77	3.23
	A6.03	2	75	78.16	0	0			10	11.9	8	4.01	3.99
	A6.04	3	95	99.17	3	2	✓	✓	12	16.46	10	6.18	3.82
	A6.05	3	95	95.00	4	3	✓	✓	12	12.05	10	5.27	4.73
	B6.01	3 (ADAPT)	95	95.00	3	3	✓	✓	12	12.1	10	5.27	4.73
	B6.02	2	75	83.02	3	2	✓	✓	10	21.51	8	4.19	3.81
	B6.03	2	75	78.35	6	4	✓		10	12.93	8	4.01	3.99
	B6.04	2	75	78.33	6	4	✓		10	12.95	8	4.01	3.99
	B6.05	3 + STUDY	95	97.76	2	2	✓	✓	12	14.14	10	6.01	3.99
	B6.06	2 + STUDY	75	81.08	2	2	✓	✓	10	13.9	8	4.98	3.02
	B6.07	2 + STUDY	75	80.47	2	2	✓	✓	10	10.12	8	5.11	2.89
	B6.08	2 + STUDY	75	84.48	0	0		✓	10	20.55	8	4.97	3.03
	Circulation/Other Area			175.08									
Level 07	A7.01	3 + STUDY	95	101.16	2	0	✓	✓	12	14.8	10	6.13	3.87
	A7.02	3 + STUDY	95	116.75	2	2	✓	✓	12	16.44	10	6.77	3.23
	A7.03	2	75	78.16	0	0			10	11.9	8	4.01	3.99
	A7.04	3	95	99.17	3	2	✓	✓	12	16.46	10	6.18	3.82
	A7.05	3	95	95.00	4	3	✓	✓	12	12.05	10	5.27	4.73
	B7.01	3 (ADAPT)	95	95.00	3	3	✓	✓	12	12.1	10	5.27	4.73
	B7.02	2	75	83.02	3	2	✓	✓	10	21.51	8	4.19	3.81
	B7.03	2	75	78.35	6	4	✓		10	12.93	8	4.01	3.99
	B7.04	2	75	78.33	6	4	✓		10	12.95	8	4.01	3.99
	B7.05	3 + STUDY	95	97.76	2	2	✓	✓	12	14.14	10	6.01	3.99
	B7.06	2 + STUDY	75	81.08	2	2	✓	✓	10	13.9	8	4.98	3.02
	B7.07	2 + STUDY	75	80.47	2	2	✓	✓	10	10.12	8	5.11	2.89
	B7.08	2 + STUDY	75	84.48	0	0		✓	10	20.55	8	4.97	3.03
	Circulation/Other Area			175.08									
Level 08	A8.01	SUB-PENT	112	169.37	6	6	✓	✓	12	112.37	10	11.58	-1.58
	A8.02	3	95	114.27	1	3	✓	✓	12	34.32	10	5.97	4.03
	A8.03	3 (ADAPT)	95	120.89	6	6	✓	✓	12	18.97	10	8.65	1.35
	B8.01	3 (ADAPT)	95	120.89	0	3	✓	✓	12	18.97	10	8.65	1.35
	B8.02	3 + STUDY	95	134.18	6	6	✓	✓	12	43.33	10	5.26	4.74
	B8.03	SUB-PENT	107	162.90	6	2	✓	✓	12	49.19	10	11.68	-1.68
	B8.04	SUB-PENT	112	157.99	2	2	✓	✓	12	29.13	10	5.54	4.46
	Circulation/Other Area			130.46									
Level 09	A9.01	PENTHOUSE	112	131.54	2	2	✓	✓	12	101.13	10	7.11	2.89
	A9.02	3	95	114.37	1	3	✓	✓	12	115.52	10	5.97	4.03
	A9.03	3	95	120.89	6	6	✓	✓	12	18.97	10	8.65	1.35
	B9.01	3 (ADAPT)	95	120.89	0	3	✓	✓	12	19.26	10	8.65	1.35
	B9.02	3 + STUDY	95	134.18	6	6	✓	✓	12	43.34	10	5.26	4.74
	B9.03	PENTHOUSE	107	162.90	6	2	✓	✓	12	120.17	10	10.37	-0.37
	B9.04	PENTHOUSE	107	147.23	2	2	✓	✓	12	97.26	10	5.48	4.52
	Circulation/Other Area			130.04									
TOTAL	**120**			**11,931.30**	**87**	**84**	**104**	**77**					
TOTAL %:					**73%**	**70%**	**87%**	**64.17%**					

ADG COMPLIANCE - SOLAR

73% APARTMENT LIVING AREAS RECEIVE 2HRS OF SOLAR (9-3pm WINTER SOLSTICE)

70% APARTMENT PRIVATE OPEN SPACES RECEIVE 2HRS OF SOLAR (9-3pm WINTER SOLSTICE)

87% APARTMENTS (ANY ROOM) RECEIVE DIRECT SOLAR (9-3pm WINTER SOLSTICE)

ADG COMPLIANCE - VENTILATION

64% APARTMENTS HAVE NATURAL CROSS-VENTILATION

ADG COMPLIANCE - AREAS

ALL APARTMENTS ACHIEVE REQUIRED AREAS FOR INTERNAL APARTMENT SIZES, STORAGE & PRIVATE OPEN SPACES

LEGEND:				
	STUDIO		**15**	12.50%
	1 BEDROOM		**11**	9.17%
	2 BEDROOM		**45**	37.50%
	3 BEDROOM		**43**	35.83%
	4 BEDROOM		**6**	5.00%

ADG COMPLIANT

TOTAL NO. OF UNITS :	**120**
TOTAL RES. GFA	**12258.50**
TOTAL GFA (incl. CCC)	**13149.71**

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North

Scale at A1

Status
SSDA

Drawn
CM, SA, RD

Print Date
12/2/2026

Checked
JG, JB

Project
251 - 257 Maroubra Road & 133 Garden Street Maroubra NSW 2035 Australia

Drawing
ADG Compliance

Project No. **24029**

Revision **A**

Drawing No. **DA 005**











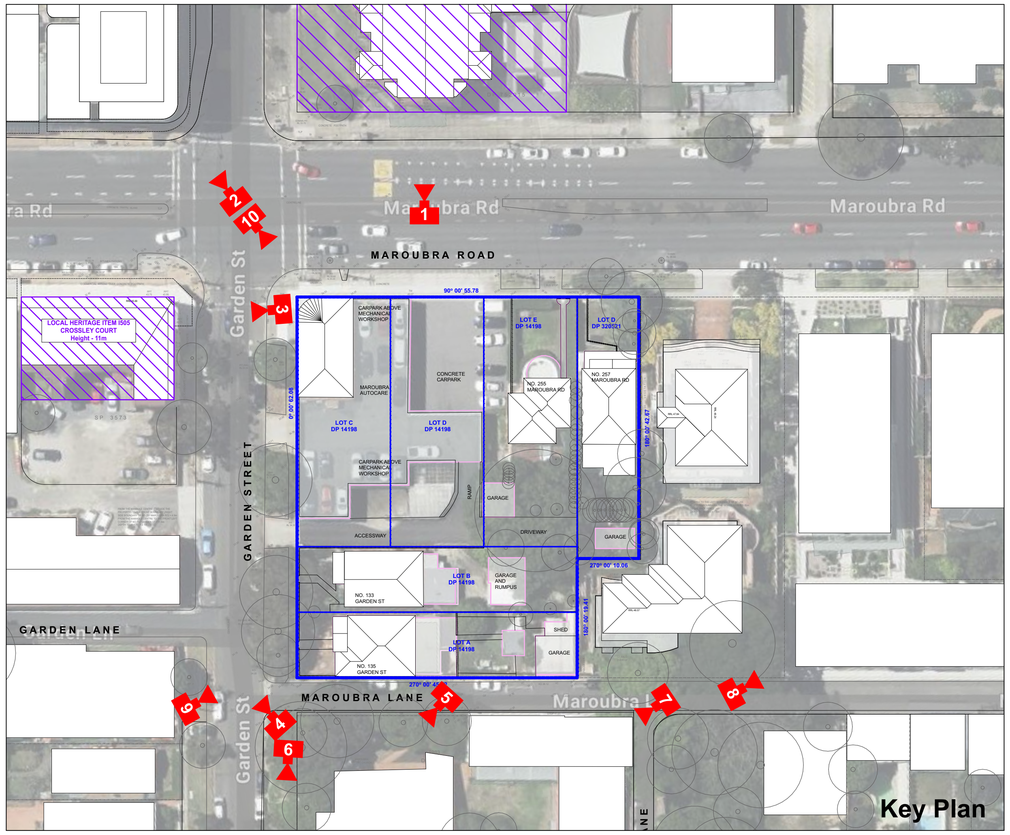












1. HOLY FAMILY CATHOLIC CHURCH ON MAROUBRA ROAD
(NORTH OF THE SUBJECT SITE)

2. No.128 APARTMENTS ON MAROUBRA ROAD

3. CROSSLEY COURT ON MAROUBRA ROAD
(WEST THE SUBJECT SITE)

4. MAROUBRA CENTRE ON GARDEN STREET
(WEST THE SUBJECT SITE)

5. BAPTIST CHURCH ON MAROUBRA LANE
(SOUTH THE SUBJECT SITE)

6. ROW OF HOUSES
(SOUTH THE SUBJECT SITE)

7. BRICK HOUSE ON MAROUBRA LANE

8. NEW HOUSE ON MAROUBRA LANE
(EAST OF THE SUBJECT SITE)

9. No.135 GARDEN ST
(PART OF THE SUBJECT SITE)

10. MAROUBRA AUTOCARE ON MAROUBRA ROAD
(PART OF THE SUBJECT SITE)

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Drawn
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Print Date
12/2/2026

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JG, JB

Project
251 - 257 Maroubra Road & 133 Garden Street Maroubra NSW 2035 Australia

Drawing
Existing Site Photos

Project No. **24029**

Revision **A**

Drawing No. **DA 006**



General Notes

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North

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1:300

Status
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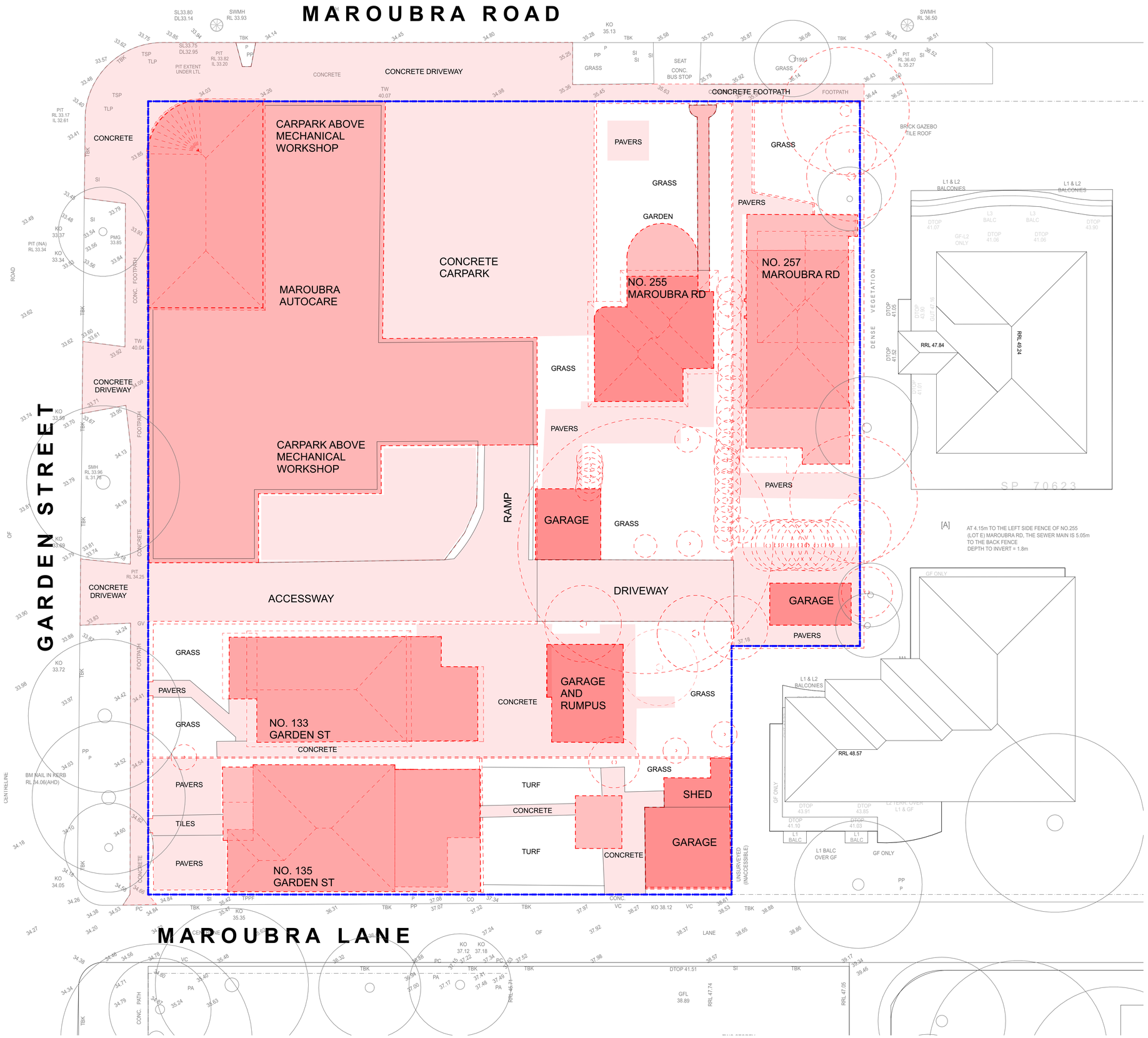
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JG, JB

Project
251 - 257 Maroubra Road & 133 Garden Street Maroubra NSW 2035 Australia

Drawing
Existing Site Analysis

Project No.	Revision	Drawing No.
24029	A	DA 007



LEGEND

- SITE BOUNDARY
- EXISTING TO BE DEMOLISHED
- EXISTING TREES TO BE RETAINED
- EXISTING TREES TO BE REMOVED
- 0.00 EXISTING LEVELS

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North

Scale at A1
1:150

Status
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Drawn
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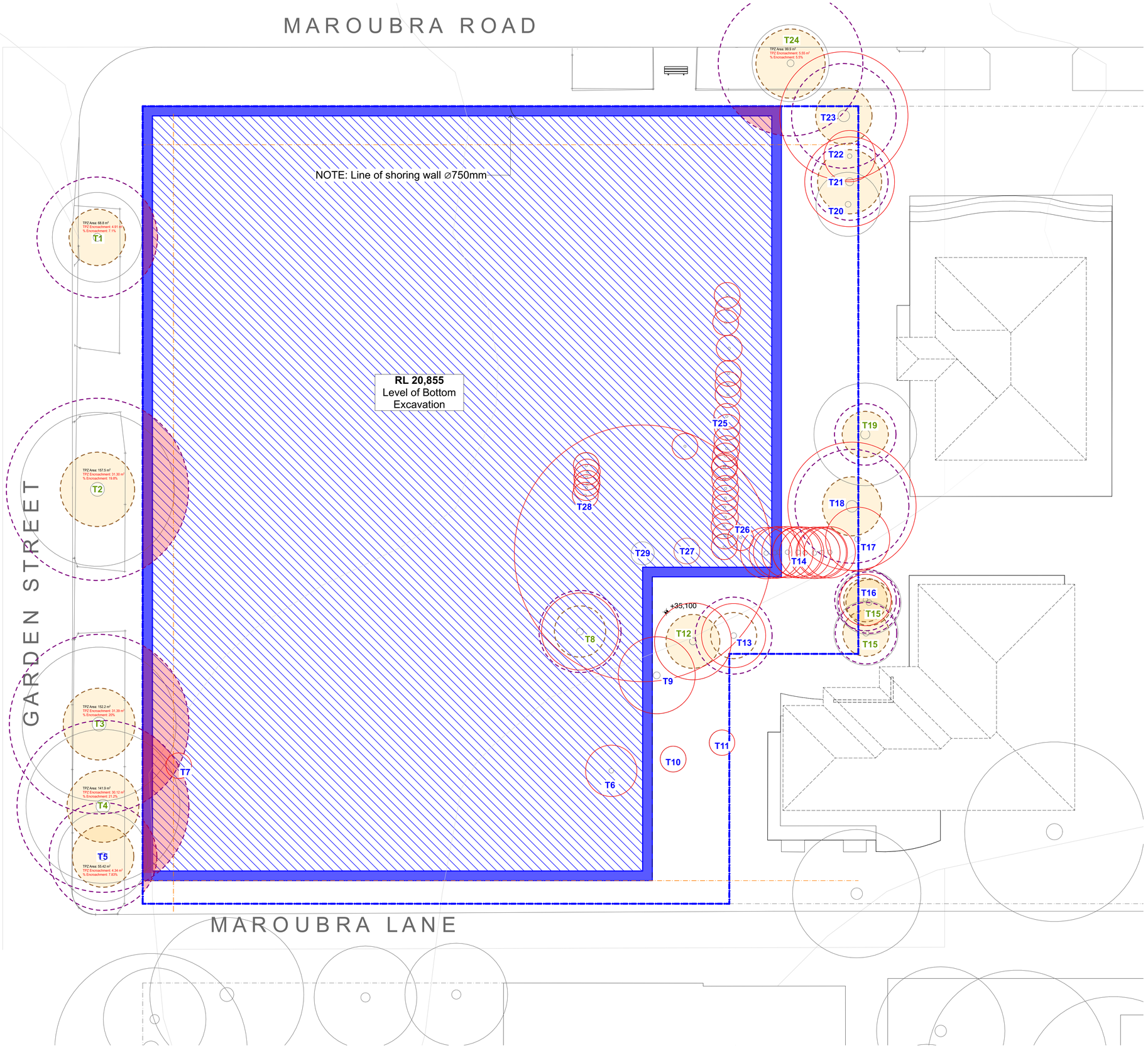
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JG, JB

Project
251 - 257 Maroubra Road & 133 Garden Street Maroubra NSW 2035 Australia

Drawing
Demolition Plan

Project No. **24029**
Revision **A**
Drawing No. **DA 008**



LEGEND

- SITE BOUNDARY
- LINE OF SHORING WALL
- PROPOSED EXCAVATION
- EXISTING TREES
- Trees Proposed to be removed
- TPZ - Tree Protection Zone
- SRZ - Structural Root Zone
- TPZ Encroachment Area
- T# High Retention Value Tree
- T# Medium Retention Value Tree
- T# Low Retention Value Tree

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North

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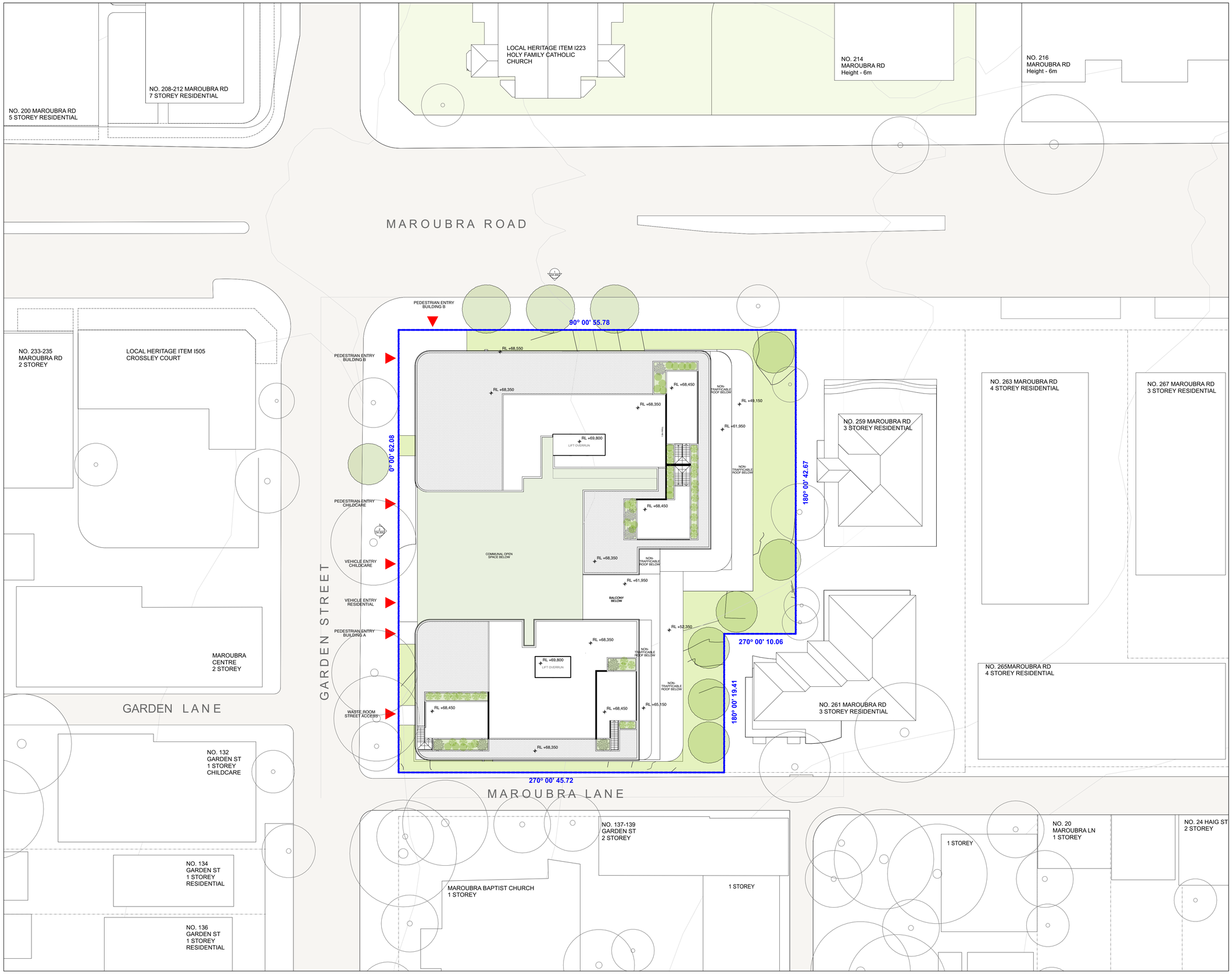
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12/2/2026

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JG, JB

Project
251 - 257 Maroubra Road & 133 Garden Street Maroubra NSW 2035 Australia

Drawing
Excavation Plan

Project No.	Revision	Drawing No.
24029	A	DA 009



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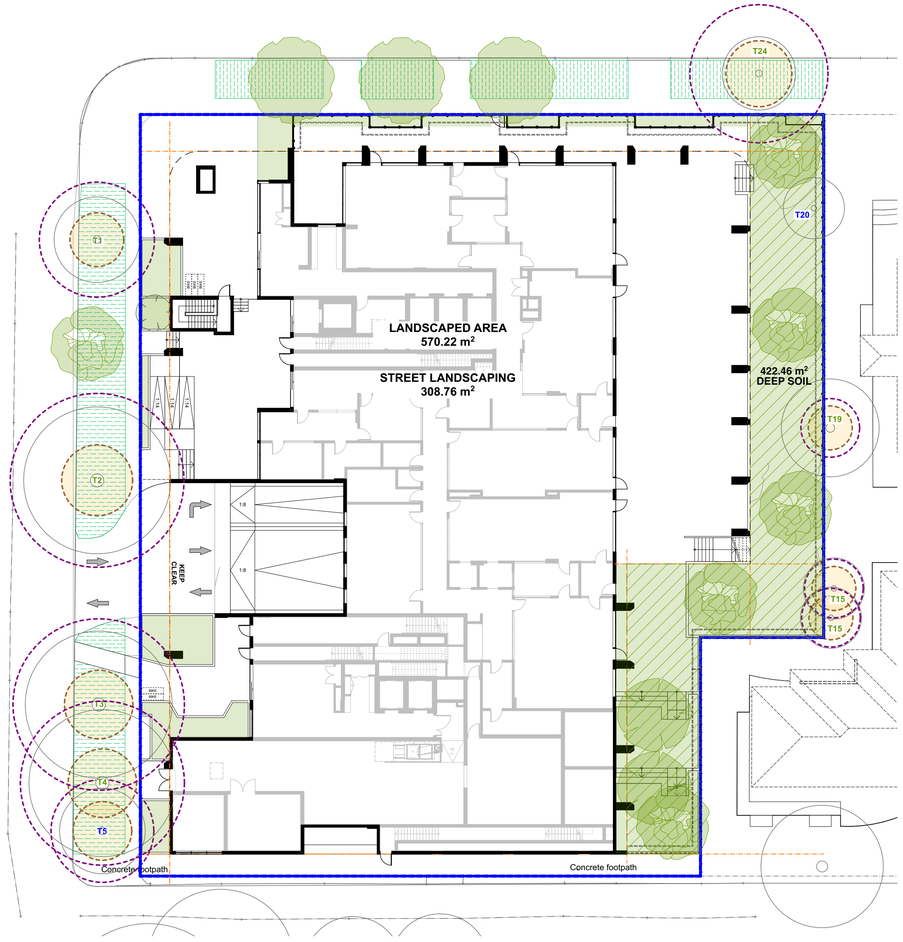
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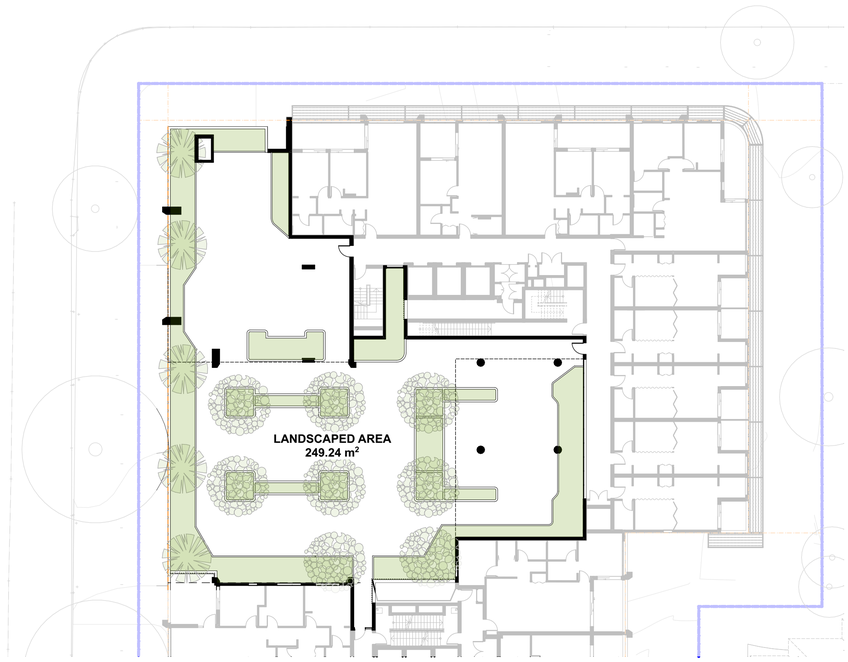
Drawing
Site Plan

Project No. **24029**
Revision **A**
Drawing No. **DA 010**

Deep Soil and Landscaped Area



1 Deep Soil & Landscaped Area Plan - Ground Level
1:250



2 Landscaped Area Plan - Level 01
1:250



3 Landscaped Area Plan - Rooftop Terraces
1:250

SITE AREA: 3270.1 m2

Landscaping	Area Requirements (m2)	
	ADG Objective 3E-1	Proposed (m2)
Deep soil	(Min. 7% of site area, at least 6m wide)	12.9%
	228.907	422.46
Landscaped Area*	N/A	27.3%
		892.14
Street Landscaping	N/A	308.76

*Note: Landscaped area calculated using RLEP 2012 definition

ADG COMPLIANT

LEGEND

- SITE BOUNDARY
- ADG REQUIRED DEEP SOIL Min. 6m wide
- LANDSCAPED AREA
- STREET LANDSCAPING

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North

Scale at A1

Status
SSDA

Drawn
CM, SA, RD

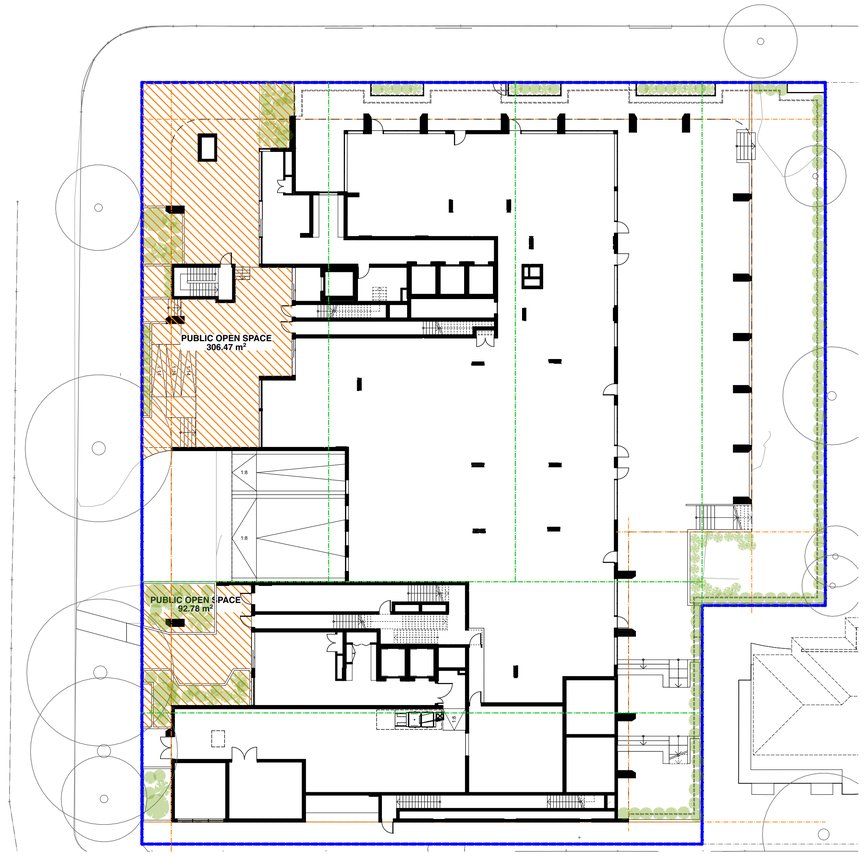
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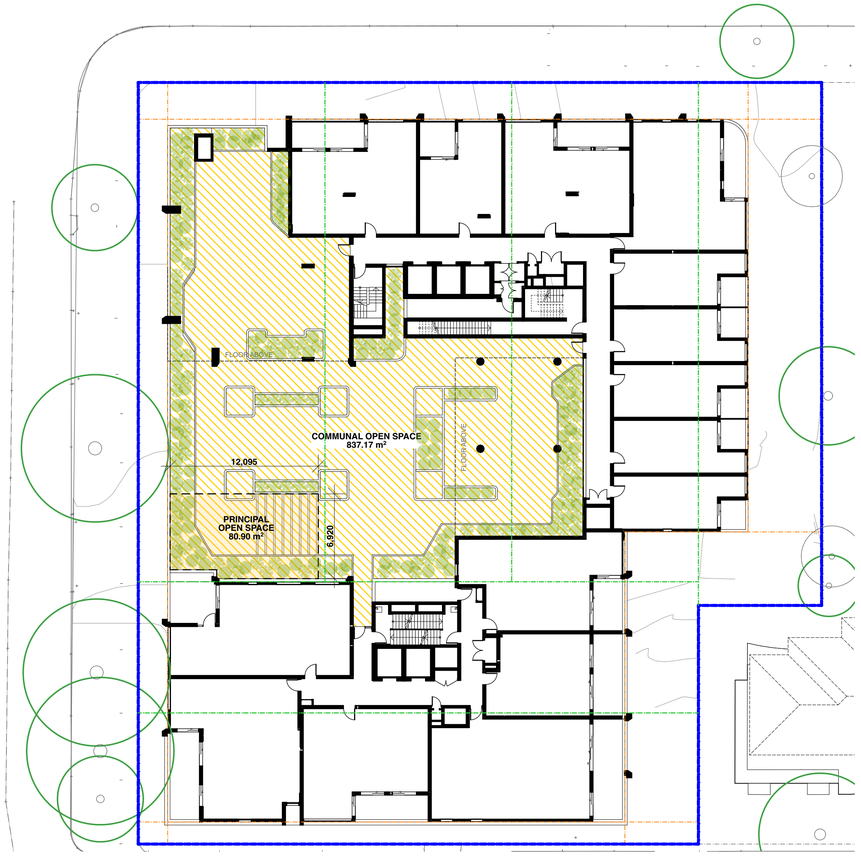
Project
251 - 257 Maroubra Road & 133 Garden Street Maroubra NSW 2035 Australia

Drawing
Analysis - Deep Soil and Landscaped Area

Project No. **24029**
Revision **A**
Drawing No. **DA 011**



1 Public Open Space - Ground Level
1:250



2 Communal Open Space - Level 01
1:250

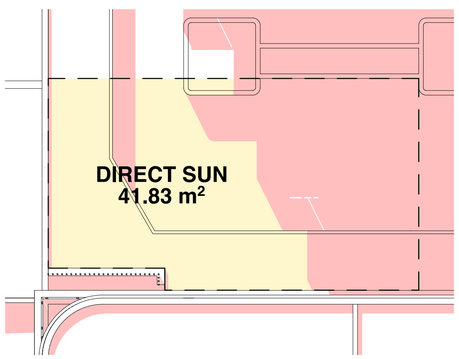
LEGEND

- SITE BOUNDARY
- ADG REQUIRED COMMUNAL OPEN SPACE (COS) Min. 3m wide
- ADG REQUIRED PRINCIPAL OPEN SPACE (POS) Min. 3m wide
- PUBLIC OPEN SPACE

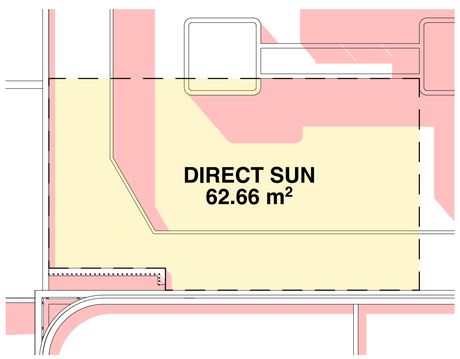
COMMUNAL OPEN SPACE - ADG ANALYSIS	
SITE AREA m2	3270.1
COMMUNAL OPEN SPACE (COS) m2	837.17
PUBLIC OPEN SPACE m2	399.25
PRINCIPAL OPEN SPACE (POS) m2	80.9
COS PROPORTION OF SITE AREA (min. 25%)	25.60%

POS SOLAR ANALYSIS (min. 2h to 50% of POS)		
TIME (JUNE 21)	DIRECT SUNLIGHT m2	PERCENTAGE OF POS (min. 50%)
9am	0	0.00%
10am	0	0.00%
11am	0	0.00%
12pm	15.15	18.73%
1pm	41.83	51.71%
2pm	62.66	77.45%
3pm	54.91	67.87%

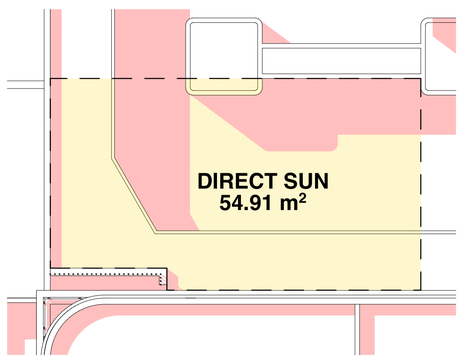
ADG COMPLIANT



3 Principal POS Shadow Diagram - 1pm
1:100



4 Principal POS Shadow Diagram - 2pm
1:100



5 Principal POS Shadow Diagram - 3pm
1:100

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251 - 257 Maroubra Road & 133 Garden Street Maroubra NSW 2035 Australia

Drawing
Analysis - Communal Open Space

Project No. **24029**
Revision **A**
Drawing No. **DA 012**

Setback Analysis

Objective 3F-1

Adequate building separation distances are shared equitably between neighbouring sites, to achieve reasonable levels of external and internal visual privacy

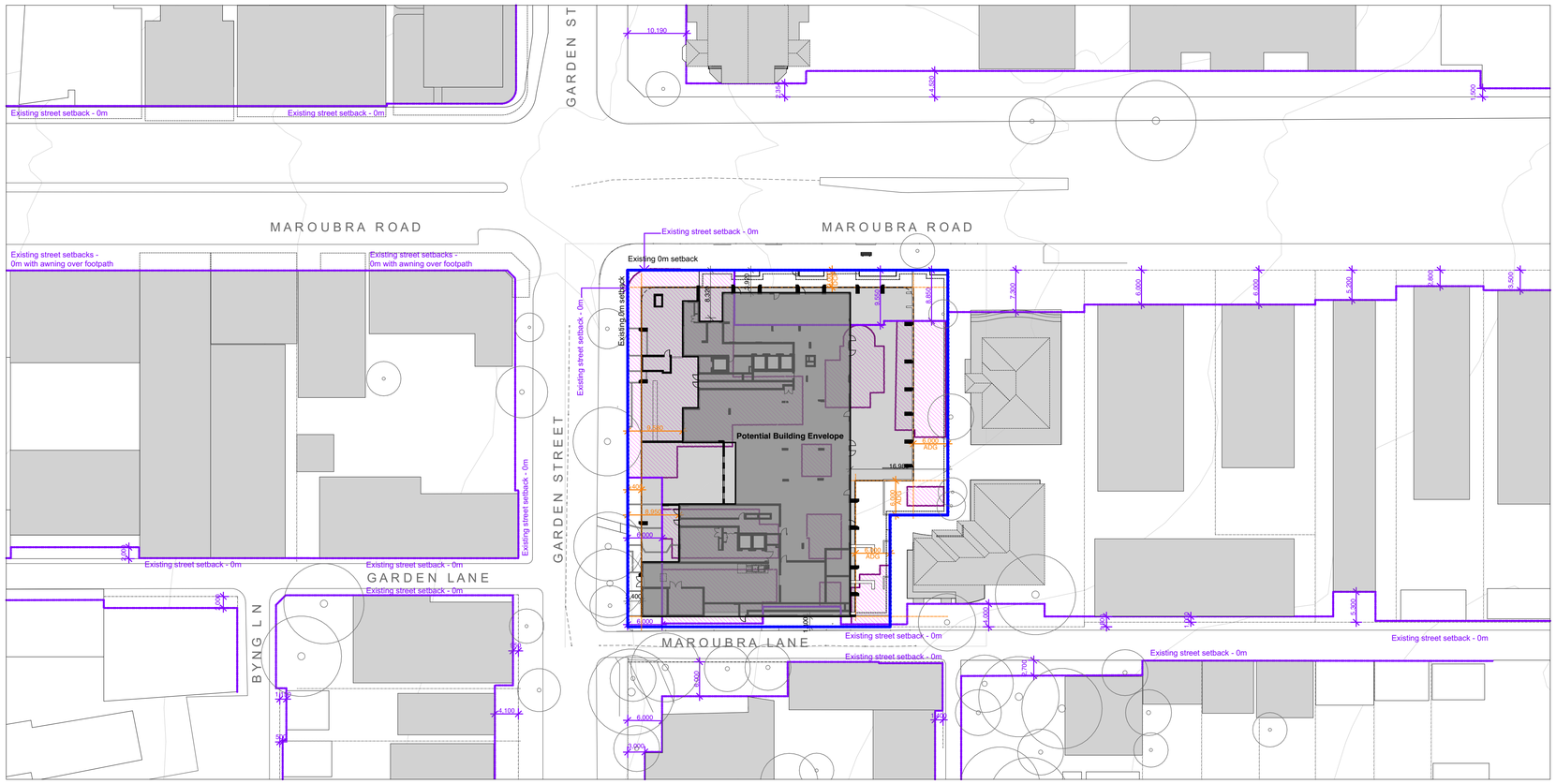
Design criteria

1. Separation between windows and balconies is provided to ensure visual privacy is achieved. Minimum required separation distances from buildings to the side and rear boundaries are as follows:

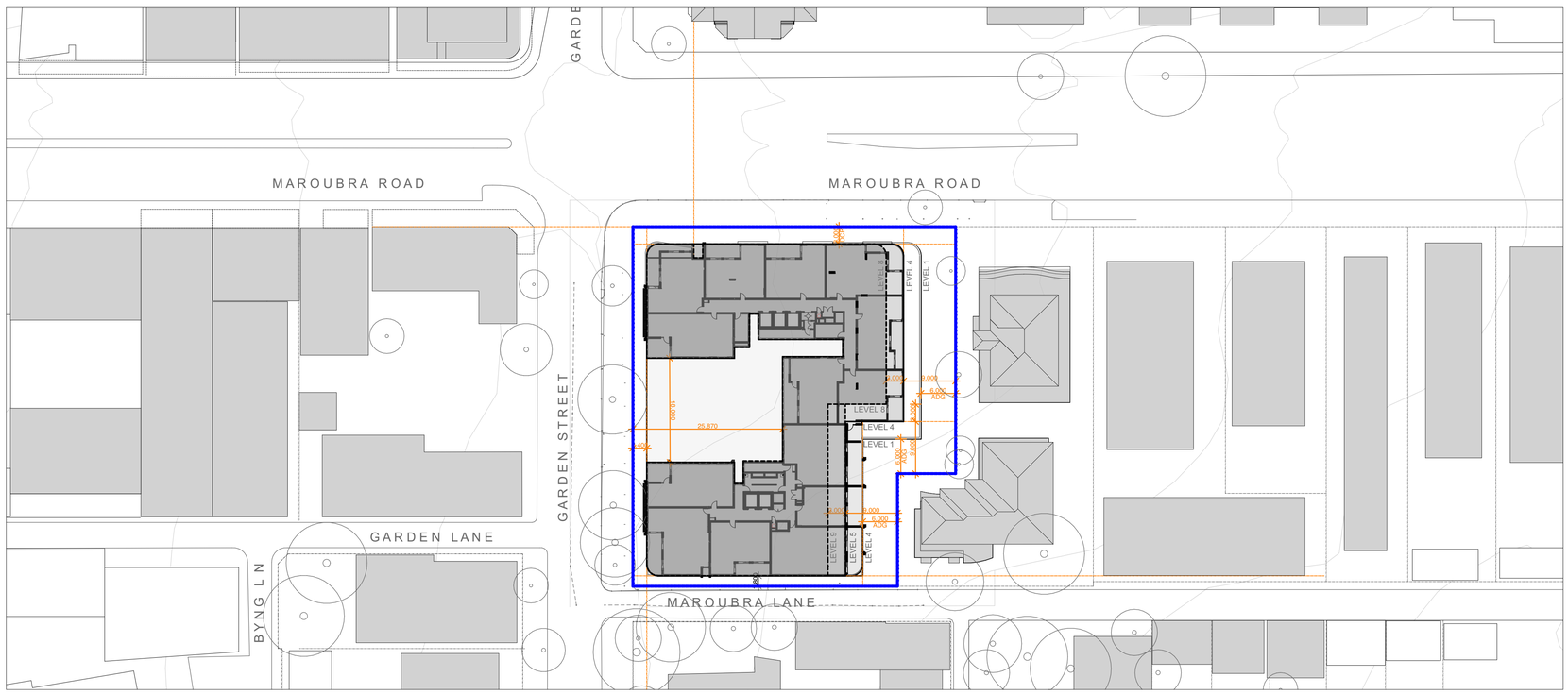
Building height	Habitable rooms and balconies	Non-habitable rooms
up to 12m (4 storeys)	6m	3m
up to 25m (5-8 storeys)	9m	4.5m
over 25m (9+ storeys)	12m	6m

Source: Apartment Design Guide, Part 3F Visual Privacy

Setbacks	DCP Part 3.4	ADG
Street and Front	Consistent with prevailing street setback (primary and secondary frontages) Generally no less than 3m Must incorporate landscape planting	
Side and Rear	Site frontage width of 20m and above requires 4m side setback Provide a minimum rear setback of 15% of allotment depth or 5m, whichever is the greater.	*To Habitable Rooms and Balconies -* 6m min. (up to 4th storey) 9m min. (up to 5-8th storey) 12m min. (9th storey +) *To Non-habitable Rooms -* 3m min. (up to 4th storey) 4.5m min. (up to 5-8th storey) 6m min. (9th storey +)



1 Proposed Setback Analysis - Ground
1:500



2 Proposed Setback Analysis - Typ. level
1:500

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North

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1:500

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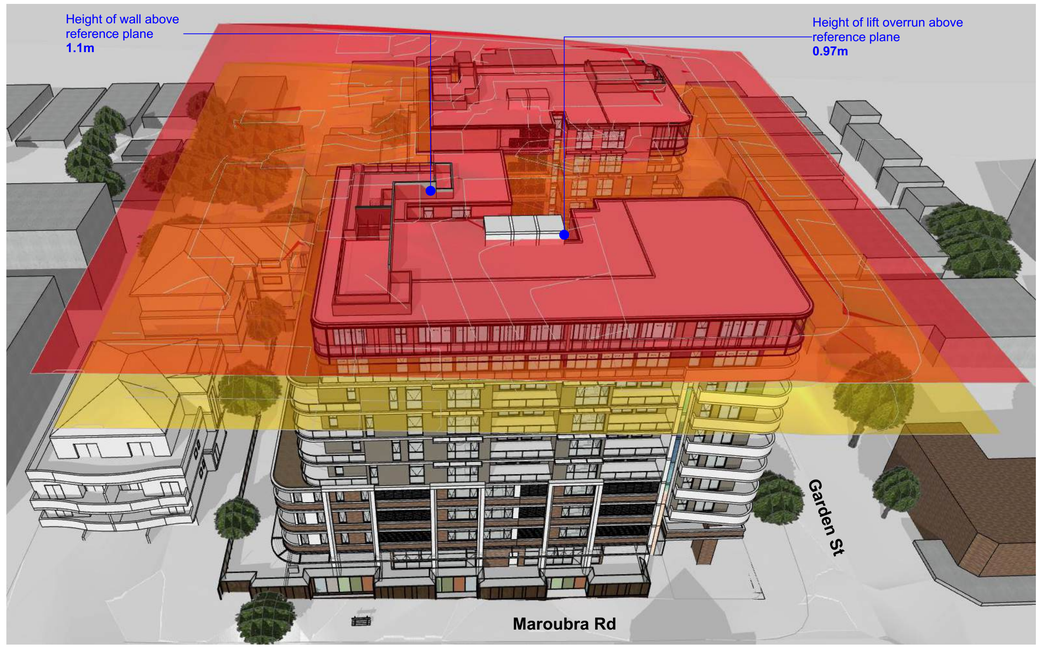
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Project
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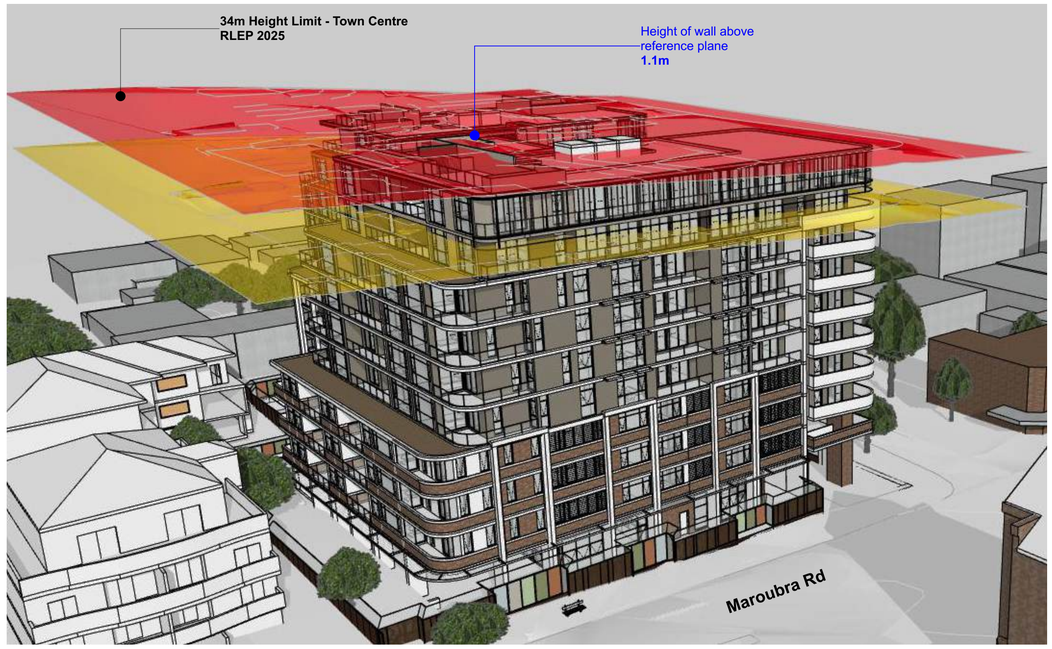
Drawing
Analysis - Setbacks

Project No. **24029**
Revision **A**
Drawing No. **DA 013**

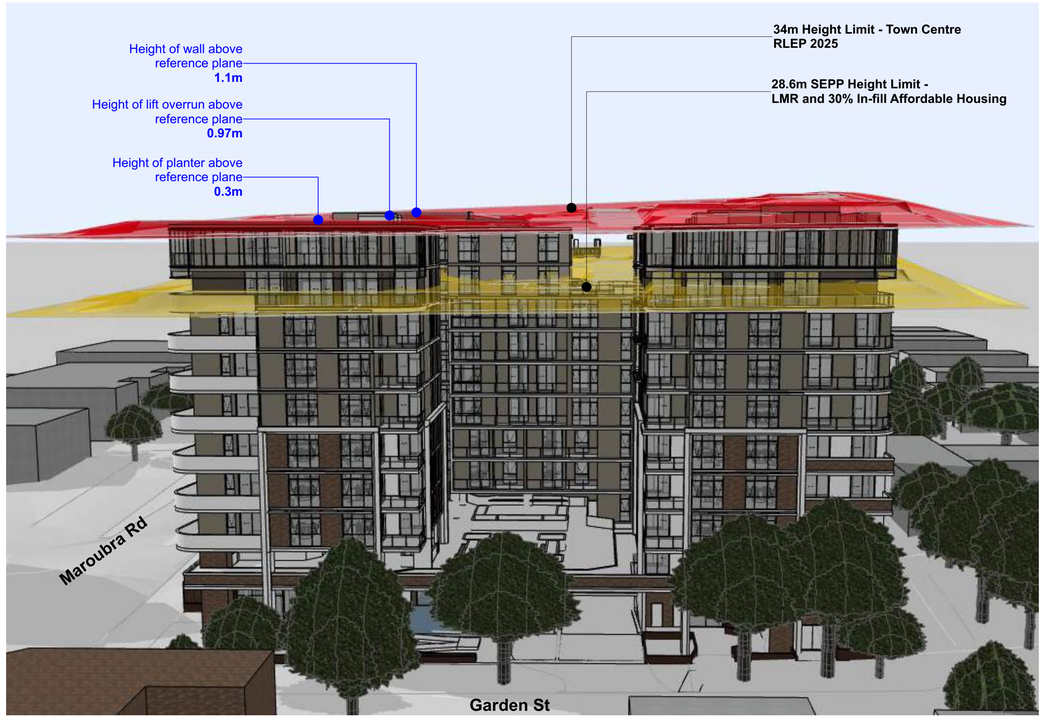
Height Plane Analysis



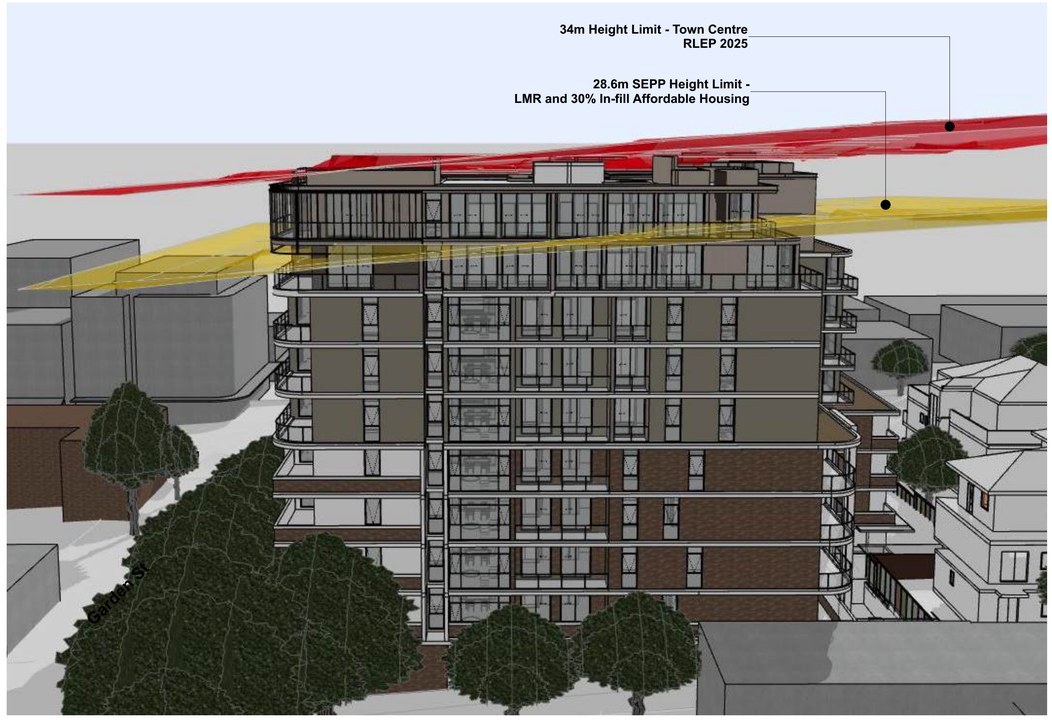
1 North Perspective - Maroubra Rd



2 North-East Perspective - Maroubra Rd



3 North West Perspective - Garden St



4 South West Perspective - Maroubra Ln

NOTE: Max. height limit planes are used as a reference only.

Proposed maximum building height: **35.6m** (incl. 2m roof service zones)

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North

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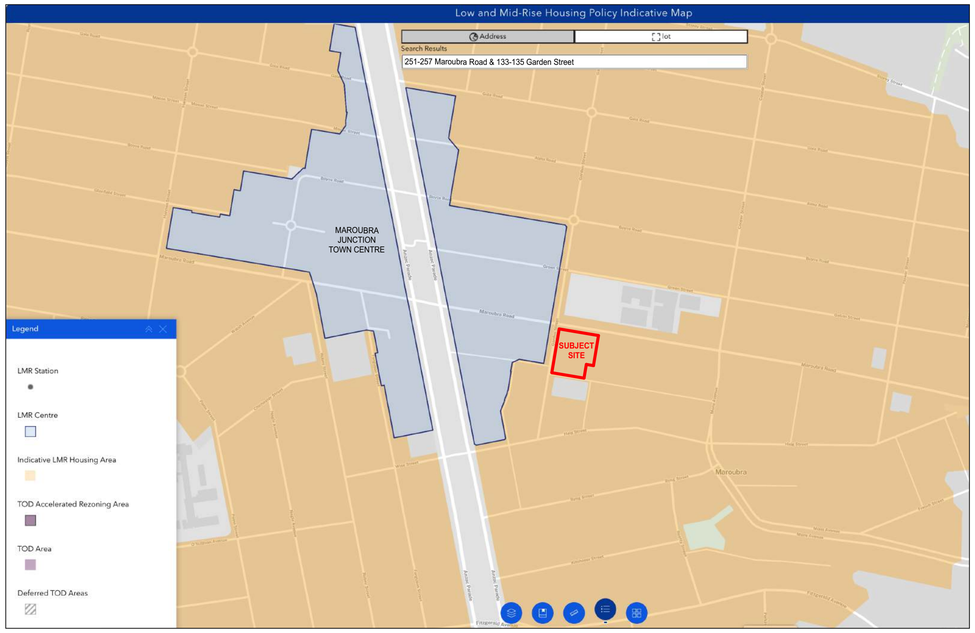
Drawing
Analysis - Height Plane

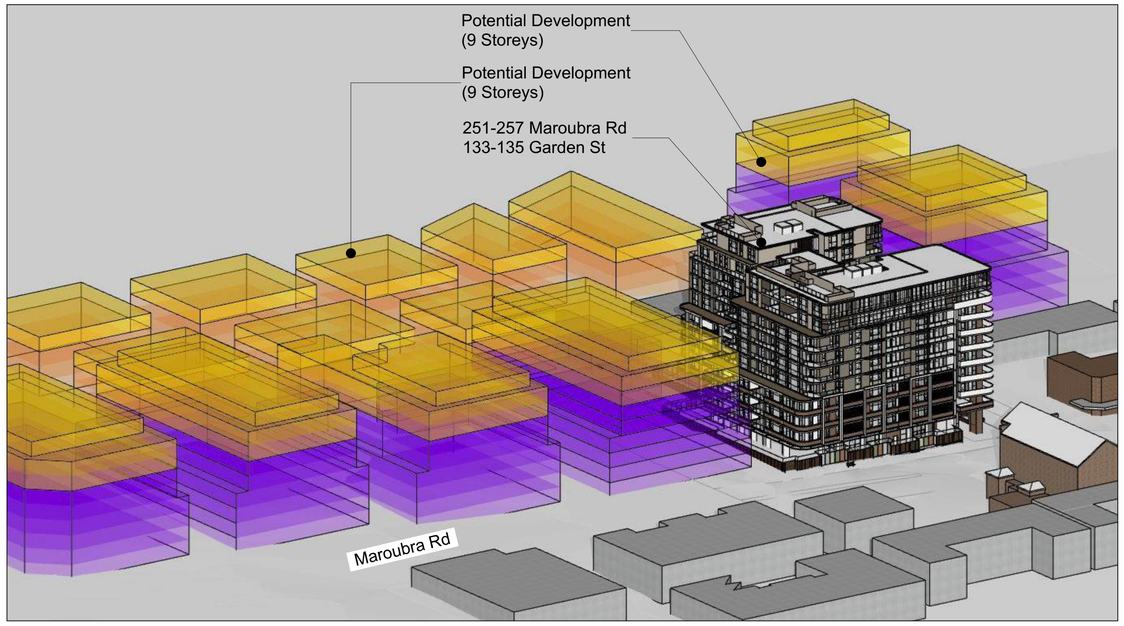
Project No.
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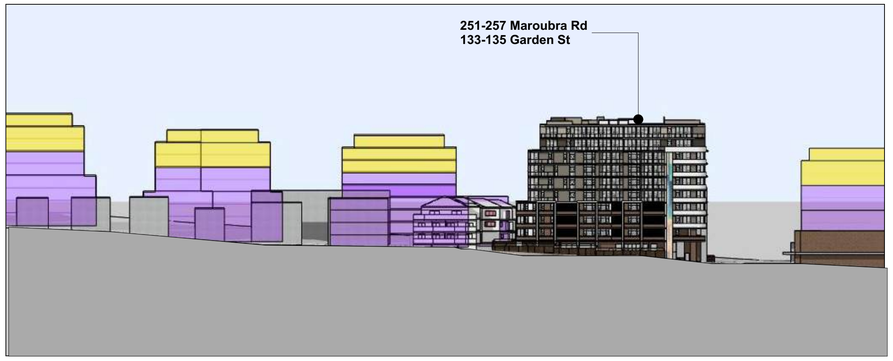
Revision
A

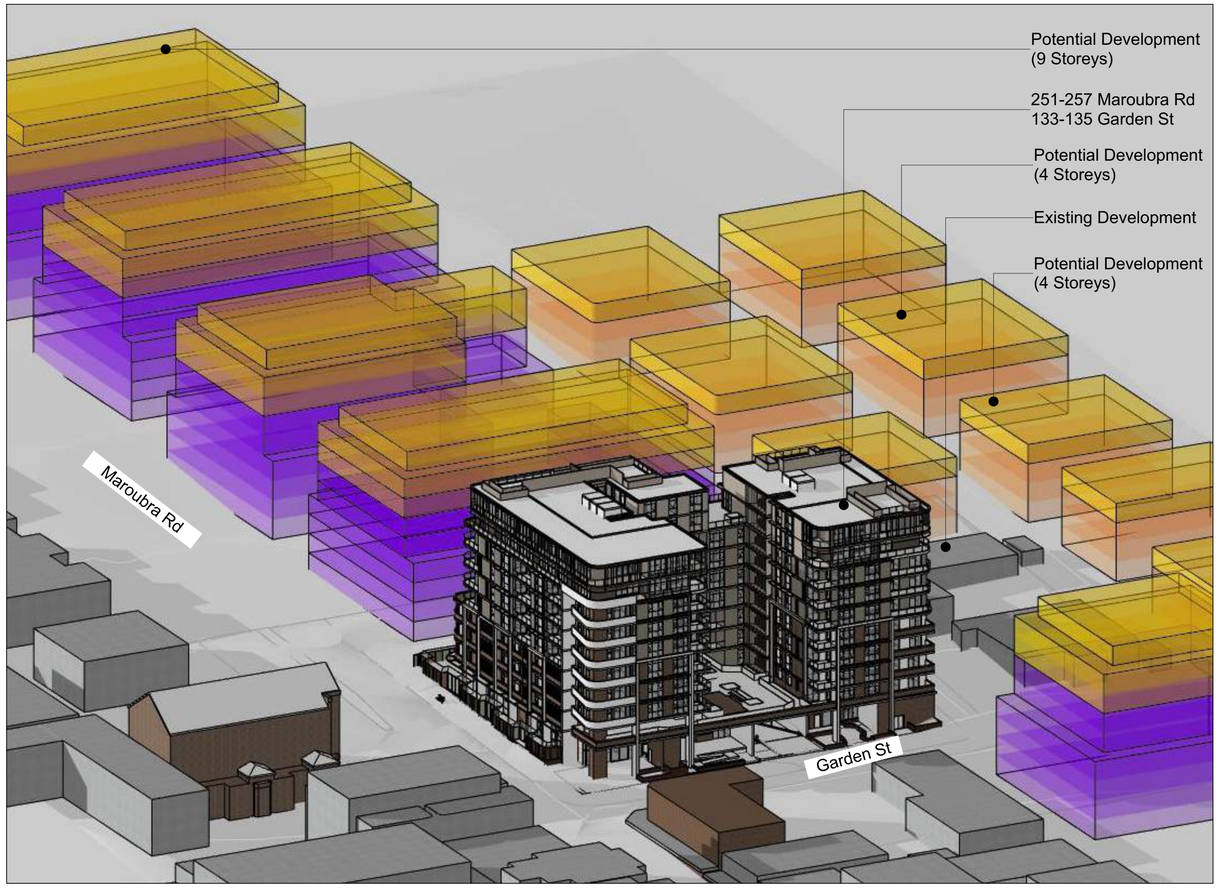
Drawing No.
DA 014

Future Character of the Area









Site Massing Legend:

- Indicative LMR Housing Policy R2
- Indicative LMR Housing Policy R3
- 30% Affordable In-Fill Housing SEPP

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Drawing
Analysis - Future Character of the Area

Project No.	Revision	Drawing No.
24029	A	DA 015



Tree Canopy	Area Requirements (m2)	
	ADG Objective 3E-1	**Proposed (m2)**
Tree Canopy Area	N/A	15.46%
		505.53

LEGEND

- SITE BOUNDARY
- EXISTING RETAINED TREE CANOPY
- PROPOSED TREE CANOPY
- PROPOSED TREE CANOPY AREA WITHIN BOUNDARY

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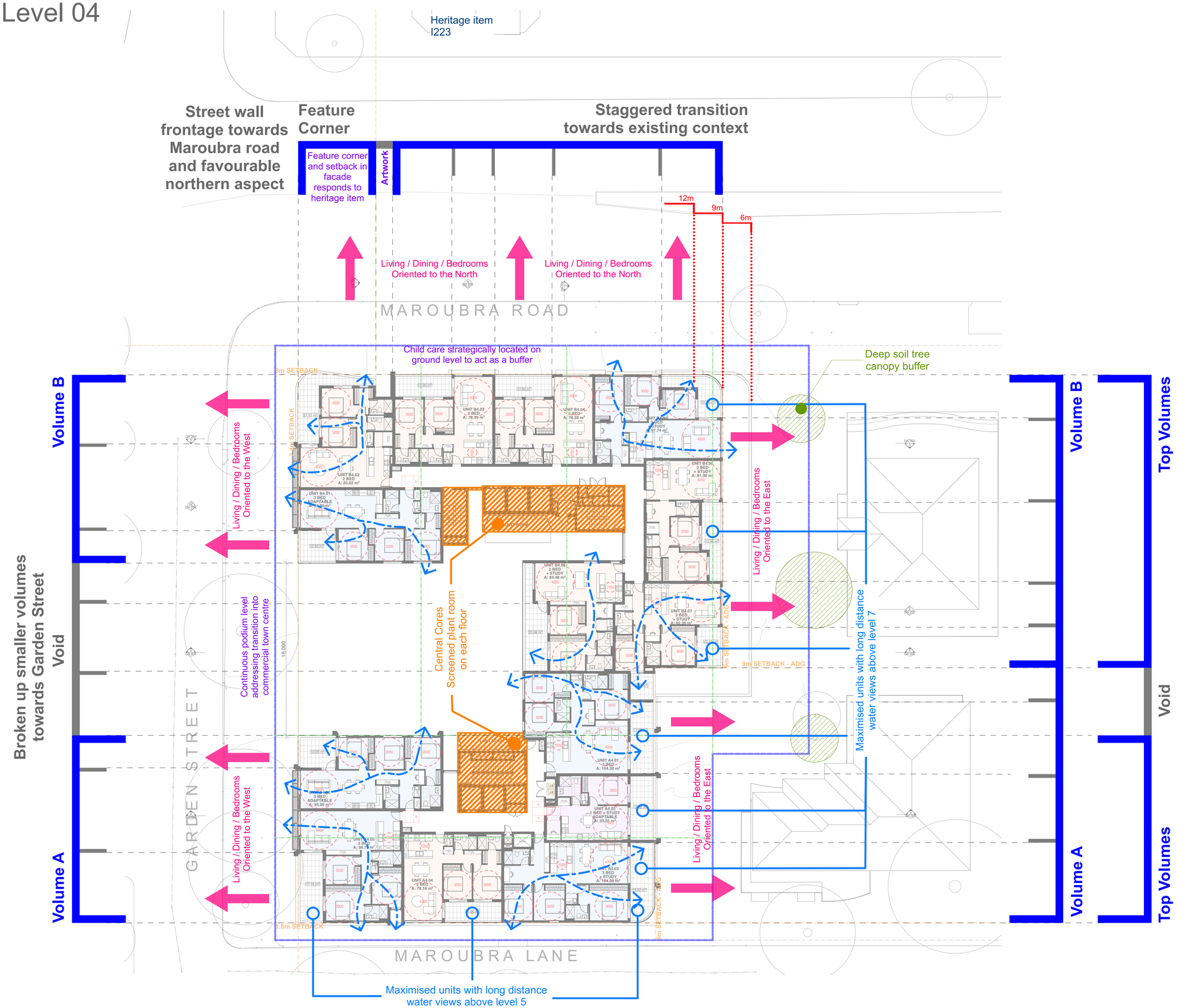
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Drawing
Analysis - Tree Canopy Coverage

Project No. **24029**
Revision **A**
Drawing No. **DA 016**

Architectural Analysis: Typical Floor Plan

Level 04



LEGEND

- SITE BOUNDARY
- 2 BEDROOM
- 3 BEDROOM
- 1 BEDROOM
- CROSS-VENTILATION
- ORIENTATION

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North

Scale at A1
1:200

Status
SSDA

Drawn
CM, SA, RD

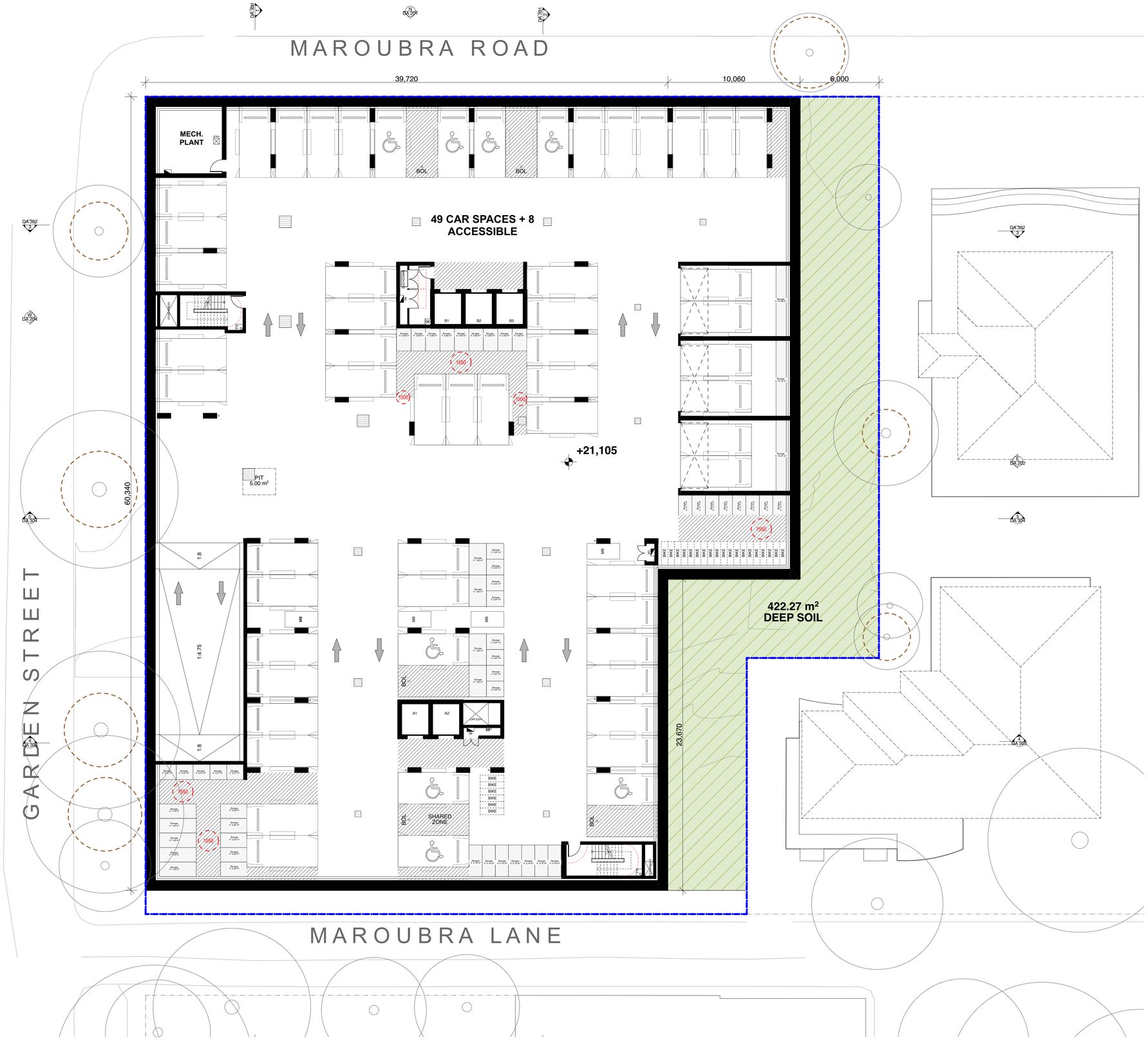
Print Date
12/2/2026

Checked
JG, JB

Project
251 - 257 Maroubra Road & 133 Garden Street Maroubra NSW 2035 Australia

Drawing
Analysis - Typical Floor Plan

Project No. **24029**
Revision **A**
Drawing No. **DA 017**



LEGEND:

- New Tree
- TPZ - Tree Protection Zone
- SRZ - Structural Root Zone
- T# High Retention Value Tree
- T# Medium Retention Value Tree
- T# Low Retention Value Tree
- Proposed Planting
- Cross Ventilation
- Setbacks
- Boundaries
- Basement Line
- Existing Boundary Lines
- Clearances

General Notes

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Nominated Architect (NSW) - John Baker 3552

Rev	Date	Issue
A	12/2/2026	SSDA Submission

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2. Surveyor
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Huy Thai
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3. Arborist
Seasoned Tree Consulting
David Gowenlock
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4. Landscape
Conzept
Robert Frew
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5. Civil and Stormwater
Smart Structures
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6. BCA and Access
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7. Acoustic
Koikas Acoustics
Rowan Frizell
T : 02 9587 9702

8. Traffic and Parking
Genesis Traffic
Bernard Lo
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9. Waste Management
Elephants Foot
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North

Scale at A1
1:150

Status
SSDA

Drawn
CM, SA, RD

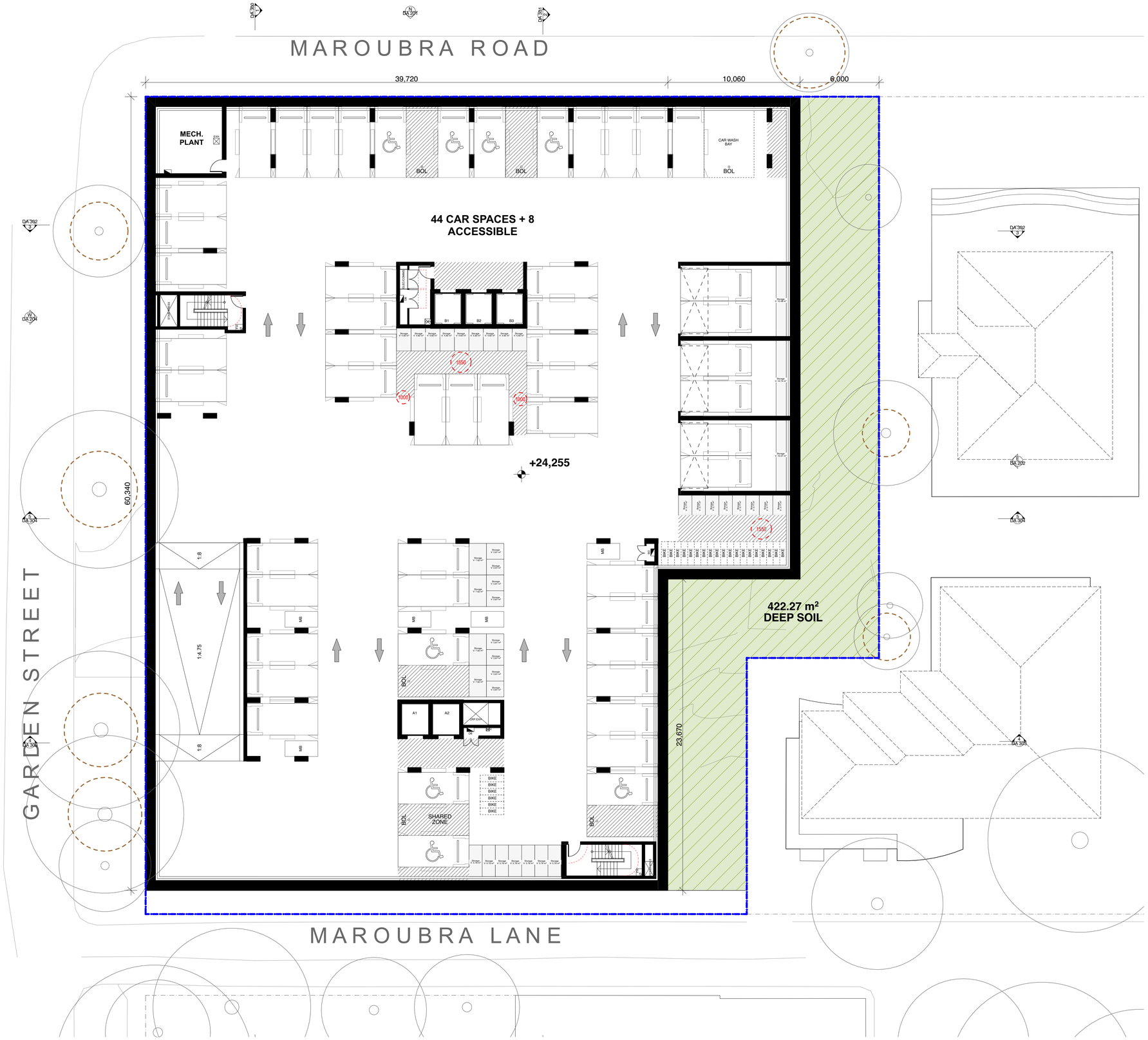
Print Date
12/2/2026

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JG, JB

Project
251 - 257 Maroubra Road & 133 Garden Street Maroubra NSW 2035 Australia

Drawing
Basement 04 Floor Plan

Project No.	Revision	Drawing No.
24029	A	DA 090



LEGEND:

- New Tree
- TPZ - Tree Protection Zone
- SRZ - Structural Root Zone
- T# High Retention Value Tree
- T# Medium Retention Value Tree
- T# Low Retention Value Tree
- Proposed Planting
- Cross Ventilation
- Setbacks
- Boundaries
- Basement Line
- Existing Boundary Lines
- Clearances

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Rev	Date	Issue
A	12/2/2026	SSDA Submission

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North

Scale at A1
1:150

Status
SSDA

Drawn
CM, SA, RD

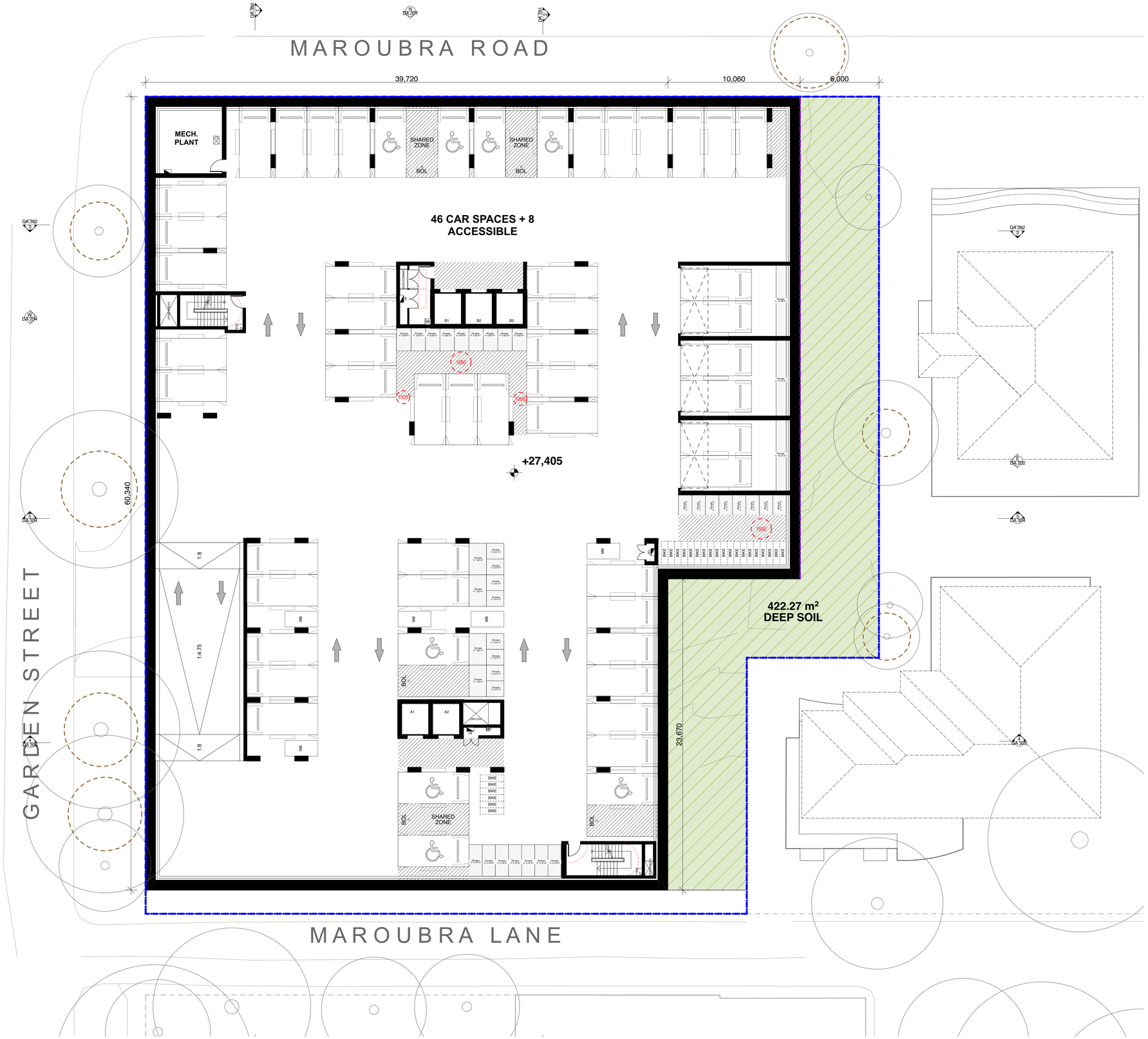
Print Date
12/2/2026

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JG, JB

Project
251 - 257 Maroubra Road & 133 Garden Street Maroubra NSW 2035 Australia

Drawing
Basement 03 Floor Plan

Project No. **24029**
Revision **A**
Drawing No. **DA 091**



LEGEND:

- New Tree
- TPZ - Tree Protection Zone
- SRZ - Structural Root Zone
- T# High Retention Value Tree
- T# Medium Retention Value Tree
- T# Low Retention Value Tree
- Proposed Planting
- Cross Ventilation
- Setbacks
- Boundaries
- Basement Line
- Existing Boundary Lines
- Clearances

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8. Traffic and Parking
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North

Scale at A1
1:150

Status
SSDA

Drawn
CM, SA, RD

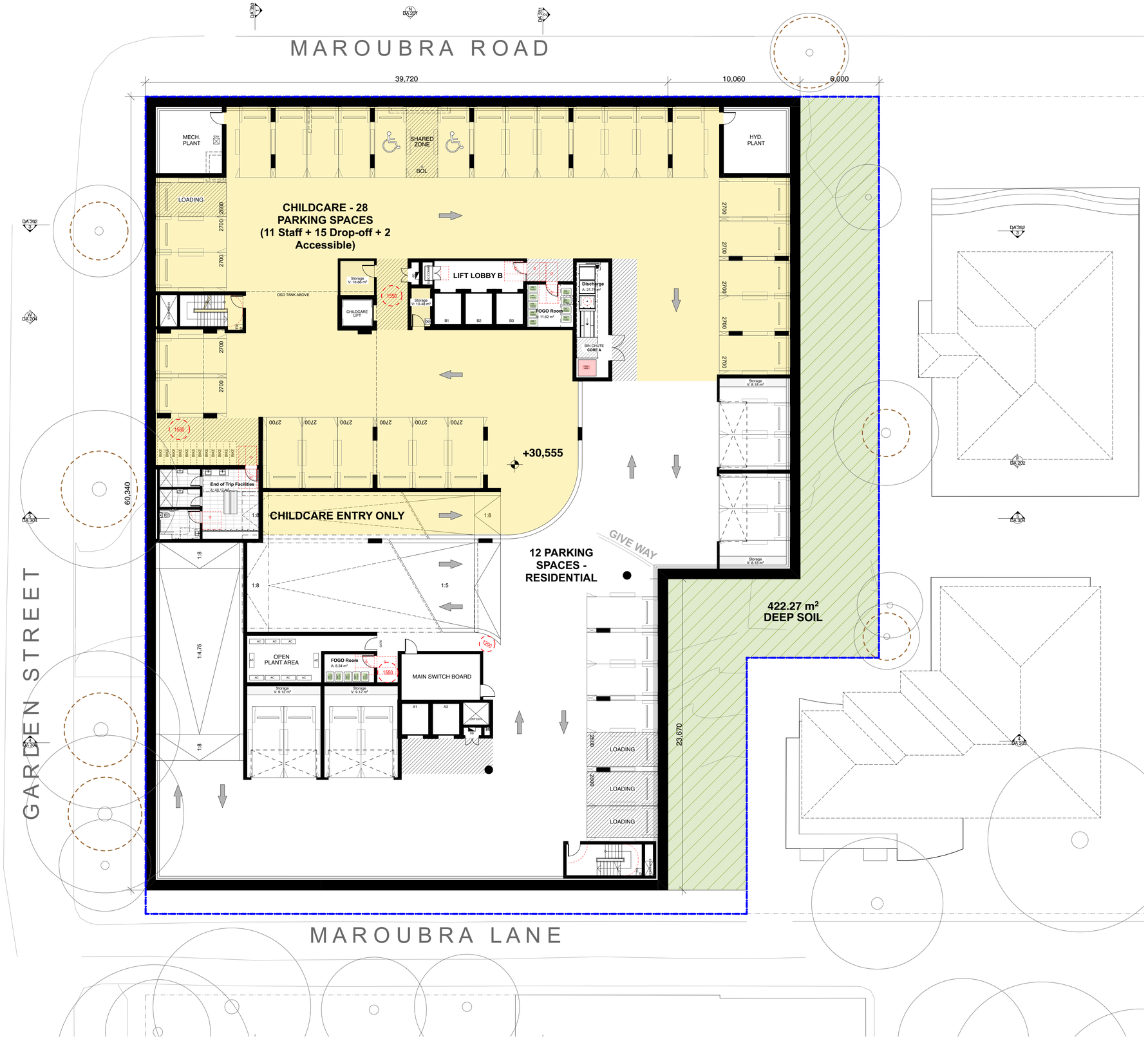
Print Date
12/2/2026

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Project
251 - 257 Maroubra Road & 133 Garden Street Maroubra NSW 2035 Australia

Drawing
Basement 02 Floor Plan

Project No.	Revision	Drawing No.
24029	A	DA 092



LEGEND:

- New Tree
- TPZ - Tree Protection Zone
- SRZ - Structural Root Zone
- T# High Retention Value Tree
- T# Medium Retention Value Tree
- T# Low Retention Value Tree
- Proposed Planting
- Cross Ventilation
- Setbacks
- Boundaries
- Basement Line
- Existing Boundary Lines
- Clearances

General Notes

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Nominated Architect (NSW) - John Baker 3552

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8. Traffic and Parking
Genesis Traffic
Bernard Lo
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9. Waste Management
Elephants Foot
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North

Scale at A1
1:150

Status
SSDA

Drawn
CM, SA, RD

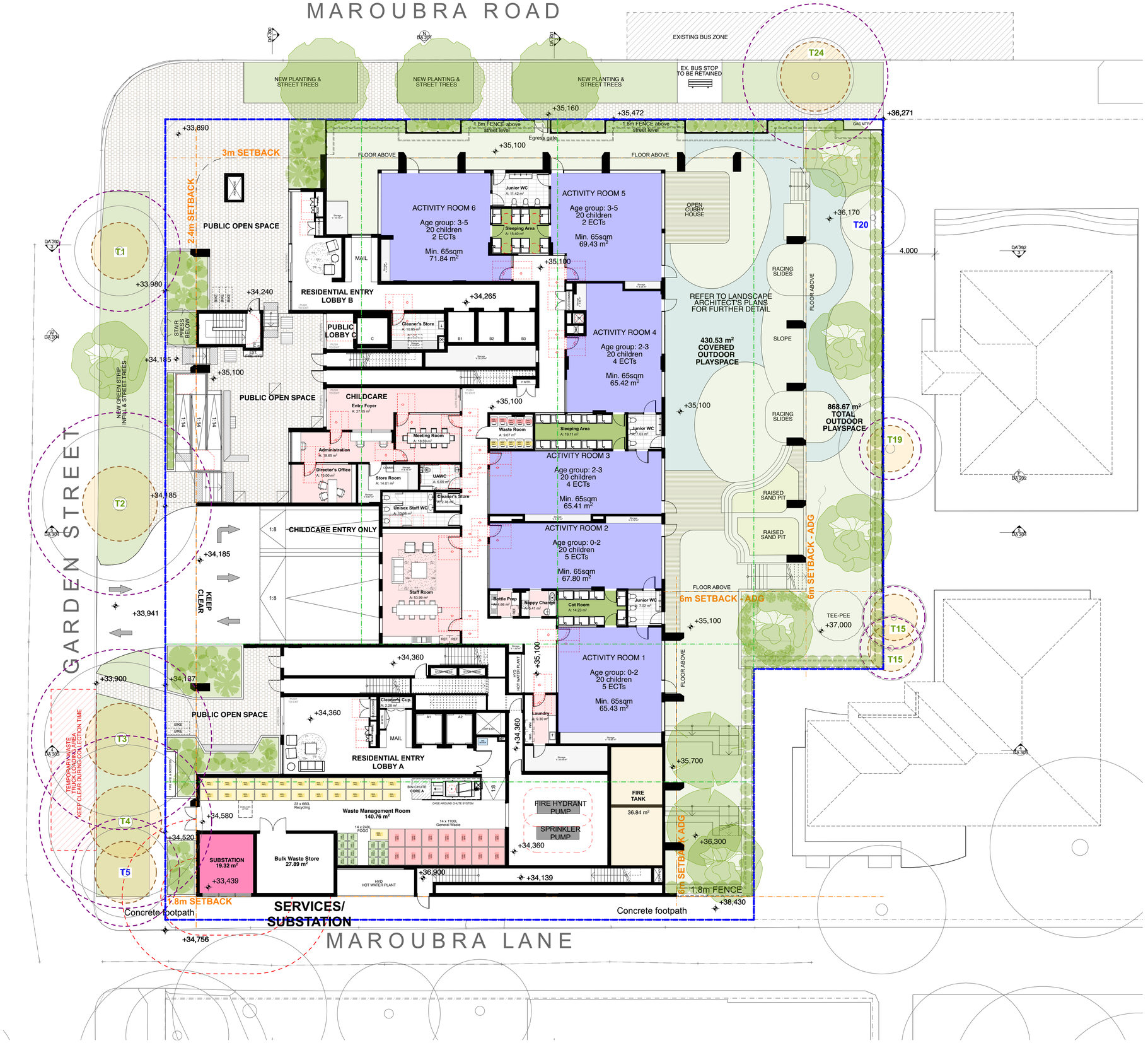
Print Date
12/2/2026

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JG, JB

Project
251 - 257 Maroubra Road & 133 Garden Street Maroubra NSW 2035 Australia

Drawing
Basement 01 Floor Plan

Project No. **24029**
Revision **A**
Drawing No. **DA 093**



LEGEND:

- New Tree
- TPZ - Tree Protection Zone
- SRZ - Structural Root Zone
- T# High Retention Value Tree
- T# Medium Retention Value Tree
- T# Low Retention Value Tree
- Proposed Planting
- Cross Ventilation
- Setbacks
- Boundaries
- Basement Line
- Existing Boundary Lines
- Clearances
- Childcare Administration Room
- Childcare Activity Room
- Childcare Sleeping Area

General Notes

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Nominated Architect (NSW) - John Baker 3552

Rev	Date	Issue
A	12/2/2026	SSDA Submission

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North

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1:150

Status
SSDA

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Print Date
12/2/2026

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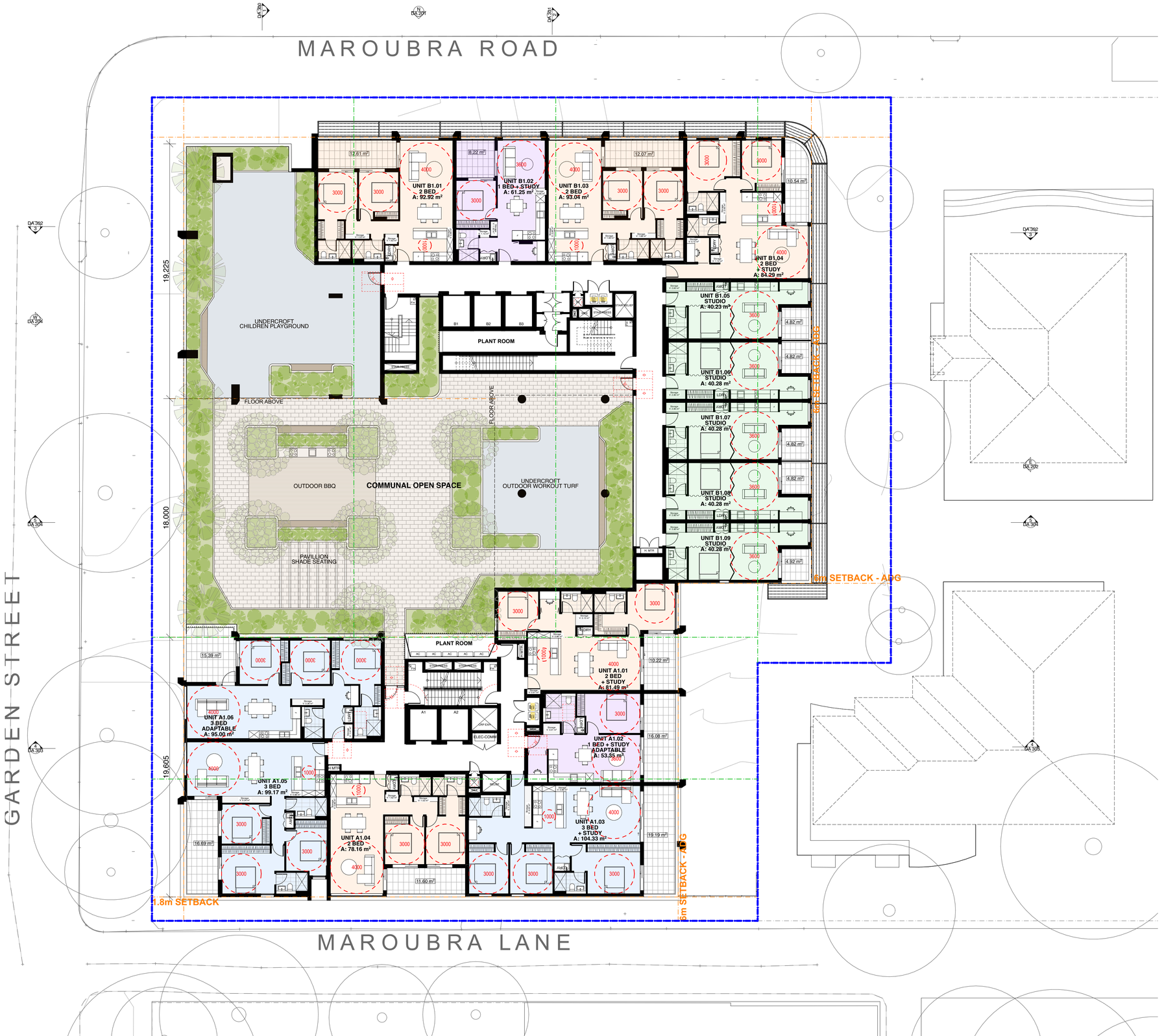
Project
251 - 257 Maroubra Road & 133 Garden Street Maroubra NSW 2035 Australia

Drawing
Ground Floor Plan

Project No.
24029

Revision
A

Drawing No.
DA 100



LEGEND:

- Studio
- 1 Bedroom
- 2 Bedroom
- 3 Bedroom
- 4 Bedroom

LEGEND:

- New Tree
- TPZ - Tree Protection Zone
- SRZ - Structural Root Zone
- T# High Retention Value Tree
- T# Medium Retention Value Tree
- T# Low Retention Value Tree
- Proposed Planting
- Cross Ventilation
- Setbacks
- Boundaries
- Basement Line
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Rev	Date	Issue
A	12/2/2026	SSDA Submission

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North

Scale at A1
1:150

Status
SSDA

Drawn
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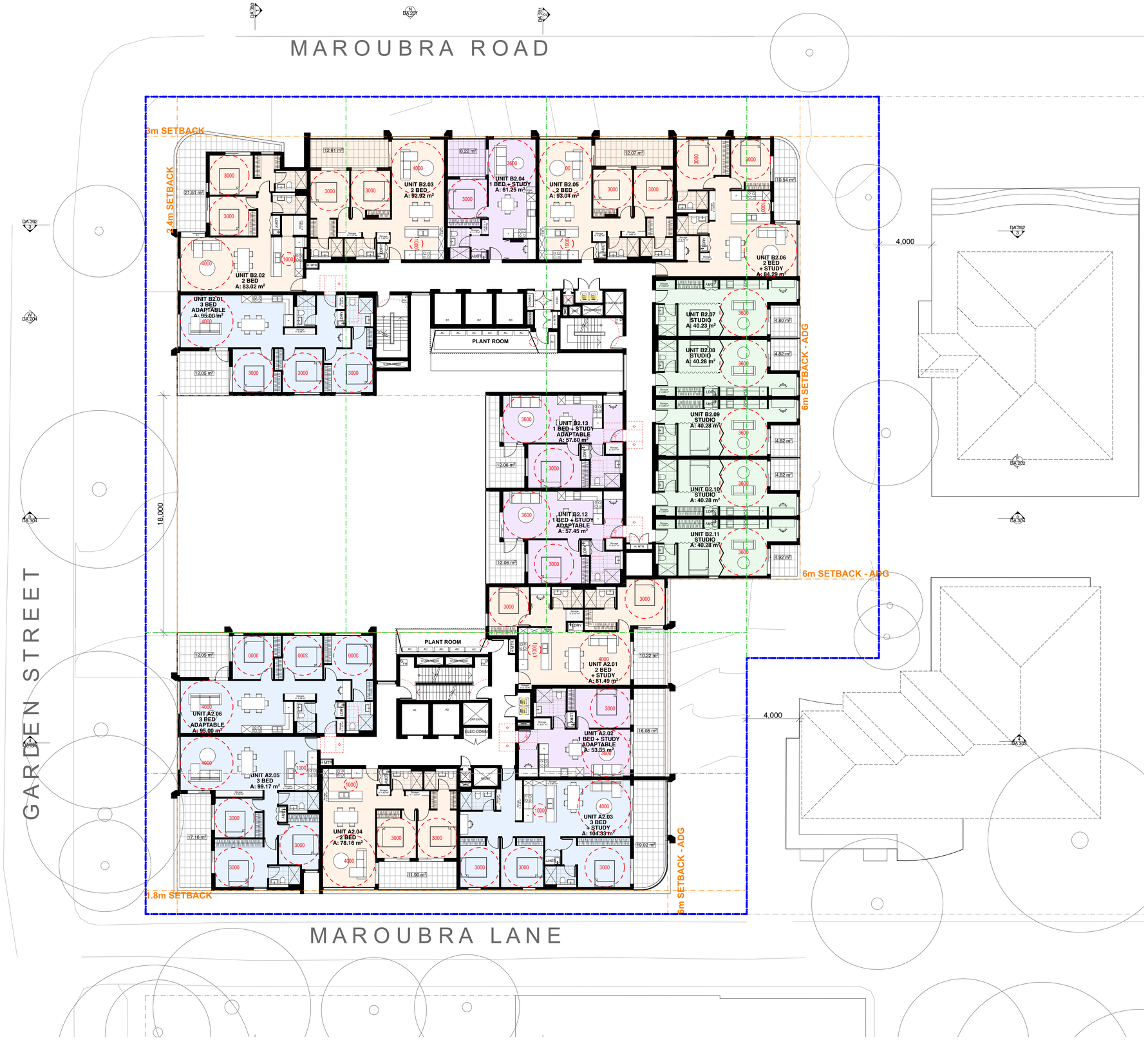
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12/2/2026

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Project
251 - 257 Maroubra Road & 133 Garden Street Maroubra NSW 2035 Australia

Drawing
Level 01 Floor Plan

Project No.	Revision	Drawing No.
24029	A	DA 101



LEGEND:

- Studio
- 1 Bedroom
- 2 Bedroom
- 3 Bedroom
- 4 Bedroom

LEGEND:

- New Tree
- TPZ - Tree Protection Zone
- SRZ - Structural Root Zone
- T# High Retention Value Tree
- T# Medium Retention Value Tree
- T# Low Retention Value Tree
- Proposed Planting
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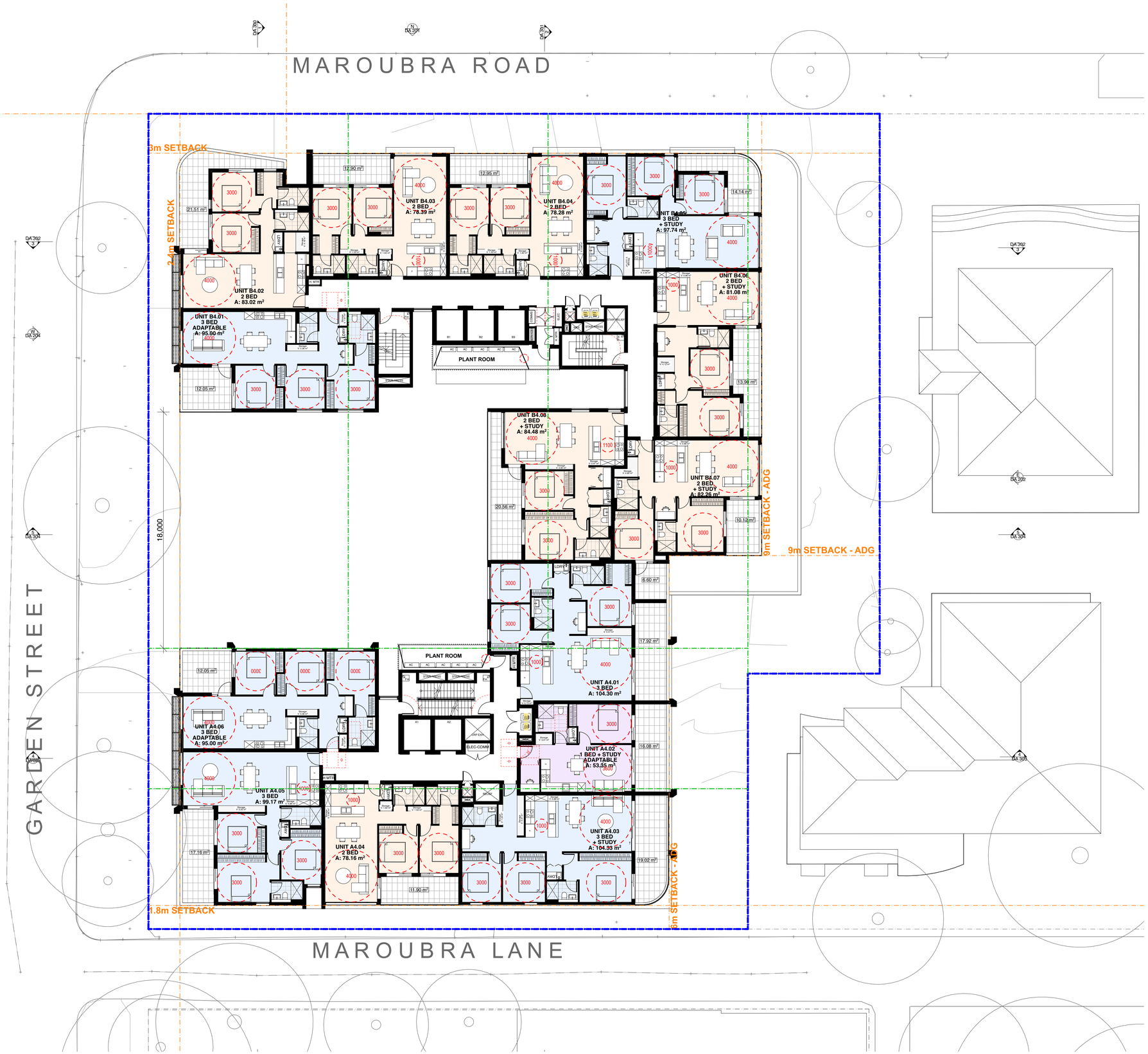
Print Date
12/2/2026

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JG, JB

Project
251 - 257 Maroubra Road & 133 Garden Street Maroubra NSW 2035 Australia

Drawing
Level 02-03 Floor Plan

Project No. **24029**
Revision **A**
Drawing No. **DA 102**



LEGEND:

- Studio
- 1 Bedroom
- 2 Bedroom
- 3 Bedroom
- 4 Bedroom

LEGEND:

- New Tree
- TPZ - Tree Protection Zone
- SRZ - Structural Root Zone
- T# High Retention Value Tree
- T# Medium Retention Value Tree
- T# Low Retention Value Tree
- Proposed Planting
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North

Scale at A1
1:150

Status
SSDA

Drawn
CM, SA, RD

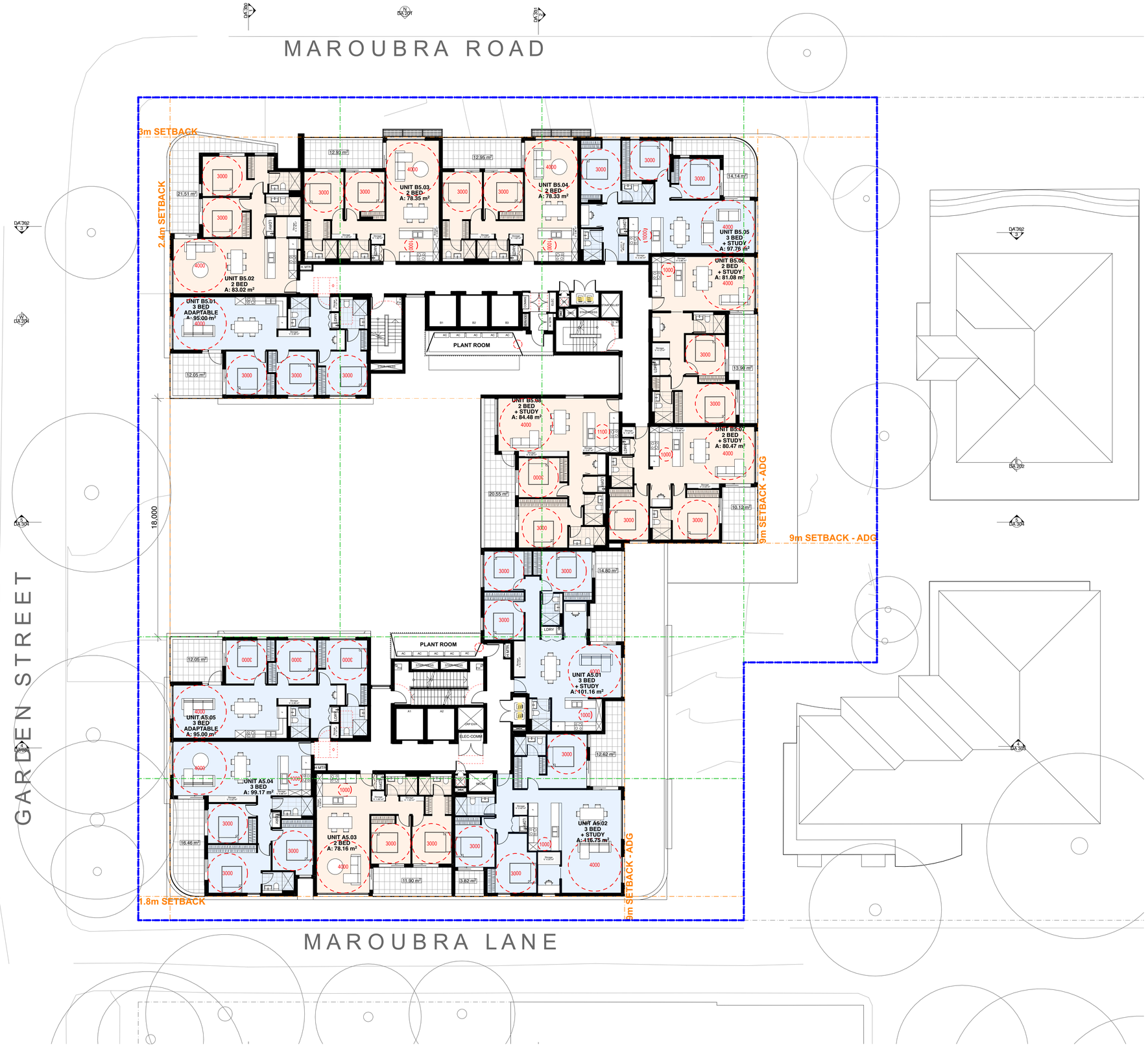
Print Date
12/2/2026

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JG, JB

Project
251 - 257 Maroubra Road & 133 Garden Street Maroubra NSW 2035 Australia

Drawing
Level 04 Floor Plan

Project No. 24029
Revision A
Drawing No. DA 103



LEGEND:

- Studio
- 1 Bedroom
- 2 Bedroom
- 3 Bedroom
- 4 Bedroom

LEGEND:

- New Tree
- TPZ - Tree Protection Zone
- SRZ - Structural Root Zone
- T# High Retention Value Tree
- T# Medium Retention Value Tree
- T# Low Retention Value Tree
- Proposed Planting
- Cross Ventilation
- Setbacks
- Boundaries
- Basement Line
- Existing Boundary Lines
- Clearances

General Notes

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Nominated Architect (NSW) - John Baker 3552

Rev	Date	Issue
A	12/2/2026	SSDA Submission

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3. Arborist
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David Gowenlock
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4. Landscape
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Robert Frew
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5. Civil and Stormwater
Smart Structures
Kamyar Eivazzadeh
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6. BCA and Access
Building Innovations
Mardiros Tatian
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7. Acoustic
Koikas Acoustics
Rowan Frizell
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8. Traffic and Parking
Genesis Traffic
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North

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1:150

Status
SSDA

Drawn
CM, SA, RD

Print Date
12/2/2026

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JG, JB

Project
251 - 257 Maroubra Road & 133 Garden Street Maroubra NSW 2035 Australia

Drawing
Level 05-07 Floor Plan

Project No.	Revision	Drawing No.
24029	A	DA 104

MAROUBRA ROAD

GARDEN STREET

MAROUBRA LANE

3m SETBACK

3m SETBACK

12m SETBACK

12m SETBACK - ADG

9m SETBACK - ADG

1.8m SETBACK

UNIT B8.02
3 BED
+ STUDY
A: 134.18 m²

UNIT B8.03
SUB-PENTHOUSE
A: 162.90 m²

UNIT B8.01
3 BED
ADAPTABLE
A: 120.89 m²

UNIT B8.04
SUB-PENTHOUSE
A: 157.99 m²

UNIT A8.03
3-BED
ADAPTABLE
A: 120.89 m²

UNIT A8.01
SUB-PENTHOUSE
A: 169.37 m²

UNIT A8.02
3 BED
A: 114.27 m²

PLANT ROOM

18,000

6,460

DA 202 · DA 203 · DA 204 · DA 302 · DA 362

LEGEND:

- Studio
- 1 Bedroom
- 2 Bedroom
- 3 Bedroom
- 4 Bedroom

LEGEND:

- New Tree
- TPZ - Tree Protection Zone
- SRZ - Structural Root Zone
- T# High Retention Value Tree
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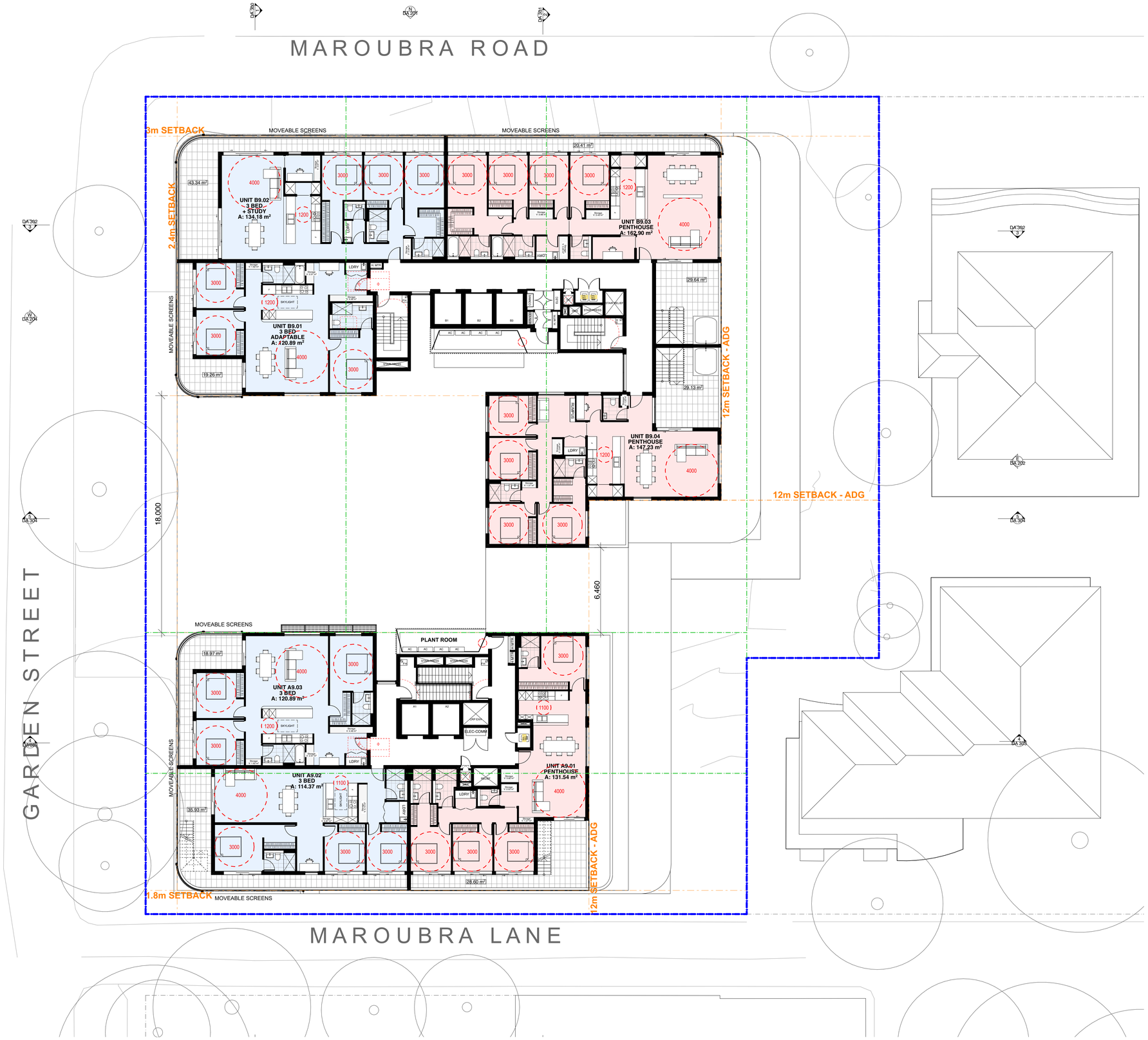
Print Date
12/2/2026

Checked
JG, JB

Project
251 - 257 Maroubra Road & 133 Garden Street Maroubra NSW 2035 Australia

Drawing
Level 08 Floor Plan

Project No.	Revision	Drawing No.
24029	A	DA 105



LEGEND:

- Studio
- 1 Bedroom
- 2 Bedroom
- 3 Bedroom
- 4 Bedroom

LEGEND:

- New Tree
- TPZ - Tree Protection Zone
- SRZ - Structural Root Zone
- T# High Retention Value Tree
- T# Medium Retention Value Tree
- T# Low Retention Value Tree
- Proposed Planting
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- Boundaries
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North

Scale at A1
1:150

Status
SSDA

Drawn
CM, SA, RD

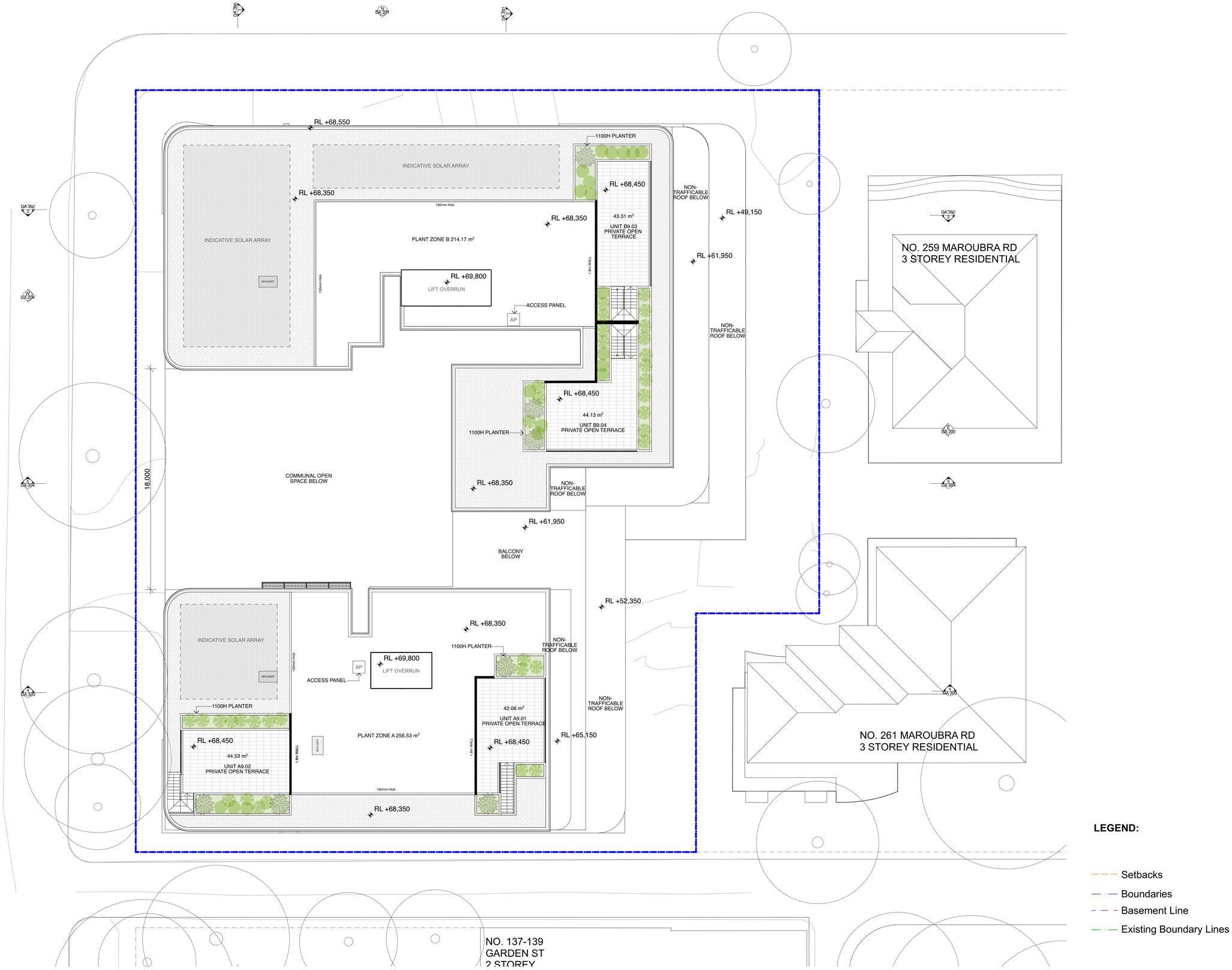
Print Date
12/2/2026

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JG, JB

Project
251 - 257 Maroubra Road & 133 Garden Street Maroubra NSW 2035 Australia

Drawing
Level 09 Floor Plan

Project No. **24029**
Revision **A**
Drawing No. **DA 106**



LEGEND:

- Setbacks
- Boundaries
- Basement Line
- Existing Boundary Lines

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North

Scale at A1
1:150

Status
SSDA

Drawn
CM, SA, RD

Print Date
12/2/2026

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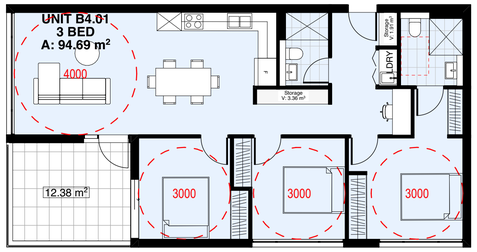
Project
251 - 257 Maroubra Road & 133 Garden Street Maroubra NSW 2035 Australia

Drawing
Roof Plan

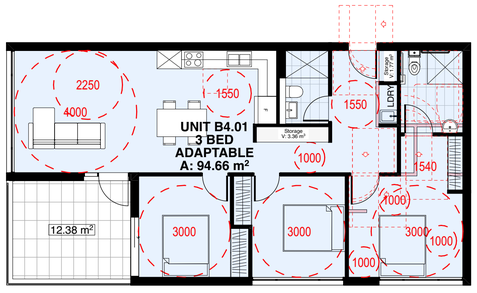
Project No. **24029**
Revision **A**
Drawing No. **DA 107**

Adaptable Units

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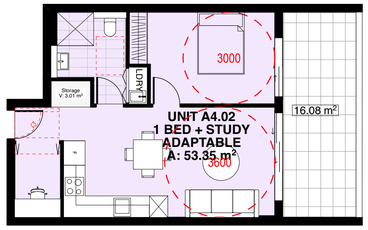


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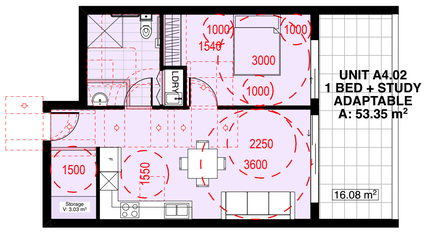


POST - ADAPTATION

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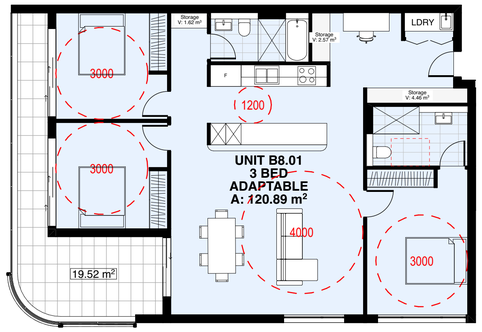


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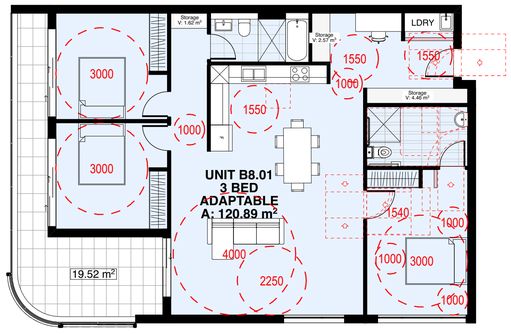


POST - ADAPTATION

3 UNITS : A8.03, B8.01, B9.01



PRE - ADAPTATION



POST - ADAPTATION

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Status
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Drawn
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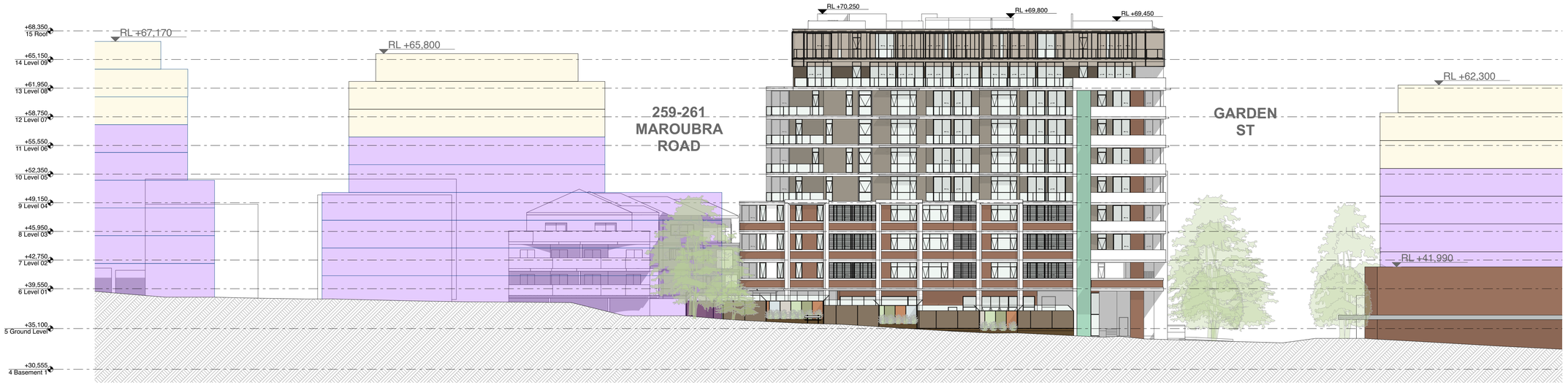
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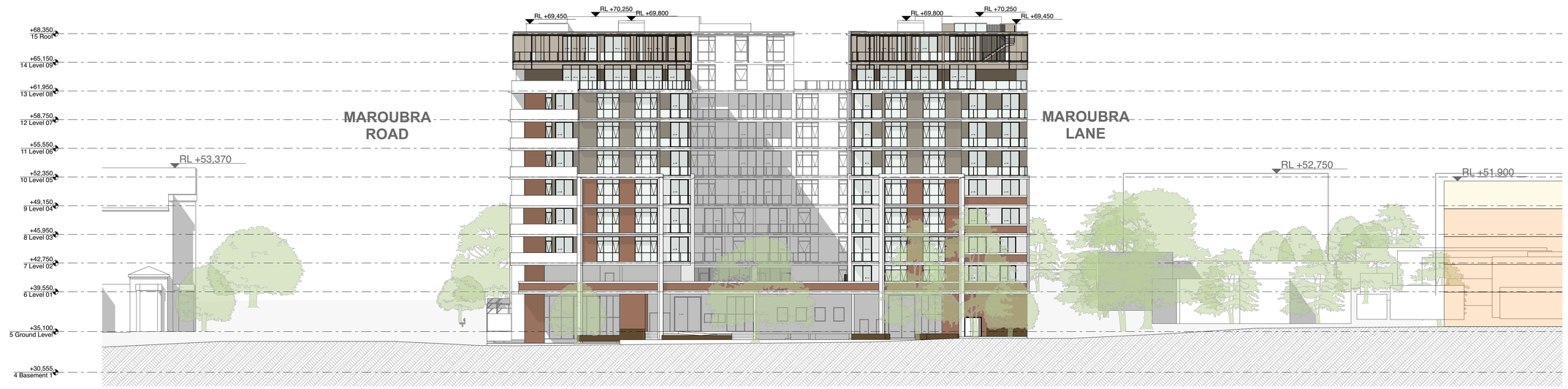
Drawing
Adaptable Units

Project No. **24029**
Revision **A**
Drawing No. **DA 108**

Streetscape Elevations



1 Maroubra Rd Elevation
1:250



2 Garden Street Elevation
1:250

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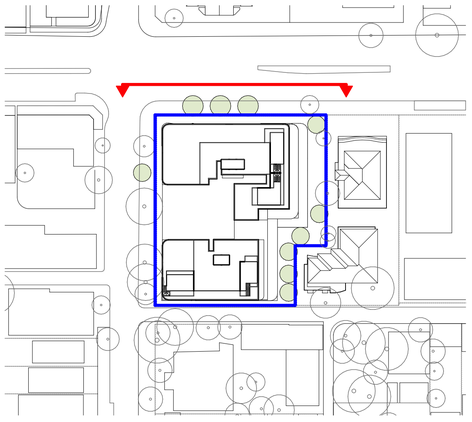
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Project
251 - 257 Maroubra Road & 133 Garden Street Maroubra NSW 2035 Australia

Drawing
Streetscape Elevation

Project No. **24029**
Revision **A**
Drawing No. **DA 200**





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NORTH COAST
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North

Scale at A1
1:150

Status
SSDA

Drawn
CM, SA, RD

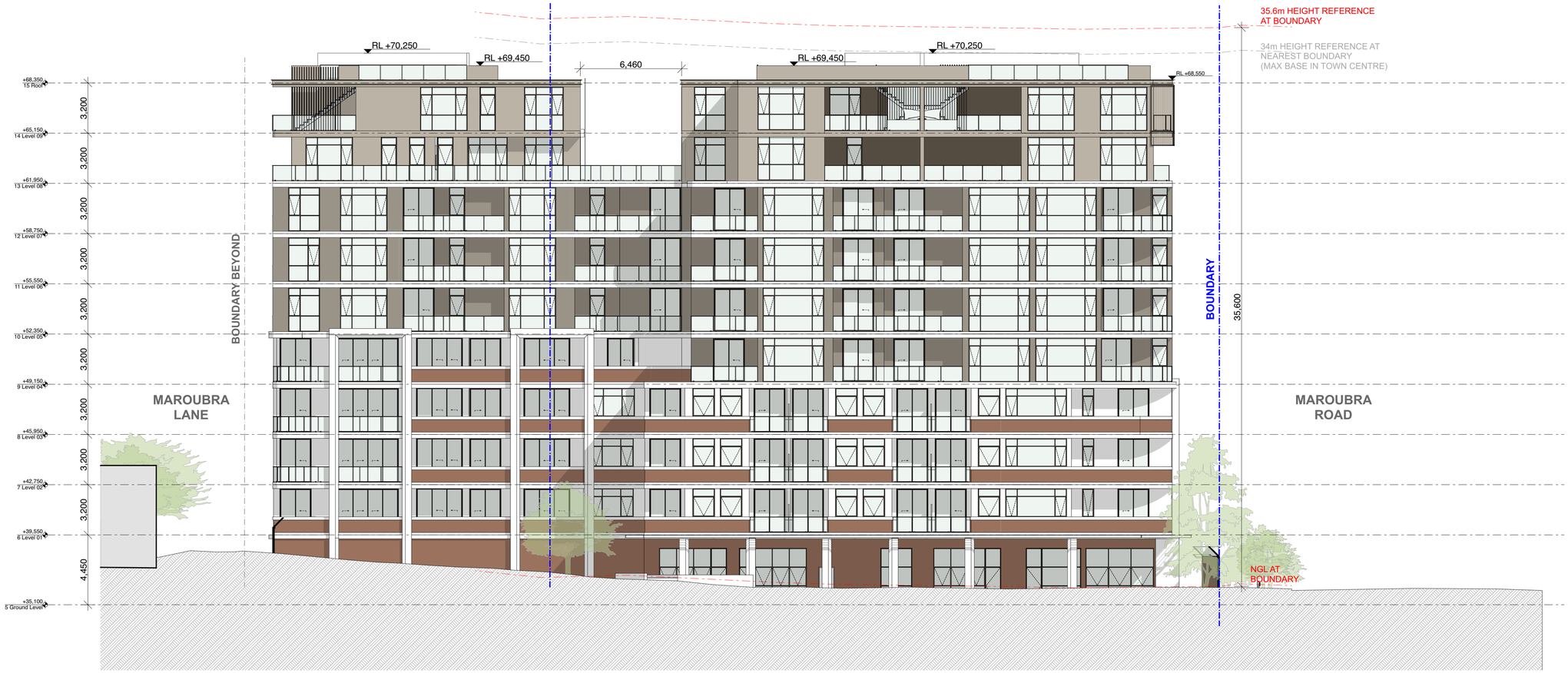
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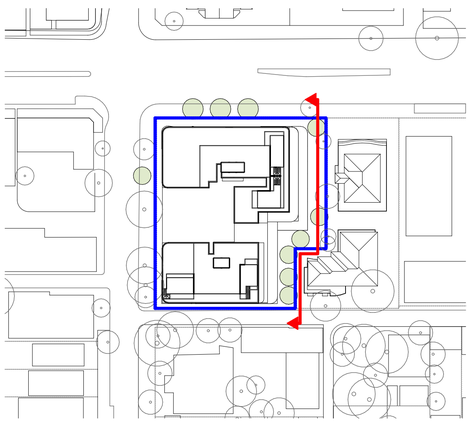
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JG, JB

Project
251 - 257 Maroubra Road & 133 Garden Street Maroubra NSW 2035 Australia

Drawing
North Elevation - Maroubra Road

Project No.	Revision	Drawing No.
24029	A	DA 201





General Notes

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Nominated Architect (NSW) - John Baker 3552

Rev	Date	Issue
A	12/2/2026	SSDA Submission

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3. Arborist
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4. Landscape
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5. Civil and Stormwater
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Kamyar Eivazzadeh
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6. BCA and Access
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7. Acoustic
Koikas Acoustics
Rowan Frizell
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8. Traffic and Parking
Genesis Traffic
Bernard Lo
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9. Waste Management
Elephants Foot
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10. Photomontage
Platypus Digit
Gordon Kam
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North

Scale at A1
1:150

Status
SSDA

Drawn
CM, SA, RD

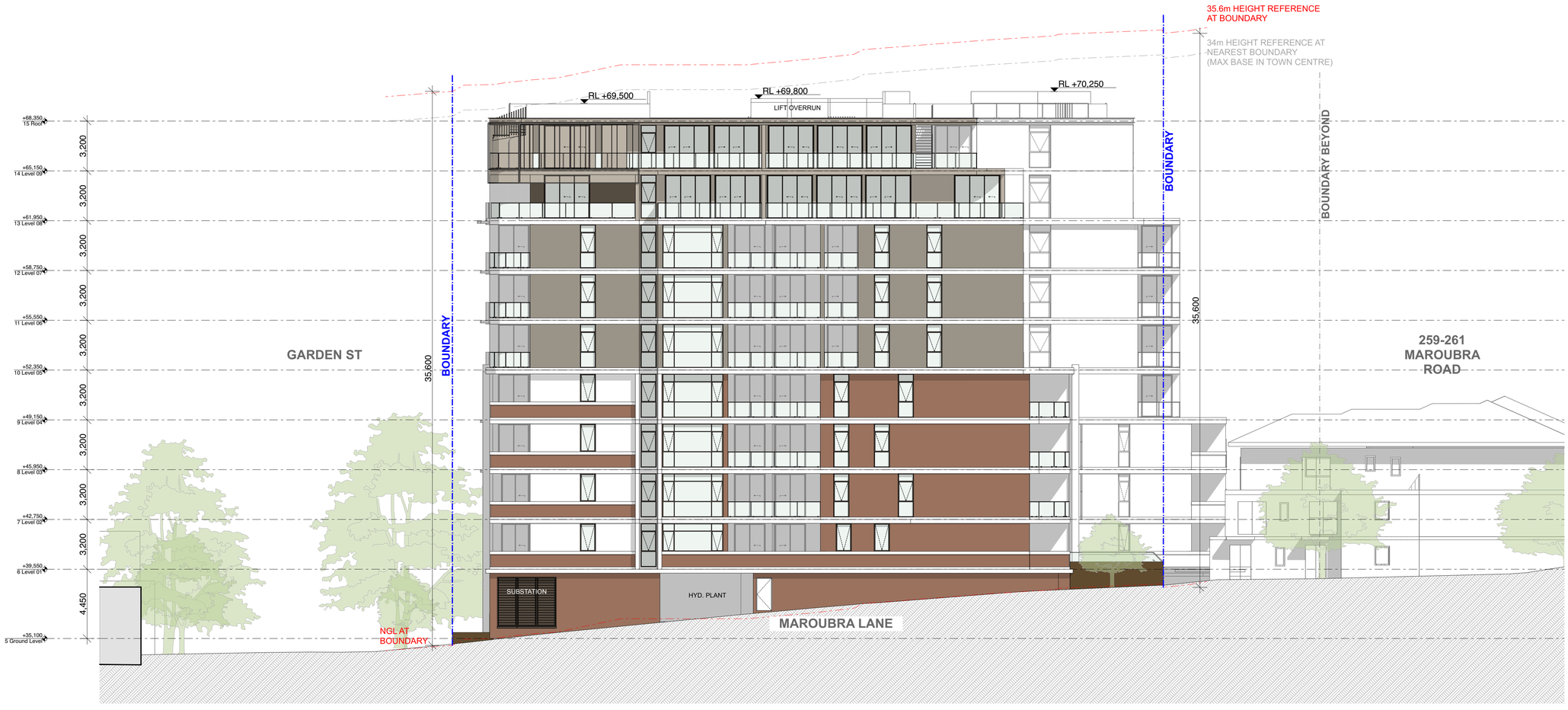
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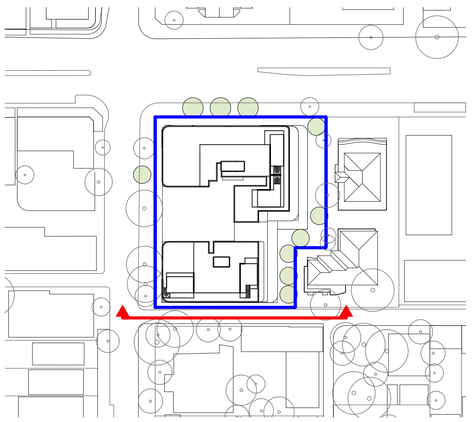
Checked
JG, JB

Project
251 - 257 Maroubra Road & 133 Garden Street Maroubra NSW 2035 Australia

Drawing
East Elevation

Project No.	Revision	Drawing No.
24029	**A**	**DA 202**





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North

Scale at A1
1:150

Status
SSDA

Drawn
CM, SA, RD

Print Date
12/2/2026

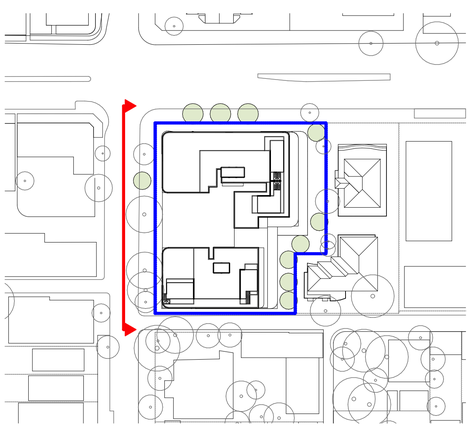
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JG, JB

Project
251 - 257 Maroubra Road & 133 Garden Street Maroubra NSW 2035 Australia

Drawing
South Elevation - Maroubra Lane

Project No.	Revision	Drawing No.
24029	A	DA 203





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North

Scale at A1
1:150

Status
SSDA

Drawn
CM, SA, RD

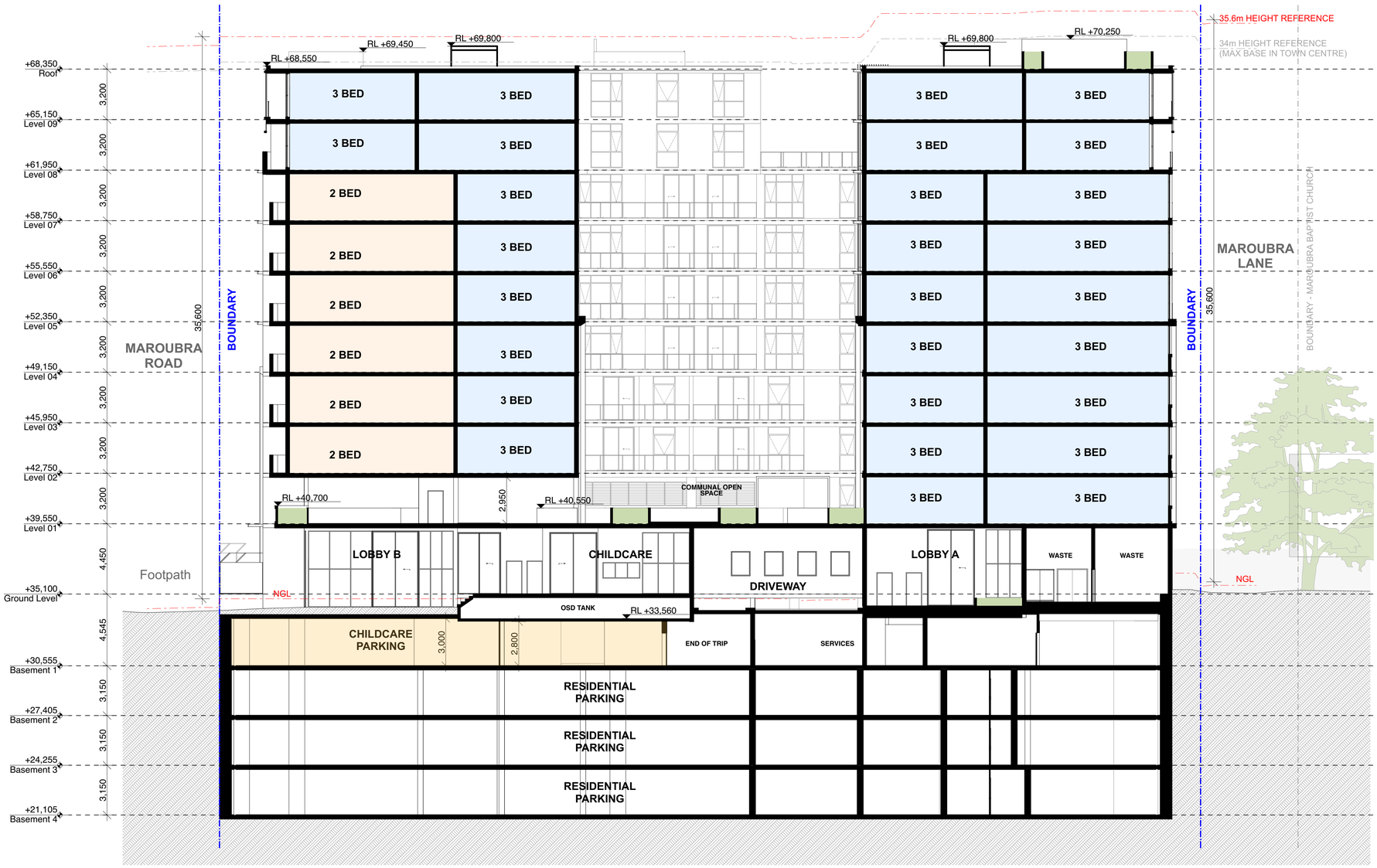
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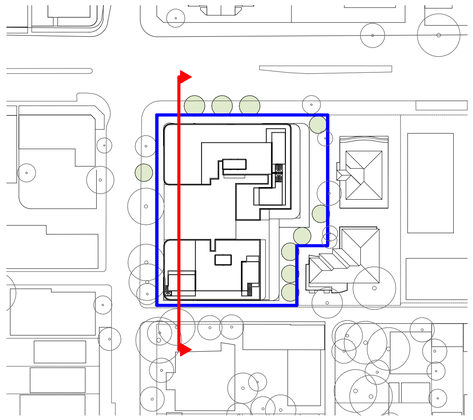
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JG, JB

Project
251 - 257 Maroubra Road & 133 Garden Street Maroubra NSW 2035 Australia

Drawing
West Elevation - Garden Street

Project No.	Revision	Drawing No.
24029	A	DA 204





General Notes

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Rev	Date	Issue
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North

Scale at A1
1:150

Status
SSDA

Drawn
CM, SA, RD

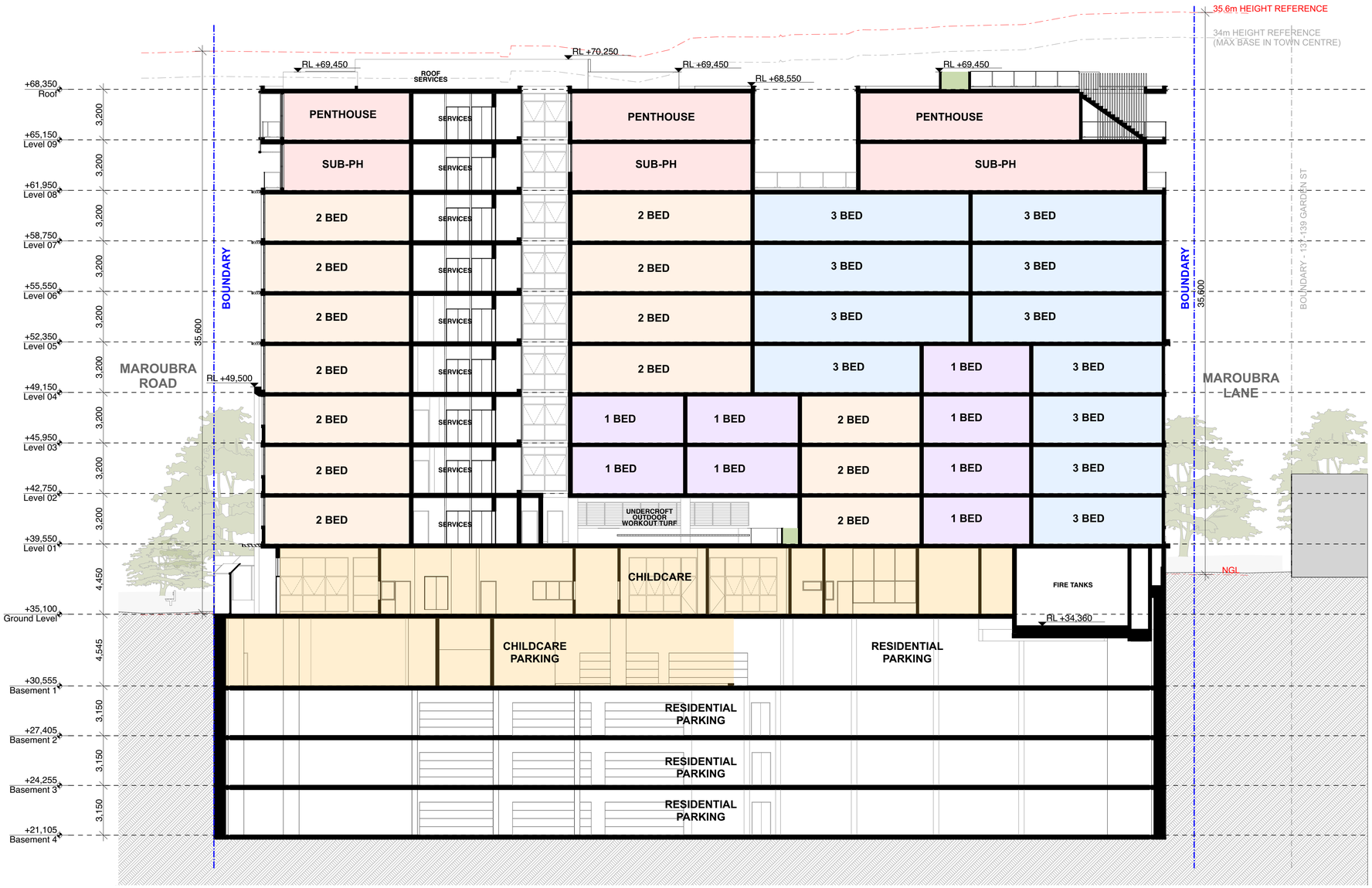
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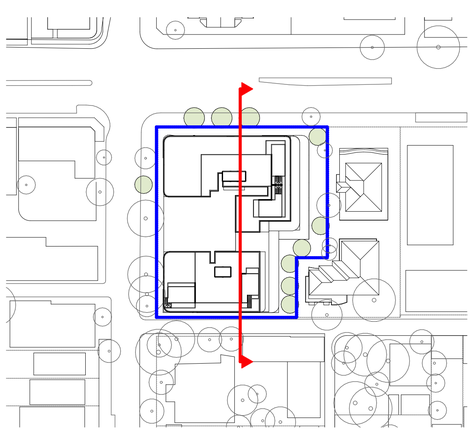
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JG, JB

Project
251 - 257 Maroubra Road & 133 Garden Street Maroubra NSW 2035 Australia

Drawing
Section 1

Project No. **24029**
Revision **A**
Drawing No. **DA 300**





General Notes

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Rev	Date	Issue
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Ruban Jayaratnam
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10. Photomontage
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North

Scale at A1
1:150

Status
SSDA

Drawn
CM, SA, RD

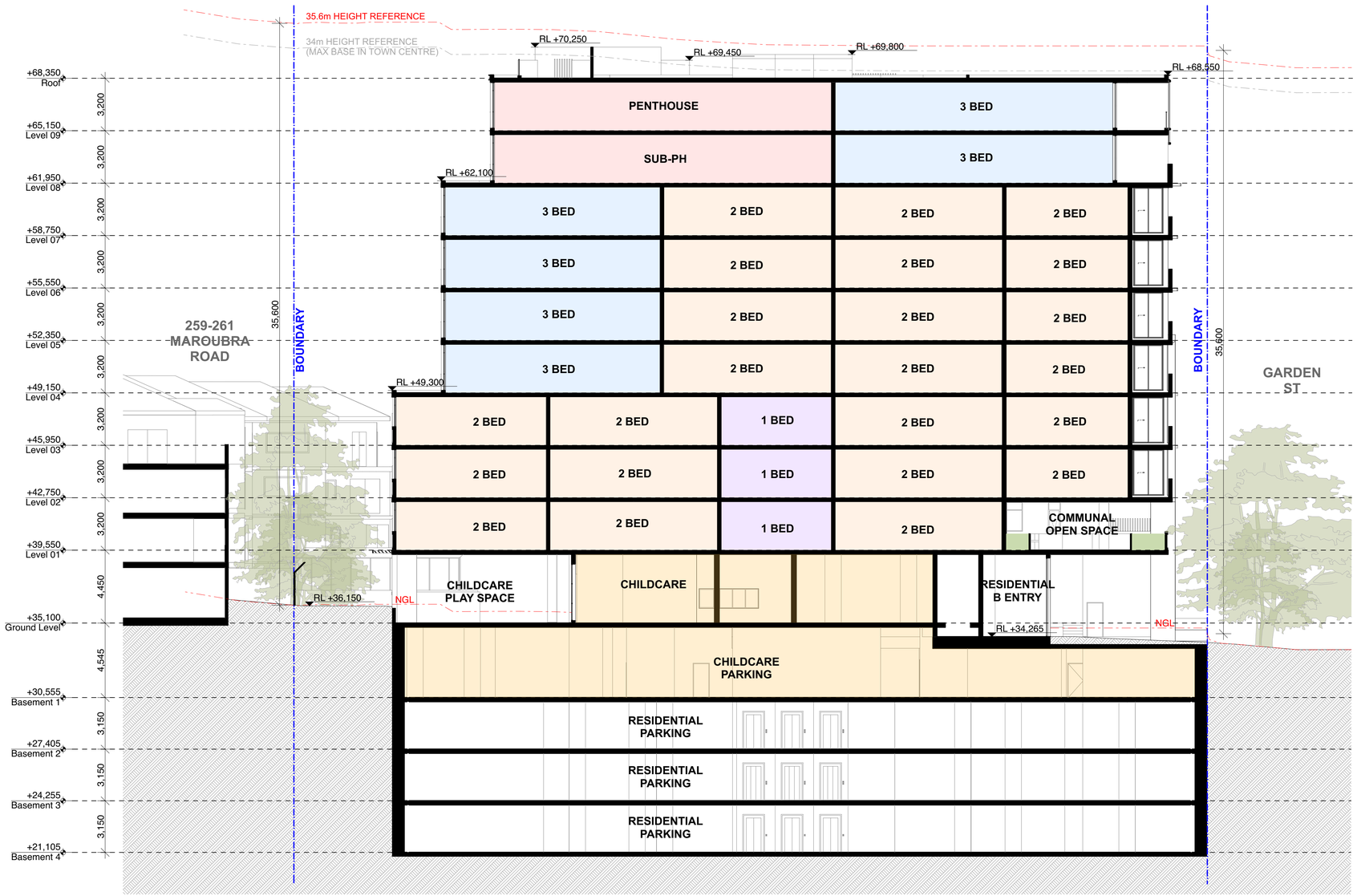
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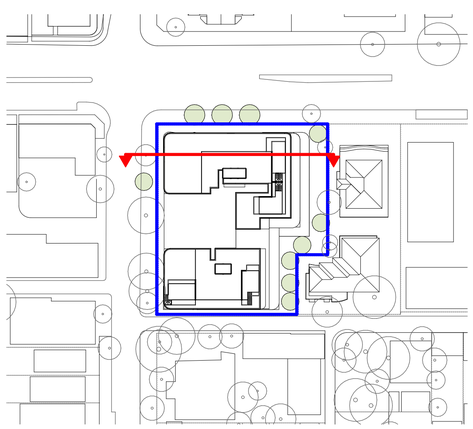
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JG, JB

Project
251 - 257 Maroubra Road & 133 Garden Street Maroubra NSW 2035 Australia

Drawing
Section 2

Project No. **24029**
Revision **A**
Drawing No. **DA 301**





General Notes

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Nominated Architect (NSW) - John Baker 3552

Rev	Date	Issue
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North

Scale at A1
1:150

Status
SSDA

Drawn
CM, SA, RD

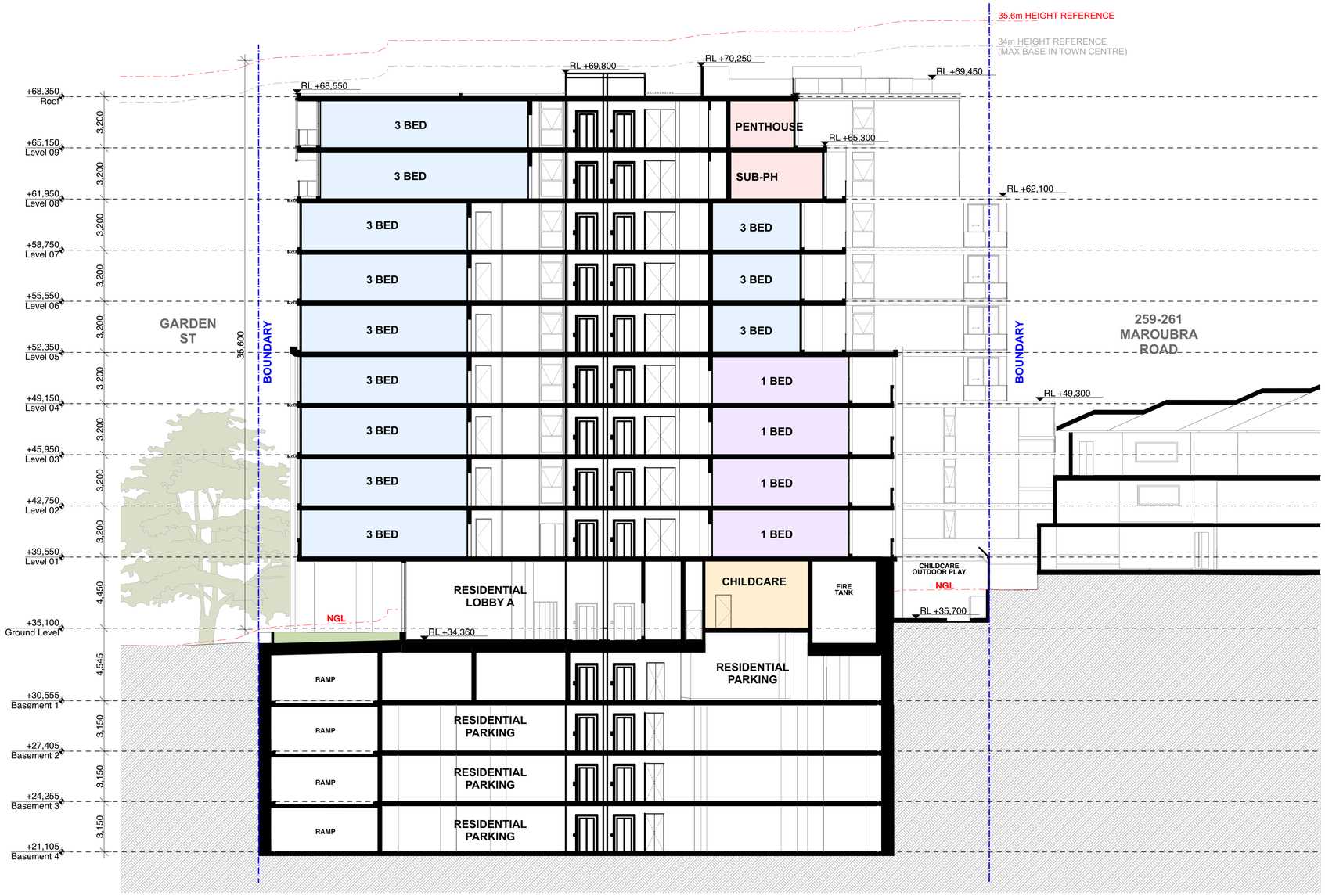
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12/2/2026

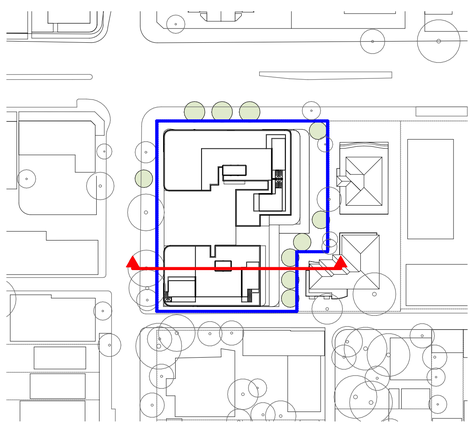
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JG, JB

Project
251 - 257 Maroubra Road & 133 Garden Street Maroubra NSW 2035 Australia

Drawing
Section 3

Project No. **24029**
Revision **A**
Drawing No. **DA 302**





General Notes

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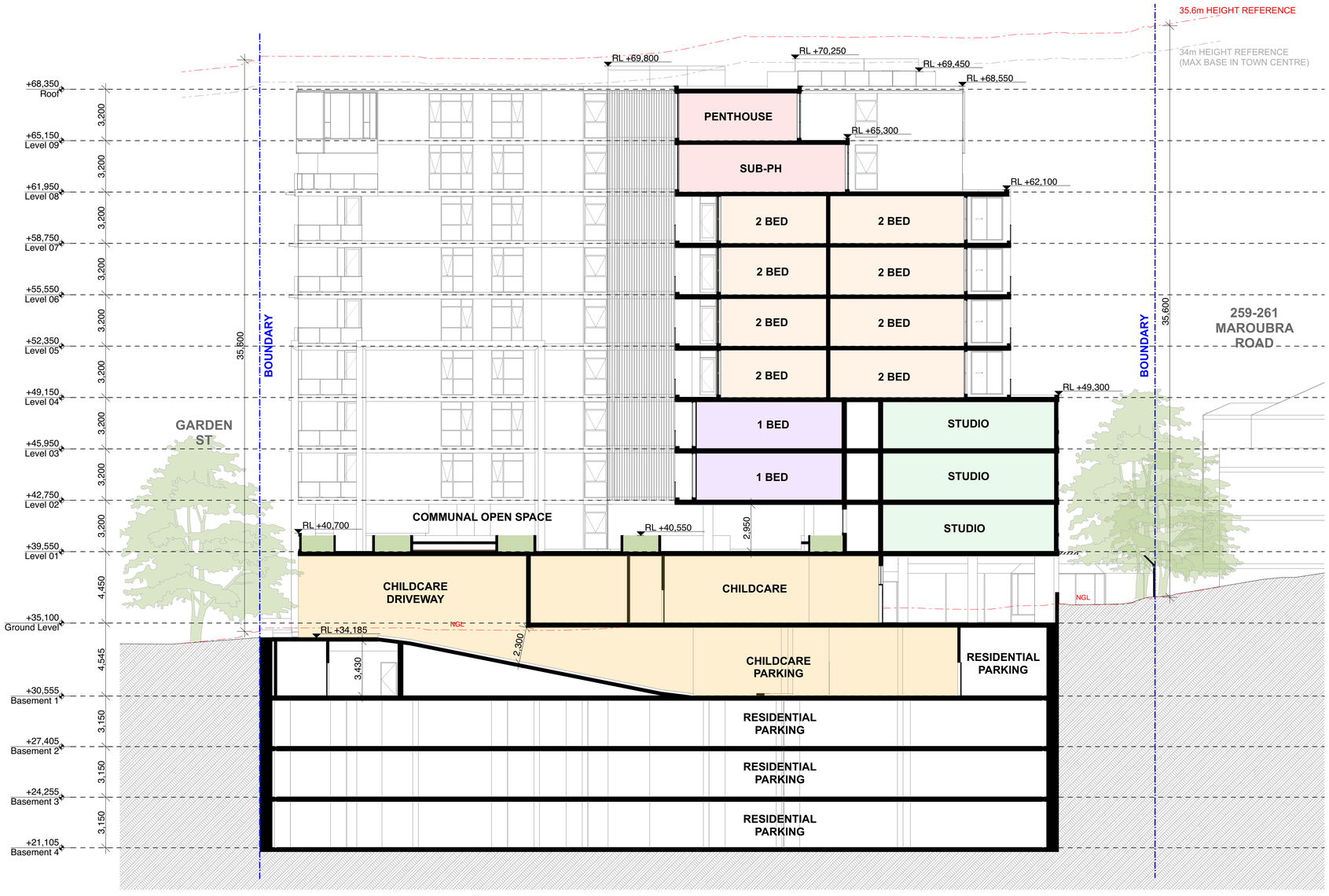
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12/2/2026

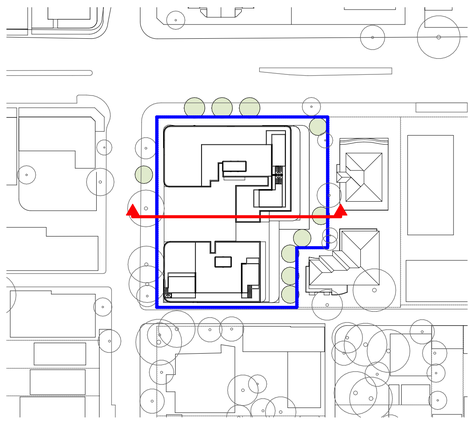
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Project
251 - 257 Maroubra Road & 133 Garden Street Maroubra NSW 2035 Australia

Drawing
Section 4

Project No.	Revision	Drawing No.
24029	A	DA 303





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Scale at A1
1:150

Status
SSDA

Drawn
CM, SA, RD

Print Date
12/2/2026

Checked
JG, JB

Project
251 - 257 Maroubra Road & 133 Garden Street Maroubra NSW 2035 Australia

Drawing
Section 5

Project No. **24029**
Revision **A**
Drawing No. **DA 304**

External Finishes Schedule





01
PERFORATED HERRINGBONE SCREEN, POWDERCOATED IN DULUX NICKEL PEARL



02
STEEL SHEET EXPRESSED JOINT CLADDING, IN COLORBOND DUNE



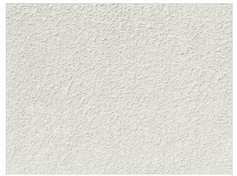
03
CEMENT RENDER WITH PAINT FINISH JASPER



04
TRUBRIX FACADE SYSTEM WITH THIN BRICK BLEND OF REDS, BROWNS AND SAND



05
CEMENT RENDER WITH PAINT FINISH GULLY



06
CEMENT RENDER WITH PAINT FINISH SNOWY MOUNTAINS HALF



07
TIMBER-LOOK ALUMINIUM SOFFIT CLADDING



08
LOUVRE SHADING POWDERCOATED WHITE



09
ALUMINIUM POWDERCOATED FRAMES IN DULUX BRONZE PEARL



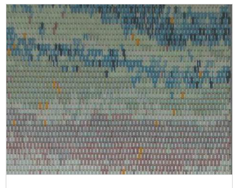
10
CLEAR GLASS BALUSTRADE



11
PERFORATED DECORATIVE SCREEN, POWDERCOAT DULUX BRONZE PEARL



12
COLOURED ACOUSTIC PANEL FENCE



13
FEATURE WALL TILE

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Nominated Architect (NSW) - John Baker 3552

Rev	Date	Issue
A	12/2/2026	SSDA Submission

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4. Landscape
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Status
SSDA

Drawn
CM, SA, RD

Print Date
12/2/2026

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Project
251 - 257 Maroubra Road & 133 Garden Street Maroubra NSW 2035 Australia

Drawing
External Finishes Schedule

Project No.	Revision	Drawing No.
24029	A	DA 600

Materiality



Balanced Composition
Solid heavier brick base + Lighter shaft



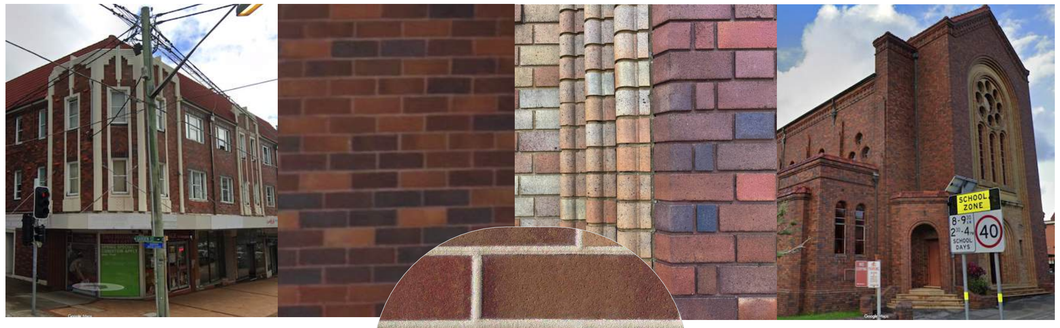
Brick balustrades wrapping around podium level balconies
Earthy material connecting to the natural context



Sculpted curved balcony
Reinterpretation of white art deco ornamentation on Crossley Court



Public artwork - Mural & Sculpture
Emphasis on verticality and connecting with country



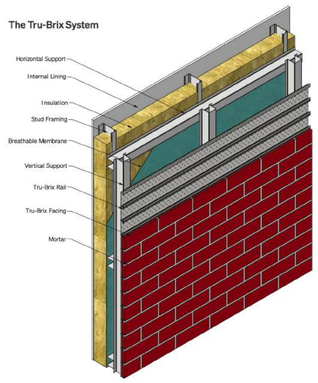
RED BRICK - 35%

MID BROWN BRICK - 50%

BLONDE BRICK - 15%



BRK01
Tru-brix facade with brown, red and sand face brick - custom blend inspired by the neighbouring heritage items



Tru-brix technical section



Perspective view
Key Material Traits

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Project
251 - 257 Maroubra Road & 133 Garden Street Maroubra NSW 2035 Australia

Drawing
Materiality

Project No. **24029**
Revision **A**
Drawing No. **DA 601**



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251 - 257 Maroubra Road & 133 Garden Street Maroubra NSW 2035 Australia

Drawing
Eye of the Sun Diagram - 9am

Project No. **24029**
Revision **A**
Drawing No. **DA 700**



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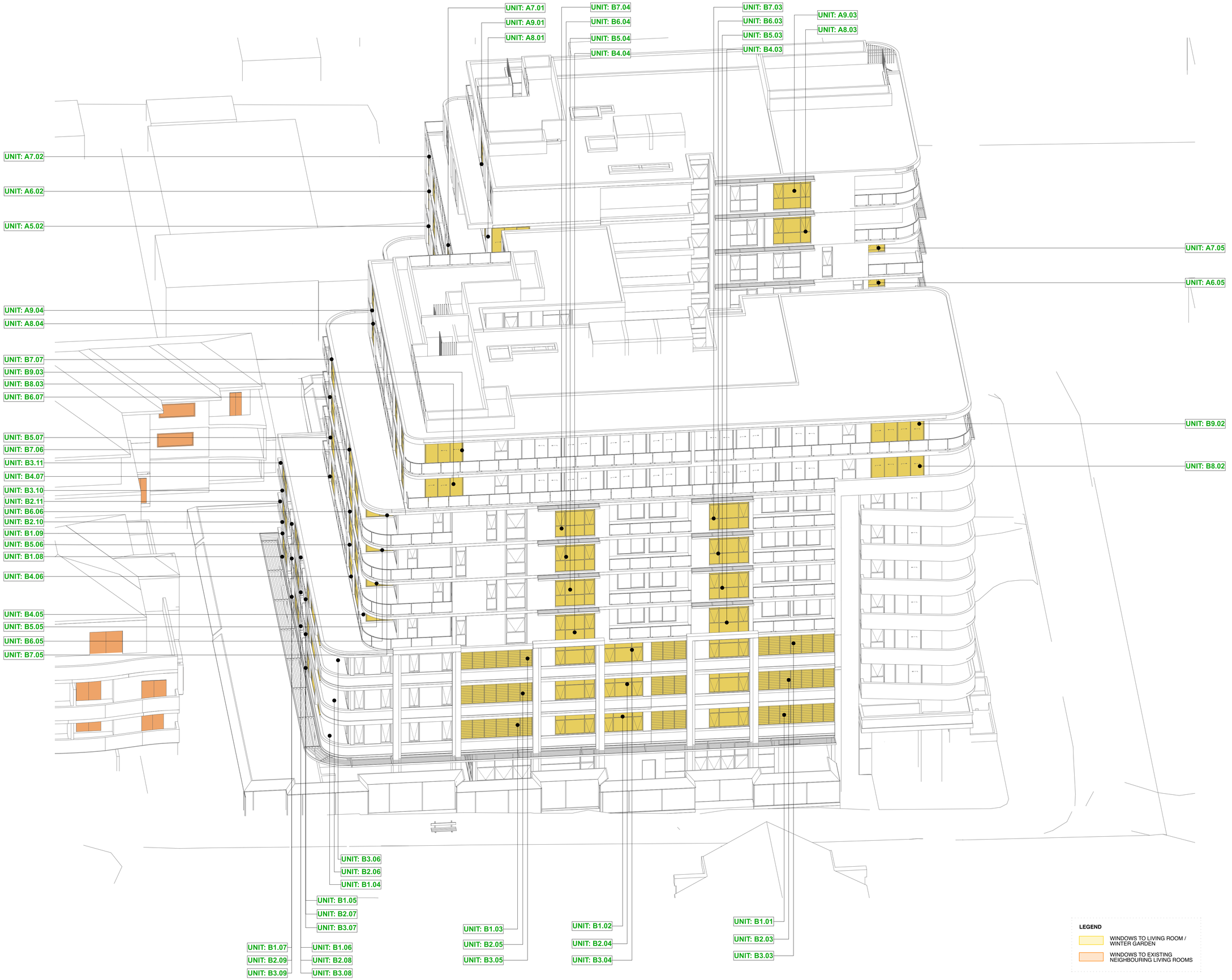
Print Date
12/2/2026

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JG, JB

Project
251 - 257 Maroubra Road & 133 Garden Street Maroubra NSW 2035 Australia

Drawing
Eye of the Sun Diagram - 10am

Project No.	Revision	Drawing No.
24029	A	DA 701



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Status
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Print Date
12/2/2026

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Project
251 - 257 Maroubra Road & 133 Garden Street Maroubra NSW 2035 Australia

Drawing
Eye of the Sun Diagram - 11am

Project No.	Revision	Drawing No.
24029	A	DA 702



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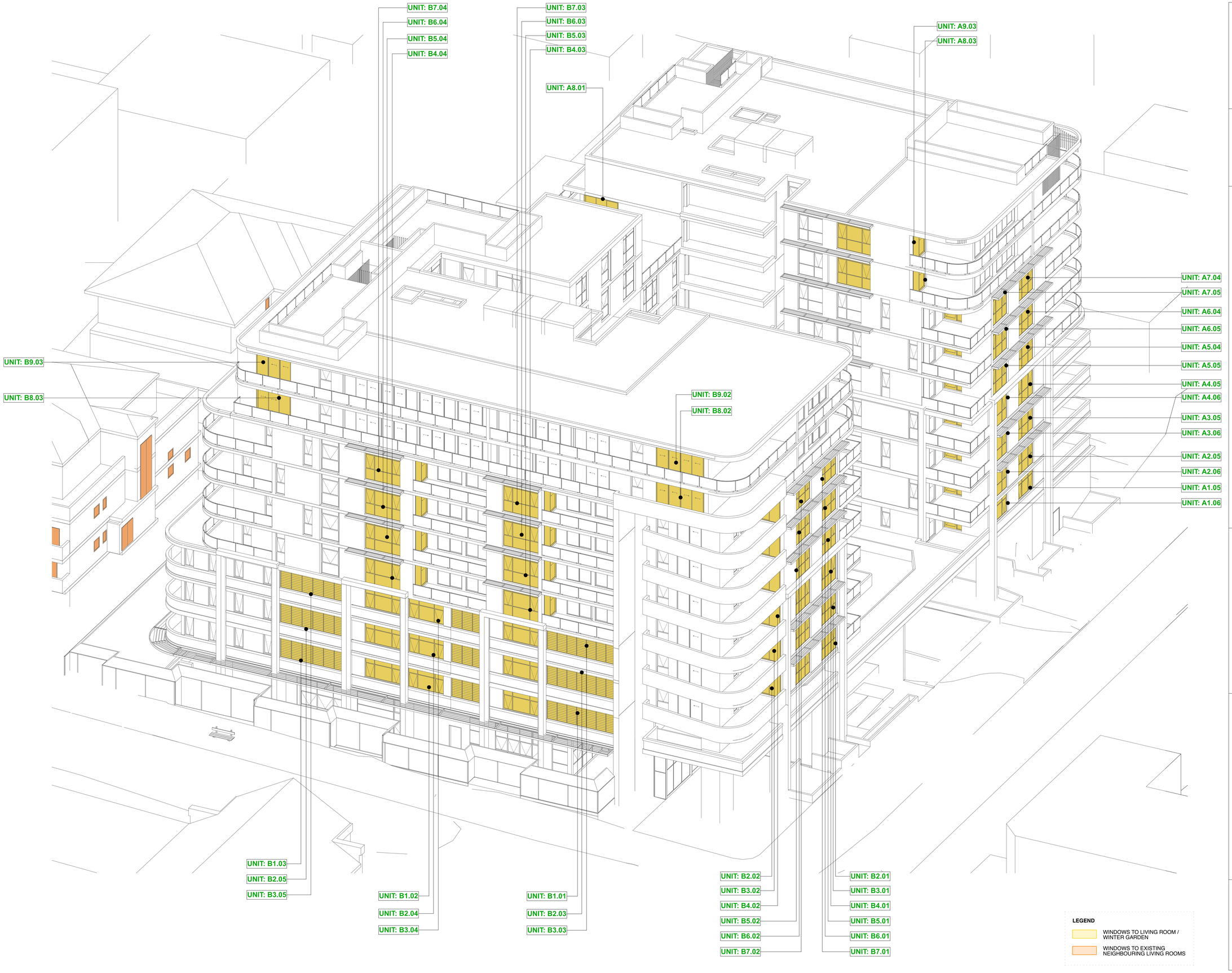
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12/2/2026

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Project
251 - 257 Maroubra Road & 133 Garden Street Maroubra NSW 2035 Australia

Drawing
Eye of the Sun Diagram - 12pm

Project No.	Revision	Drawing No.
24029	A	DA 703



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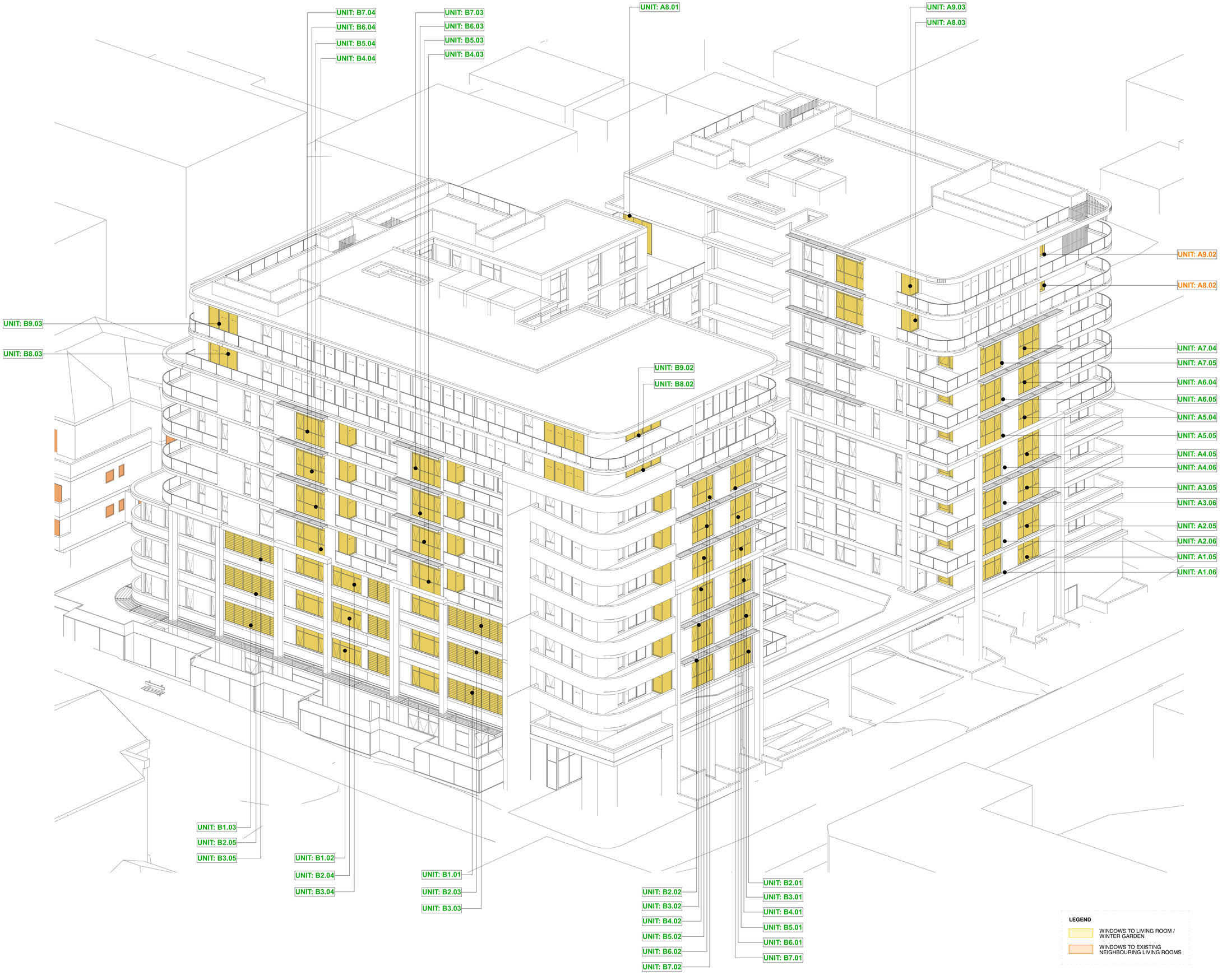
Project
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Drawing
Eye of the Sun Diagram - 1pm

Project No. **24029**

Revision **A**

Drawing No. **DA 704**



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Project
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Drawing
Eye of the Sun Diagram - 2pm

Project No. **24029**

Revision **A**

Drawing No. **DA 705**



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Nominated Architect (NSW) - John Baker 3552

Rev	Date	Issue
A	12/2/2026	SSDA Submission

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Gordon Kam
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North

Scale at A1

Status
SSDA

Drawn
CM, SA, RD

Print Date
12/2/2026

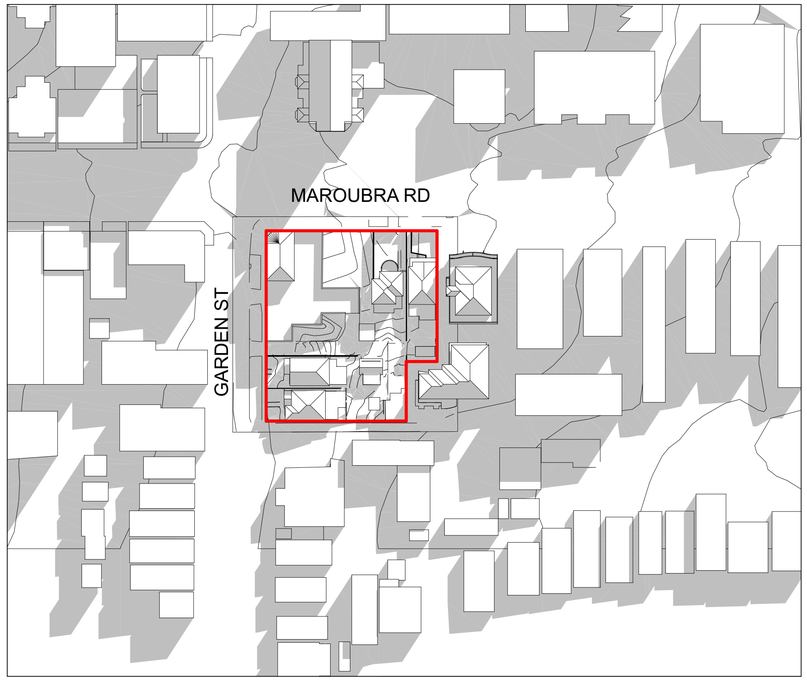
Checked
JG, JB

Project
251 - 257 Maroubra Road & 133 Garden Street Maroubra NSW 2035 Australia

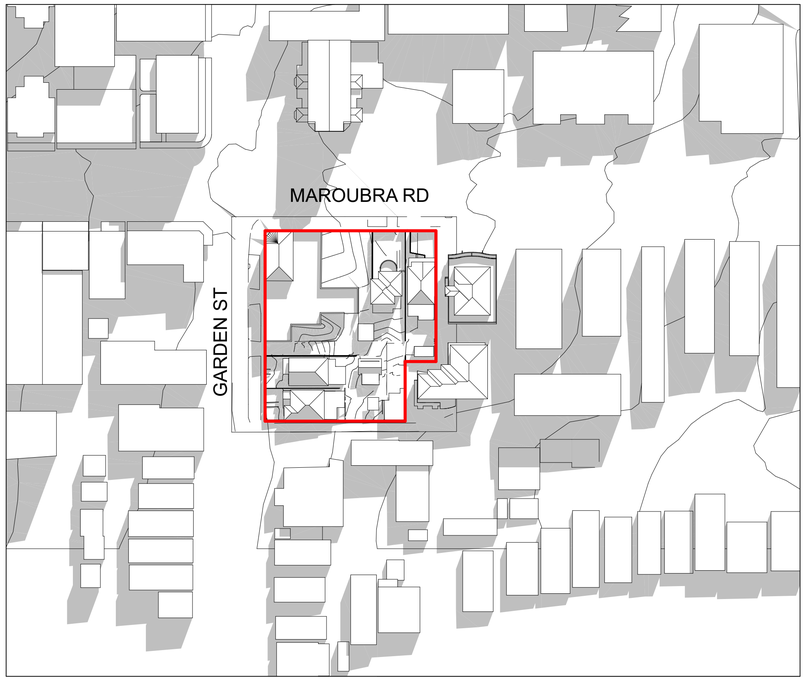
Drawing
Eye of the Sun Diagram - 3pm

Project No.	Revision	Drawing No.
24029	A	DA 706

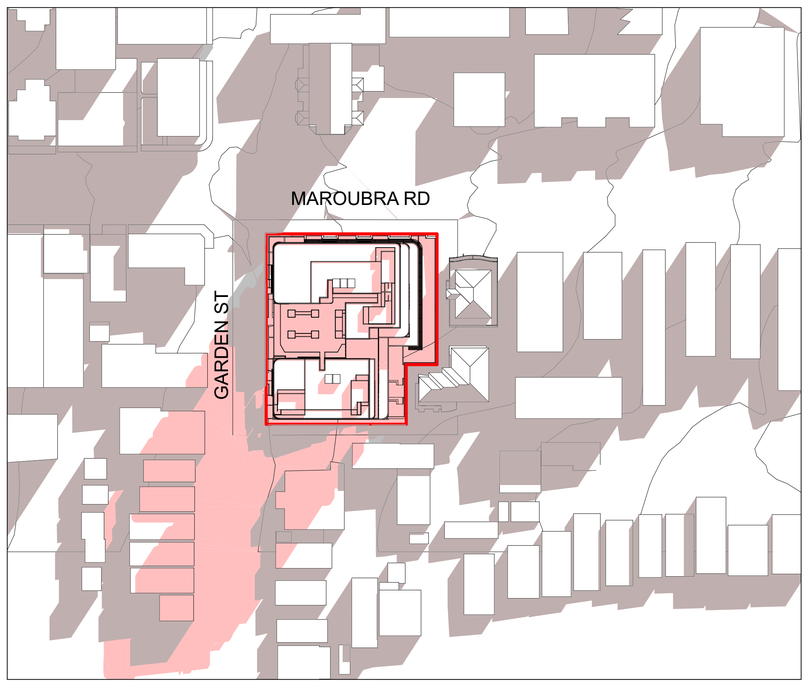
Shadow Diagrams



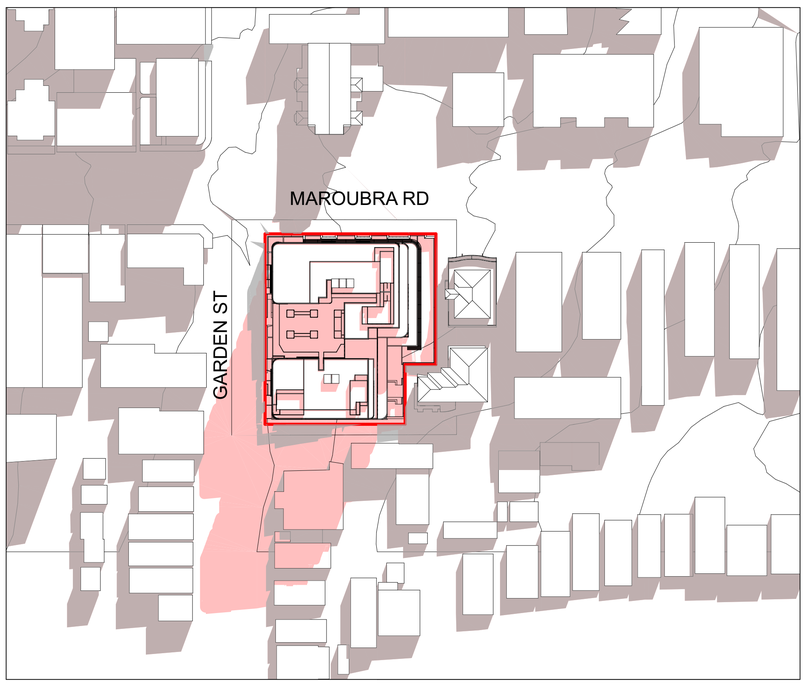
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1:1000



2 Shadow Diagram - 10am Existing
1:1000



3 Shadow Diagram - 9am Proposed
1:1000



4 Shadow Diagram - 10am Proposed
1:1000

EXISTING SHADOW

PROPOSED SHADOW

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North

Scale at A1
1:1000

Status
SSDA

Drawn
CM, SA, RD

Print Date
12/2/2026

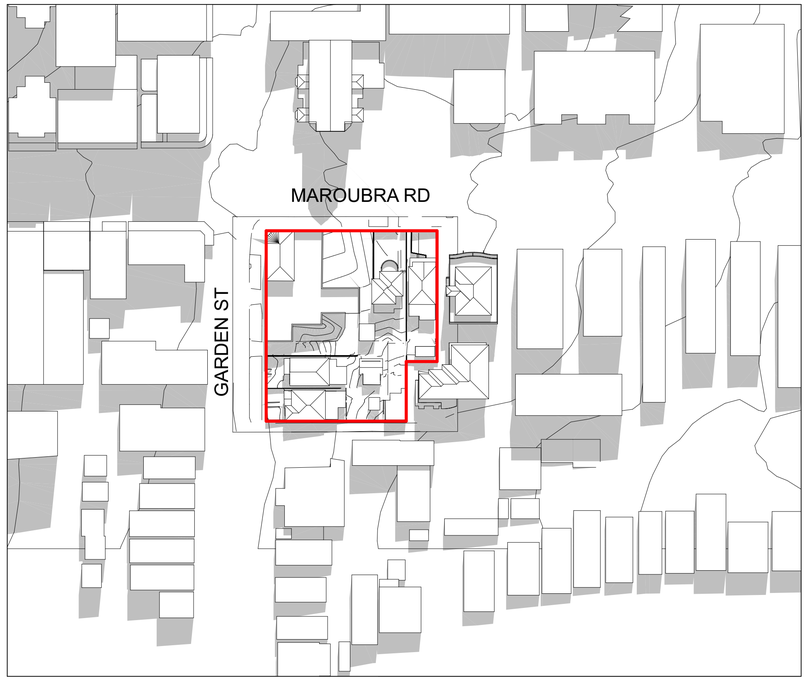
Checked
JG, JB

Project
251 - 257 Maroubra Road & 133 Garden Street Maroubra NSW 2035 Australia

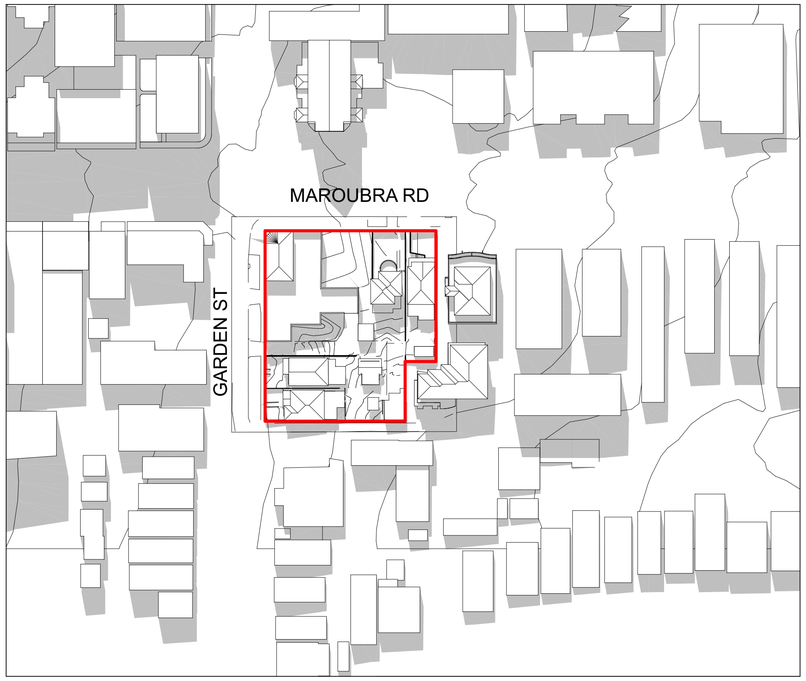
Drawing
Shadow Diagrams 1

Project No.	Revision	Drawing No.
24029	**A**	**DA 710**

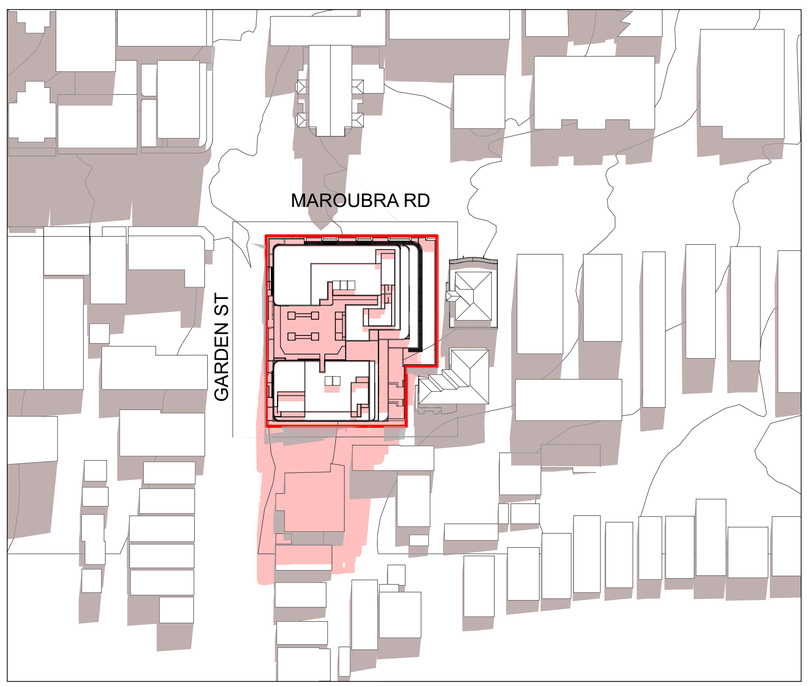
Shadow Diagrams



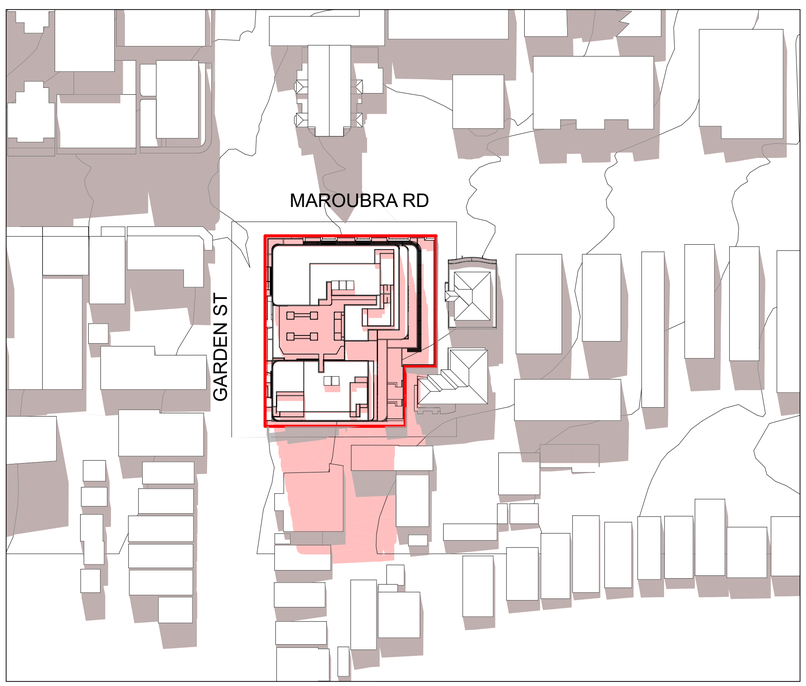
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1:1000



2 Shadow Diagram - 12pm Existing
1:1000



3 Shadow Diagram - 11am Proposed
1:1000



4 Shadow Diagram - 12pm Proposed
1:1000

EXISTING SHADOW

PROPOSED SHADOW

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North

Scale at A1
1:1000

Status
SSDA

Drawn
CM, SA, RD

Print Date
12/2/2026

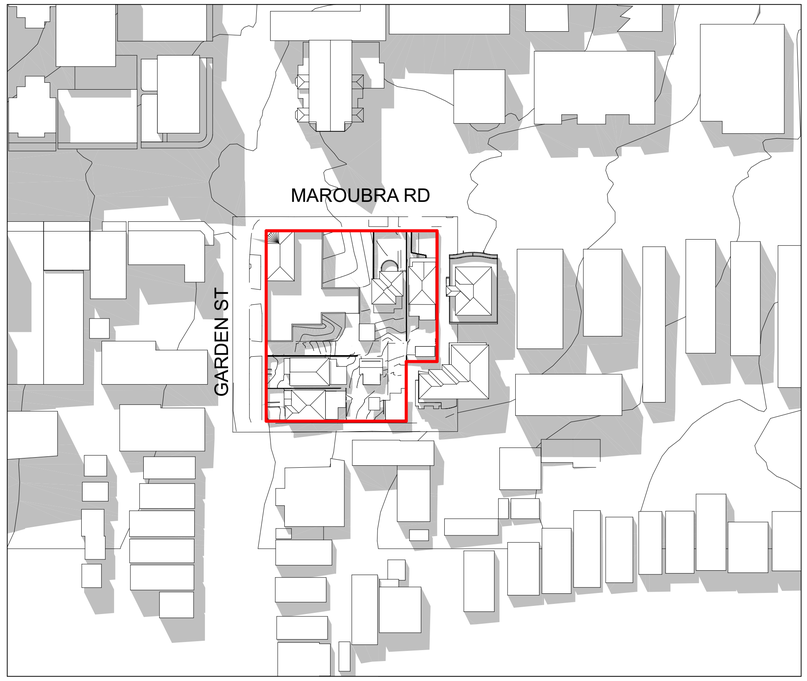
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JG, JB

Project
251 - 257 Maroubra Road & 133 Garden Street Maroubra NSW 2035 Australia

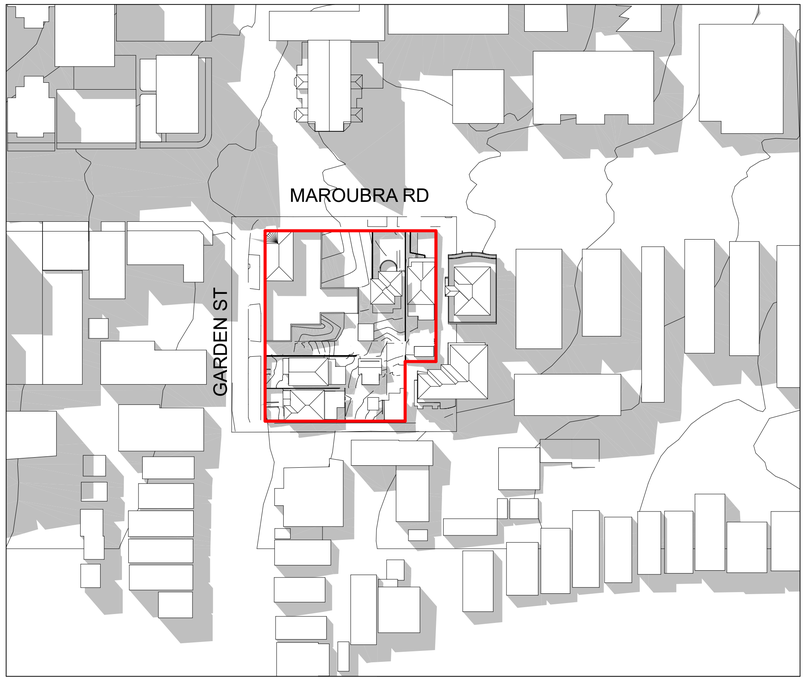
Drawing
Shadow Diagrams 2

Project No.	Revision	Drawing No.
24029	**A**	**DA 711**

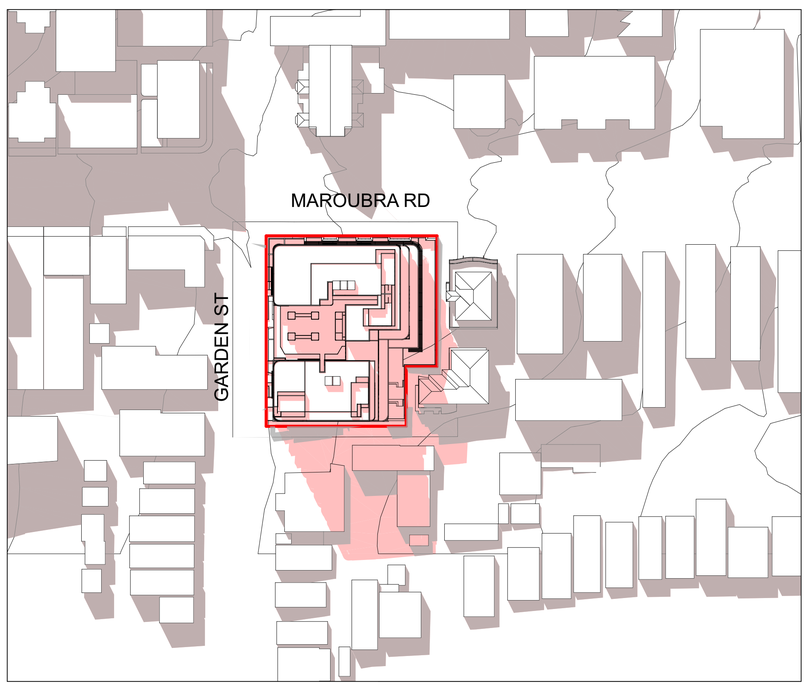
Shadow Diagrams



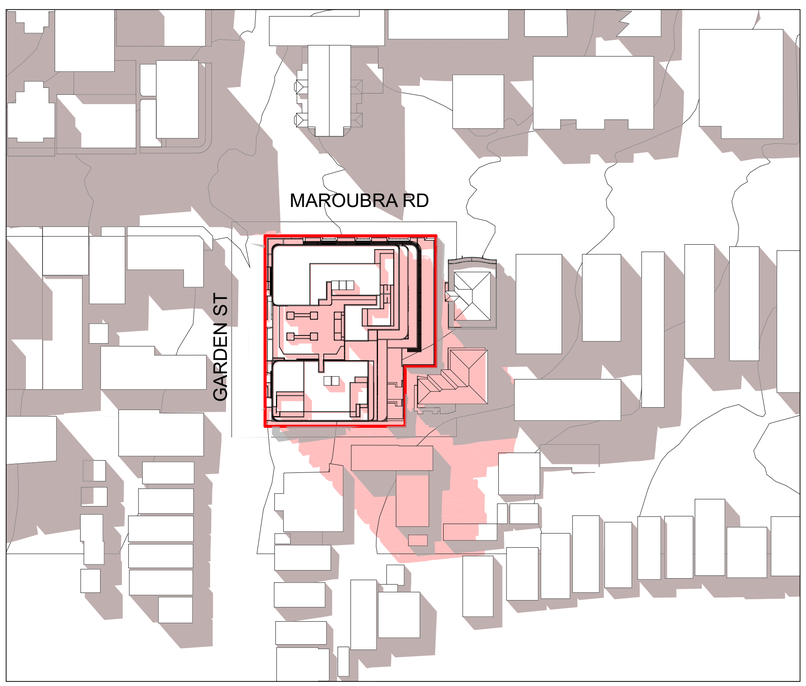
1 Shadow Diagram - 1pm Existing
1:1000



4 Shadow Diagram - 2pm Existing
1:1000



2 Shadow Diagram - 1pm Proposed
1:1000



3 Shadow Diagram - 2pm Proposed
1:1000

EXISTING SHADOW

PROPOSED SHADOW

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North

Scale at A1
1:1000

Status
SSDA

Drawn
CM, SA, RD

Print Date
12/2/2026

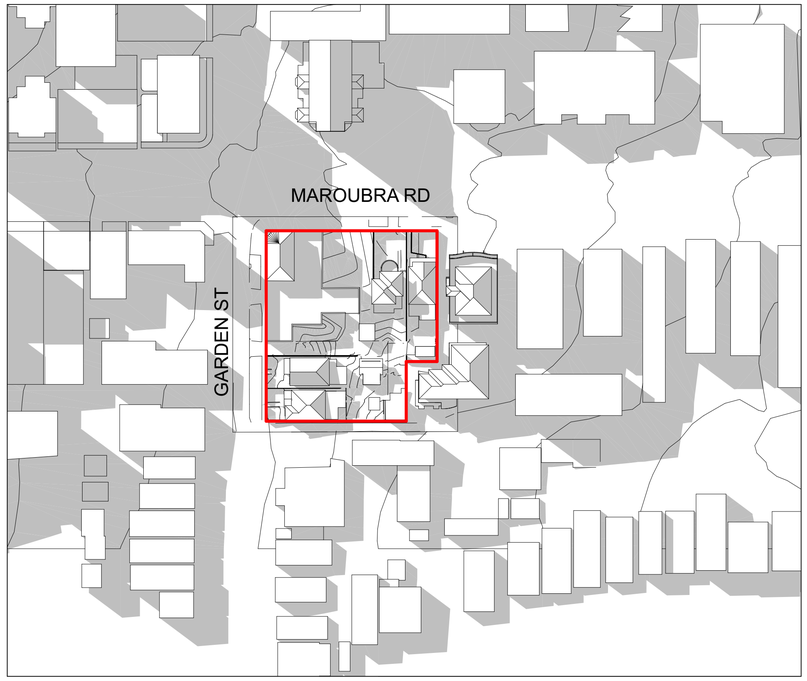
Checked
JG, JB

Project
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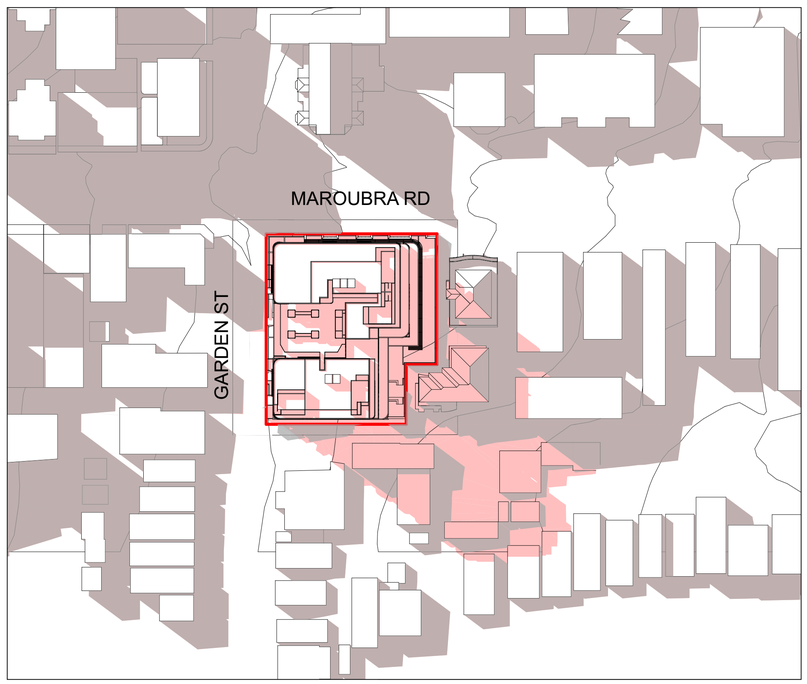
Drawing
Shadow Diagrams 3

Project No.	Revision	Drawing No.
24029	**A**	**DA 712**

Shadow Diagrams



1 Shadow Diagram - 3pm Existing
1:1000



2 Shadow Diagram - 3pm Proposed
1:1000

EXISTING SHADOW

PROPOSED SHADOW

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North

Scale at A1
1:1000

Status
SSDA

Drawn
CM, SA, RD

Print Date
12/2/2026

Checked
JG, JB

Project
251 - 257 Maroubra Road & 133 Garden Street Maroubra NSW 2035 Australia

Drawing
Shadow Diagrams 4

Project No. **24029**
Revision **A**
Drawing No. **DA 713**

Photomontage

1 Artist's CGI Impression - Corner view of Maroubra Road & Garden Street

2 Existing View





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Print Date
12/2/2026

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Project
251 - 257 Maroubra Road & 133 Garden Street Maroubra NSW 2035 Australia

Drawing
3D Views - Sheet 1

Project No.	Revision	Drawing No.
24029	A	DA 800

Photomontage

1 Artist's CGI Impression - View along Maroubra Road towards the Town Centre

2 Existing View





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Drawn
CM, SA, RD

Print Date
12/2/2026

Checked
JG, JB

Project
251 - 257 Maroubra Road & 133 Garden Street Maroubra NSW 2035 Australia

Drawing
3D Views - Sheet 2

Project No. **24029**

Revision **A**

Drawing No. **DA 801**

Photomontage

1 Artist's CGI Impression - Aerial view along Maroubra Road towards the Town Centre

2 Existing View

1



2



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Scale at A1

Status
SSDA

Drawn
CM, SA, RD

Print Date
12/2/2026

Checked
JG, JB

Project
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Drawing
3D Views - Sheet 3

Project No.	Revision	Drawing No.
24029	**A**	**DA 802**

APPENDIX C: SUMMARY TABLES

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Table C1

Sample Information				Heavy Metals (mg/kg)								TRH (mg/kg)						BTEX (mg/kg)					PAH (mg/kg)				OCP (mg/kg)									OPP (mg/kg)			
Label	Depth (m BGL)	Date	Soil Type	ARSENIC	CADMIUM	CHROMIUM	COPPER	LEAD	MERCURY	NICKEL	ZINC	F1 (C_6-C_{10}) [2]	F2 (>C_{10}-C_{16}) [3]	F1 (C_6-C_{10})	F2 (>C_{10}-C_{16})	F3 (C_{16}-C_{34})	F4 (C_{34}-C_{40})	BENZENE	TOLUENE	ETHYL BENZENE	TOTAL XYLENES	NAPHTHALENE	BENZO(A)PYRENE	CARINOGENIC PAHs (as Bap TEQ)	TOTAL PAH	NAPHTHALENE	DDT + DDD + DDE	ALDRIN + DIELDRIN	CHLORDANE	ENDOSULFAN	ENDRIN	HEPTACHLOR	HCB	METHOXYCHLOR	DDT	CHLORPYIPHOS (OPP)	TOTAL PCB (mg/kg)	TOTAL VOC (mg/kg)	ASBESTOS ID (Presence / Absense)
FES DSI 2025																																						
BH1	0.0-0.1	11.08.2025	F- Sand	<1	<0.3	<0.5	3.20	11.0	<0.05	<0.5	16.0	<25	<25	<25	<25	<90	<120	<0.1	<0.1	<0.1	<0.3	<0.1	<0.1	<0.3	<0.8	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1	-	ND
BH1	0.6-0.7	11.08.2025	N-SAND	<1	<0.3	<0.5	<0.5	<1	<0.05	<0.5	<2	<25	<25	<25	<25	<90	<120	<0.1	<0.1	<0.1	<0.3	<0.1	<0.1	<0.3	<0.8	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1	-	-
BH2	0.1-0.2	12.08.2025	F- Sand	2	<0.3	2.10	19.00	79.0	<0.05	7.20	44.0	<25	<25	<25	<25	<90	<120	<0.1	<0.1	<0.1	<0.3	<0.1	<0.1	<0.3	<0.8	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1	-	ND
BH2	0.4-0.5	12.08.2025	N-SAND	<1	<0.3	0.50	0.70	1.0	<0.05	<0.5	4.3	<25	<25	<25	<25	<90	<120	<0.1	<0.1	<0.1	<0.3	<0.1	<0.1	<0.3	<0.8	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1	-	-
BH3	0.3-0.4	12.08.2025	F- Sand	<1	<0.3	1.30	8.40	17.0	<0.05	0.90	31.0	<25	<25	<25	<25	<90	<120	<0.1	<0.1	<0.1	<0.3	<0.1	0.3	0.5	2.4	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1	<LOR	ND
BH3	0.6-0.7	12.08.2025	F- Sand	<1	<0.3	1.70	11.00	25	<0.05	1.70	52	<25	<25	<25	<25	<90	<120	<0.1	<0.1	<0.1	<0.3	<0.1	0.7	1	5.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1	-	ND
BH4	0.0-0.1	12.08.2025	F- Sand	2	<0.3	5.60	20.00	240	<0.05	2.60	96	<25	<25	<25	<25	93	<120	<0.1	<0.1	<0.1	<0.3	<0.1	0.2	0.4	1.9	<0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	-	ND
BH4	0.2-0.3	12.08.2025	F- Sand	1	<0.3	3.30	19.00	200	0.05	2.10	71	<25	<25	<25	<25	160	<120	<0.1	<0.1	<0.1	<0.3	<0.1	2.1	2.9	27	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1	-	ND
BH5	0.0-0.1	12.08.2025	F- Sand	3	0.4	10.00	38.00	74	0.19	4.00	180	<25	60	<25	60	1200	250	<0.1	<0.1	<0.1	<0.3	<0.1	0.1	0.3	1.6	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1	-	ND
BH6	0.2-0.3	12.08.2025	F- Sand	2	<0.3	2.30	4.30	19	0.1	0.70	36	<25	<25	<25	<25	<90	<120	<0.1	<0.1	<0.1	<0.3	<0.1	0.2	0.3	1.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1	<LOR	ND
BH7	0.0-0.1	12.08.2025	F- Sand	2	<0.3	3.40	26.00	98	0.56	1.70	51	<25	<25	<25	<25	180	<120	<0.1	<0.1	<0.1	<0.3	<0.1	0.3	0.5	2.4	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1	-	ND
BH7	0.4-0.5	12.08.2025	N-SAND	1	<0.3	1.80	15.00	38	0.09	1.00	36	<25	<25	<25	<25	150	<120	<0.1	<0.1	<0.1	<0.3	<0.1	1.2	1.7	12	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1	-	-
BH8	0.0-0.1	12.08.2025	F- Sand	3	0.4	4.70	17.00	120	0.24	1.70	120	<25	<25	<25	<25	120	<120	<0.1	<0.1	<0.1	<0.3	<0.1	<0.1	<0.3	<0.8	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1	-	ND
BH9	0.0-0.1	12.08.2025	F- Sand	3	0.3	9.50	44.00	85	0.23	4.30	160	<25	<25	<25	<25	200	<120	<0.1	<0.1	<0.1	<0.3	<0.1	0.2	0.3	1.8	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	-	ND
BH10	0.1-0.2	08.09.2025	F -Silty Sandy Clay	10	<0.3	11.00	13.00	29	0.08	6.10	35	<25	<25	<25	<25	<90	<120	<0.1	<0.1	<0.1	<0.3	<0.1	<0.1	<0.3	<0.8	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1	-	ND
BH11	0.1-0.2	08.09.2025	F -Silty Sandy Clay	10	<0.3	10.00	12.00	24	0.09	5.70	35	<25	<25	<25	<25	<90	<120	<0.1	<0.1	<0.1	<0.3	<0.1	<0.1	<0.3	<0.8	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1	-	ND
TRH Silica Gel																																						
BH5	0.0-0.1	12.08.2025	F- Sand	-	-	-	-	-	-	-	-	-	<25	-	<25	550	<120	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Statistical Analysis																																						
No of Observations																11																							
Min																90																							
Max																550																							
Mean																159.4																							
Standard Deviation																135.9																							
95% UCL																338																							
Limit of Resolution (LOR)				4	0.4	1	1	1	0.1	1	1	25	50	25	50	100	100	0.2	0.5	1	1	1	0.05	0.5	0.05	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1		
NEPM (2013) HIL A				**100**	**20**	**100**	**6,000**	**300**	**40**	**400**	**7,400**													**3**	**300**		**240**	**6**	**50**	**270**	**10**	**6**	**10**	**300**		**160**	**1**		
NEPM (2013) EIL & ESLs [1]				100																					170								180				
BH1 (0.0-0.1) F-Sand						190	100	1100		30	250																											
BH1 (0.6-0.7) N-SAND						190	100	1100		30	230																											
NEPM (2013) ESLs - (Coarse Grain Soil - Sand / Gravel) [1]												180	120			300	2,800	50	85	70	105		0.7														
NEPM (2013) HSL A (SAND)																																						
0 to < 1m												45	110					0.5	160	55	40	3																
Soil Saturation Concentration (Csat)												950	560					360	560	64	300	9																
NEPM (2013) Management Limit (Fine Grain Soil)															700	1,000	2,500	10,000																			
NEPM (2013) HSL - Asbestos																																						
Asbestos ID																																						**Detected**

Notes

1	Urban residential / public open space is broadly equivalent to the HIL-A, HIL-B and HIL-C land use scenarios in Table 1A(1) Footnote 1 and as described in Schedule B7.
2	To obtain F1 subtract the sum of BTEX concentrations from the C6-C10 fraction.
3	To obtain F2 subtract naphthalene from the >C_{10}-C_{16} fraction.
NL	Calculated HSL is Non Limiting per NEPM (2013)
ND	Not detected

Table K2

Sample Information		Heavy Metals								TRH		BTEX							PAH						
SAMPLE ID	Date	ARSENIC	CADMIUM	CHROMIUM	COPPER	LEAD	MERCURY	NICKEL	ZINC	F1 (C_6-C_{10}) [2]	F2 (>C_{10}-C_{16}) [3]	BENZENE	TOLUENE	ETHYL BENZENE	M/P-XYLENE	O-XYLENE	NAPHTHALENE	TOTAL-XYLENE	BENZO(A)PYRENE	2-methylnaphthalene	1-methylnaphthalene	ANTHRACENE	PHENANTHRENE	FLUORANTHENE	NAPHTHALENE
FES DSI 2025																									
GW101	19.08.2025	<1	<0.1	<1	5	<1	<0.1	**11**	**24**	<50	<60	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<1.5	<0.01	0.02	0.01	<0.01	<0.01	<0.01	<0.02
GW102	19.08.2025	<1	<0.1	<1	**5**	<1	<0.1	5	**88**	<50	<60	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<1.5	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02
GW103	19.08.2025	<1	<0.1	**5**	**5**	<1	<0.1	2	**32**	<50	<60	<0.5	<0.5	0.8	2	0.7	<0.5	2.2	**4.9**	0.24	0.24	**1.1**	**1.90**	**3.4**	0.24
Limit of Resolution (LOR)		1	0.1	1	1	1	0.1	1	1	50	60	1	1	1	2	1	1	-	0.01			0.01	0.01	0.01	0.02
GILs - NEPM (2013) - Groundwater Investigation Levels *Marine Waters* [2]		-	0.7	4.4	1.3	4.4	0.1	7	15			500	-	-	-	-	-	-	0.1 [5]			0.01 [5]	0.6 [5]	1 [5]	50
Groundwater HSLs - NEPM (2013) HSL B (SAND)																									
2m to <4m										1,000	1,000	800	NL	NL	-	-	NL	NL							
4m to <8m										1,000	1,000	800	NL	NL	-	-	NL	NL							
Solubility Limit										9,000	3,000	59,000	61,000	3,900	-	-	170	21,000							

Notes

1	All units are in ug/L
2	Investigation Levels apply to typical slightly-moderately disturbed systems
3	QSAR derived, statistical distribution method used, 95% trigger values applied as per ANZECC 2000
4	Investigation levels are taken from the health values of the Australian Drinking Water Guidelines NHMRC 2011
NL	Non Limiting
5	99% Level of species detection - to account for bioaccumulating nature of the toxicant as per ANZECC

Table C3

Sample Information		ALKANES								ALKENES					BENZENES											
SAMPLE ID	GME DATE	TETRACHLOROMETHANE (CARBON TETRACHLOR	TRICHLOROMETHANE (CHLOROFORM)	BROMODICHLOROMETHANE	TRIHALOMETHANES (TOTAL)	1, 2-DICHLOROETHANE	CYCLOHEXANE	DICHLOROMETHANE (METHYLENE CHLORIDE)	1,1,2-TRICHLOROETHANE	CHLOROETHENE (VINYL CHLORIDE)	TRICHLOROETHENE	CIS-1,2-DICHLOROETHENE	1,1-DICHLOROETHENE	TETRACHLOROETHENE (PCE PERCHLOROETHENE	CHLOROBENZENE	1,2-DICHLOROBENZENE	1,3-DICHLOROBENZENE	1,4-DICHLOROBENZENE	1,2,3-TRICHLOROBENZENE	1,2,4-TRICHLOROBENZENE	ISOPROPYL BENZENE (CUMENE)	SEC-BUTYL BENZENE	1,3,5-TRIMETHYL BENZENE	N-PROPYL BENZENE	N-BUTYL BENZENE	1.2.4 - TRIMETHYLBENZENE	HEXACHLOROBUTADIENE
FES DSI 2025																										
GW101	19.08.2025	<0.5	1.7	<0.5	1.7	<0.5	-	<5	<0.5	<0.3	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.3	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
GW102	19.08.2025	<0.5	<0.5	<0.5	<0.5	<0.5	-	<5	<0.5	<0.3	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.3	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
GW103	19.08.2025	<0.5	<0.5	<0.5	<0.5	<0.5	-	<5	<0.5	<0.3	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.3	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Limit of Resolution (LOR)		0.5	0.5	0.5	0.5	0.5		5	0.5	0.3	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.3	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
GILs - NEPM (2013) - Groundwater Investigation Levels																										
Marine Waters2									**1,900**									**60**		**20**						
Marine Low reliability			**370**								**330.00**		**700**	**70**												

Notes

1	All units are in ug/L
2	Investigation levels apply to typical slightly-moderately disturbed systems
4	Investigation levels are taken from the health values of the Australian Drinking Water Guidelines NHMRC 2011
-	NV - no derived value
-	" - " Not Tested
a:	QSAR derived, statistical distribution method used, 99% trigger value applied as per ANZECC guidelines for slightly-moderately disturbed systems
b:	QSAR derived, statistical distribution method used, 95% trigger value applied as per ANZECC guidelines for slightly-moderately disturbed systems
c:	US EPA Region 9 RSL (MCLs) utilised in absence of criteria from NEPM 2013. MCLs are legally enforceable USEPA drinking water standards
d:	US EPA Region 9 RSL (Tapwater) utilised in absence of criteria from NEPM 2013. Non cancer

Table C4

Sample ID	Date Sampled	Depth	Heavy Metals (mg/kg)								TRH (mg/kg)					BTEX (mg/kg)				PAH (mg/kg)		OCP (mg/kg)		OPP	PCB (mg/kg)	
			ARSENIC	CADMIUM	CHROMIUM	COPPER	LEAD	MERCURY	NICKEL	ZINC	C6-C9	C10-C14	C15-C28	C29-C36	C10-C36 [a]	BENZENE	TOLUENE	ETHYL BENZENE	TOTAL XYLENES	BENZO(a)PYRENE	TOTAL PAH	Other OCPs	TOTAL ENDOSULFAN[11]	CHLORPYRIPHOS (OPP)	TOTAL PCB	ASBESTOS ID (Presence / Absence
NSW EPA Waste Criteria (No Leachates)																										
CT1			100	20	100	-	100	4	40	-	NA	-	-	-	NA	10	288	600	1000	0.8	200	<50	60	4	<50	Detected
CT2			400	80	400	-	400	16	160	-	NA	-	-	-	NA	40	1152	2400	4000	3.2	800	<50	240	16	<50	
NSW EPA Waste Criteria (With Leachates)																										
SCC1			500	100	1900	-	1500	50	1050	-	650	-	-	-	10000	18	518	1080	1800	10	200	Total = <50**	108	7.5	<50**	
SCC2			2000	400	7600	-	6000	200	4200	-	2600	-	-	-	40000	72	2073	4320	7200	23	800	Total = <50**	432	30	<50**	
Limit of Resolution (LOR)			4	0.4	5	5	5	0.10	5	5	25	50	100	100	NA	0.2	0.5	1	3	0.05	0.05	0.1	0.1	0.1	0.1	
Sample ID	**Date Sampled**	**Depth**																								
	FES DSI 2025																									
BH1	11.08.2025	0.0-0.1	<1	<0.3	<0.5	3.2	11.0	<0.05	<0.5	16.0	<20	<20	<45	<45	<110	<0.1	<0.1	<0.1	<0.3	<0.1	<0.8	<0.1	<0.1	-	<0.1	ND
BH2	12.08.2025	0.1-0.2	2	<0.3	2.1	19.0	79.0	<0.05	7.20	44.0	<20	<20	<45	<45	<110	<0.1	<0.1	<0.1	<0.3	<0.1	<0.8	<0.1	<0.1	-	<0.1	ND
BH3	12.08.2025	0.3-0.4	<1	<0.3	1.3	8.4	17.0	<0.05	0.90	31.0	<20	<20	<45	<45	<110	<0.1	<0.1	<0.1	<0.3	0.3	2.4	<0.1	<0.1	-	<0.1	ND
BH3	12.08.2025	0.6-0.7	<1	<0.3	1.7	11.0	25	<0.05	1.70	52	<20	<20	<45	<45	<110	<0.1	<0.1	<0.1	<0.3	0.7	5.2	<0.1	<0.1	-	<0.1	ND
BH4	12.08.2025	0.0-0.1	2	<0.3	5.6	20.0	240	<0.05	2.60	96	<20	<20	54	55	<110	<0.1	<0.1	<0.1	<0.3	0.2	1.9	0.1	<0.1	<0.2	<0.1	ND
BH4	12.08.2025	0.2-0.3	1	<0.3	3.3	19.0	200	0.05	2.10	71	<20	<20	110	69	180	<0.1	<0.1	<0.1	<0.3	2.1	27	<0.1	<0.1	-	<0.1	ND
BH5	12.08.2025	0.0-0.1	3	0.4	10.0	38.0	74	0.19	4.00	180	<20	39	730	600	1400	<0.1	<0.1	<0.1	<0.3	0.1	1.6	<0.1	<0.1	-	<0.1	ND
BH5 - silica	12.08.2025	0.0-0.1	-	-	-	-	-	-	-	-	-	<20	330	270	600	-	-	-	-	-	-	-	-	-	-	-
BH6	12.08.2025	0.2-0.3	2	<0.3	2.3	4.3	19	0.1	0.70	36	<20	<20	<45	<45	<110	<0.1	<0.1	<0.1	<0.3	0.2	1.3	<0.1	<0.1	-	<0.1	ND
BH7	12.08.2025	0.0-0.1	2	<0.3	3.4	26.0	98	0.56	1.70	51	<20	<20	120	90	210	<0.1	<0.1	<0.1	<0.3	0.3	2.4	<0.1	<0.1	-	<0.1	ND
BH8	12.08.2025	0.0-0.1	3	0.4	4.7	17.0	120	0.24	1.70	120	<20	<20	79	73	150	<0.1	<0.1	<0.1	<0.3	<0.1	<0.8	<0.1	<0.1	-	<0.1	ND
BH9	12.08.2025	0.0-0.1	3	0.3	9.5	44.0	85	0.23	4.30	160	<20	<20	140	92	230	<0.1	<0.1	<0.1	<0.3	0.2	1.8	0.1	<0.1	<0.2	<0.1	ND
BH10	08.09.2025	0.1-0.2	10	<0.3	11.00	13.00	29	0.08	6.10	35	<20	<20	<45	<45	<110	<0.1	<0.1	<0.1	<0.3	<0.1	<0.8	<0.1	<0.1	-	<0.1	ND
BH11	08.09.2025	0.1-0.2	10	<0.3	10.00	12.00	24	0.09	5.70	35	<20	<20	<45	<45	<110	<0.1	<0.1	<0.1	<0.3	<0.1	<0.8	<0.1	<0.1	-	<0.1	ND

Notes

1 CT1, CT2
2 SCC1,
3 Concent
4 Concent
5 Concent
6 Concent
7 Concentrations in YELLOW indicate the presence of Asbestos
8 NA = Not Applicable
9 " - " Not Tested
10 *** Indicates Retest Result
11 Total Endosulfan = Endosulfan I, Endosulfan II and Endosulfan Sulphate

Table C5

Sample Information		Interim Soil VOC															
SAMPLE ID	DATE	TETRACHLOROETHENE (PCE)	TRICHLOROETHENE (TCE)	1.1.1 TCA	cis-1,2-dichloroethene	Vinyl chloride	1.2.4-Trimethylbenzene	1.3.5-Trimethylbenzene	TRH F1	TRH F2	Benzene	Toluene	Ethylbenzene	m.p-Xylene	Naphthalene	o-Xylene	Xlyenes
2025 FES																	
AM1	11.11.2025	<0.034	<0.027	<0.027	<0.02	<0.013	<0.025	<0.025	<2	<0.4	<0.016	<0.019	<0.022	<0.043	<0.026	<0.022	<0.065
AM2	11.11.2025	<0.034	<0.027	<0.027	<0.02	<0.013	<0.025	<0.025	<2	<0.4	<0.016	<0.019	<0.022	<0.043	<0.026	<0.022	<0.065
AM3	11.11.2025	0.01	<0.0027	<0.0027	<0.002	<0.0013	0.004	<0.0025	0.64	0.09	<0.0016	0.006	<0.0022	<0.0043	<0.0026	<0.0022	<0.0065
AM4	11.11.2025	0.004	<0.0027	<0.0027	<0.002	<0.0013	0.003	<0.0025	0.2	<0.04	<0.0016	0.005	<0.0022	<0.0043	<0.0026	<0.0022	<0.0065
SS1	11.11.2025	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<5	5.1	<0.10	0.16	<0.10	<0.10	<0.10	<0.10	<0.10
Limit of Resolution (LOR)		0.003	0.0027	0.002	0.002	0.002	0.002	0.002			0.002	0.002	0.002	0.002	0.002	0.002	0.002
Interim Soil Vapour HILs - NEPM (2013)																	
Residential A		2	0.02	60	0.08	0.03											
Soil Vapour HSLs for Vapour Intrusion																	
Residential A & B - SAND																	
0 m to <1m									180	130	1	1300	330		0.8		220
1m to <2m									640	560	3	3800	1100		3		750

Notes

1 All units are in mg/m3