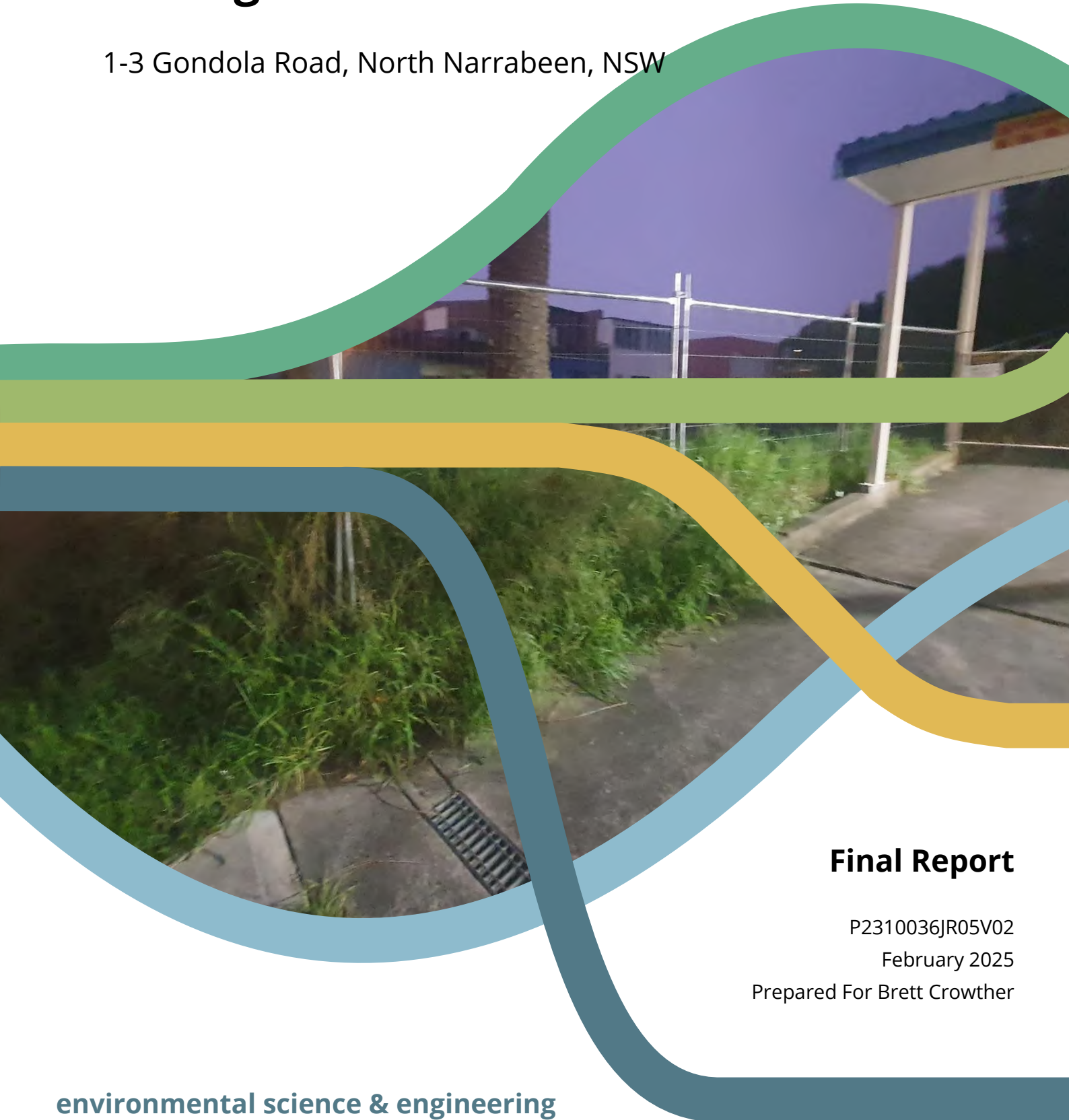


# Hydrogeology Assessment and Groundwater Dewatering Management Plan

1-3 Gondola Road, North Narrabeen, NSW



## Final Report

P2310036JR05V02

February 2025

Prepared For Brett Crowther

## Project Details

<b>Report Title</b>	Hydrogeology Assessment and Groundwater Dewatering Management Plan: 1-3 Gondola Road, North Narrabeen, NSW
<b>Client</b>	Brett Crowther
<b>Document</b>	P2310036JR05V02
<b>Director</b>	Daniel Martens
<b>Manager</b>	Gray Taylor
<b>Principal Author</b>	Trystan Richards

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Issue	Issue Date	Status	Description / Comment	Author	Reviewer	Approved
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# 1 Introduction

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## 1.1 Overview

This report documents a Hydrogeology Assessment (**HA**) and Groundwater Dewatering Management Plan (**GDMP**) completed by Martens and Associates Pty Ltd (**MA**) on behalf of Brett Crowther (the **Client**). The assessment pertains to a proposed three-story mixed-use development with a basement car park and bulk excavation to approximately 1.1 mAHD at 1–3 Gondola Road, North Narrabeen, NSW (the **Site**).

This version of the report (V02) has been updated in response to a recent Request for Further Information (RFI) issued by WaterNSW (Ref. IDAS1158640, dated 20 December 2024). The updated report incorporates proposed flood storage infrastructure to be constructed beneath the basement car park level.

The report has been prepared to support a development application (**DA**) to Northern Beach Council (**NBC**).

## 1.2 Proposed Development

### 1.2.1 Overview

We understand from provided architectural plans (Mackenzie Architects, 2024, Appendix B) that the proposed development will include the demolition of existing structures at the Site, and the construction of a new three-storey mixed use development with one level of basement carpark.

### 1.2.2 Basement Extent

The basement is proposed to have a finished floor level (**FFL**) of 1.4 mAHD, requiring bulk excavation to approximately 1.2 m below the existing ground level (**mbgl**) with two lift wells extending to a base level - 0.1 mAHD, accounting for a 300 mm basement slab.

To provide flood storage, a 1 m deep void with 270 m<sup>2</sup> footprint is proposed beneath the basement carpark level. This will necessitate additional excavation to approximately 0.0 mAHD or 2.6 mbgl. A sump is also proposed, extending approximately 0.6 m below the flood storage level.

All elements of the basement, including the lift well and flood storage are designed to be tanked (fully watertight). A proposed layout is provided in Appendix B.

## 1.3 Scope

### 1.3.1 Hydrogeological Assessment (HA)

The scope of the HA is noted as:

1. Undertake a desktop review of available site information including topography, geology, soil landscape and acid sulfate soils (**ASS**) risk.
2. Site inspection to assess the serviceability and condition of existing monitoring well (**MW01**).
3. Installation of one groundwater monitoring well (**MW02**) in conjunction with a geotechnical investigation.
4. Purging and development of installed monitoring wells approximately one week following Site inspection.
5. Collection of one groundwater sample from each monitoring well and subsequent laboratory analysis to assess groundwater quality.
6. Assessment of aquifer permeability characteristics through the completion of slug tests.
7. Manual measurement of groundwater levels in each monitoring well using an electronic dip meter, and monitoring of groundwater level using a data logger for a period of approximately three months.

### 1.3.2 Groundwater Dewatering Management Plan (GDMP)

The scope of the GDMP is as follows:

1. Assessment of anticipated groundwater interception by the proposed development
2. Calculation of predicted groundwater infiltration rates and dewatering volumes during basement, lift well and flood storage construction (based on assumed timeframes).
3. Provide a monitoring plan for the duration of the construction dewatering in accordance with current Water NSW requirements.

## 1.4 Other Assessments

The following relevant assessments have been completed by MA for the Site:

- a. *Geotechnical, Hydrogeological and Acid Sulfate Soil Assessment: 3 Gondola Road, North Narrabeen, NSW.* Report ref: P2108694JR02V03 (**MA, 2022**).
- b. *Site Contamination Assessment: 1-3 Gondola Road, North Narrabeen NSW.* Report ref P2310036JR01V01 (**MA, 2024a**).
- c. *Geotechnical And Acid Sulfate Soil Assessment: 1 – 3 Gondola Road, North Narrabeen, NSW.* Report ref P2310036JR02V01 (**MA, 2024b**).

- d. *Acid Sulfate Management Plan: 1 – 3 Gondola Road, North Narrabeen, NSW.* Report ref P2310036JR04V01 (**MA, 2024c**).

Where required in this report, reference has been made to the findings of the above reports.

## 2 Hydrogeological Assessment

### 2.1 Site Details

A summary of Site details is provided in Table 1, with site locality plan provided in Appendix A.

**Table 1:** Site detail summary.

Item	Description
Site address	1-3 Gondola Road, North Narrabeen, NSW
Legal identifier	Lot 187 and 188 DP 16719 (Six Maps)
Surveyed area	1289.3 m <sup>2</sup> (C & A Surveyors, 2024)
Topography	The Site is relatively flat with grades < 5%.  3 Gondola Rd elevation ranges from 5.61 mAHD in the centre to 1.95 mAHD along the northern boundary (C & A Surveyors, 2024).  1 Gondola Rd elevations range from 1.91 mAHD in the northeast corner to 2.15 mAHD at the centre of the western boundary (C & A Surveyors, 2024).
Geology	The Sydney 1:100,000 Geological Sheet 9030 (Herbert, 1983) describes site geology as silty peaty quartz sand, silt and clay. Ferruginous and humic cementation in places. Common shell layers
Soil landscape	The NSW Environment and Heritage eSPADE website identifies the site as having soils of the Warriewood landscape having soils of deep, well sorted, sandy humus podzols and dark, mottled siliceous sands, overlying buried acid peats in depressions; deep podzols and pale siliceous sands on sandy rises
Acid sulfate soils	The Pittwater Local Environment Plan 2014, Acid Sulfate Soil Map (Sheet ASS – 019), the site is located within Class 3 ASS risk

### 2.2 Fieldworks

#### 2.2.1 Well Installation

Groundwater monitoring wells MW01 and MW02 were installed between July 2023 and March 2024, in conjunction with geotechnical and acid sulfate soil (ASS) investigations at the Site.

A summary of the monitoring well details is provided in Table 2, while the well locations and construction logs are included in Appendix A and Appendix C, respectively.

**Table 2:** Summary of monitoring wells.

MW ID	Total MW Depth (m)	Screen Interval Lenth (m)
MW01	7.2	6
MW02	9	7.5

## 2.2.2 Collection of Groundwater Samples

Groundwater sampling works were completed on 11 April 2024. The following works were undertaken:

- Manual measurement of groundwater levels in each monitoring well using an electronic dip meter.
- Field screening of groundwater quality parameters using a water quality meter at each monitoring well.
- Collection of representative groundwater samples from each monitoring well location for laboratory analysis.

## 2.3 Groundwater Monitoring

### 2.3.1 Monitoring Methodology

Groundwater monitoring was undertaken at MW02 between 7 March 2024 and 5 July, 2024 and MW01 between 11 April 2024 – 5 July 2024. Works undertaken included:

- Continuous monitoring using a data logger at 15 minute recording intervals.
- Manual dip meter measurements taken at the beginning and end of the continuous monitoring period.
- Efforts to perform rising and falling slug tests in each monitoring well for calculation of hydraulic conductivity ( $k$ ) across the Site.

### 2.3.2 Monitoring Results

Dip meter measurements and continuous data logger recordings are summarised in Table 3 and Table 4 respectively, and a graphical plot of collected groundwater level data is provided in Figure 1.

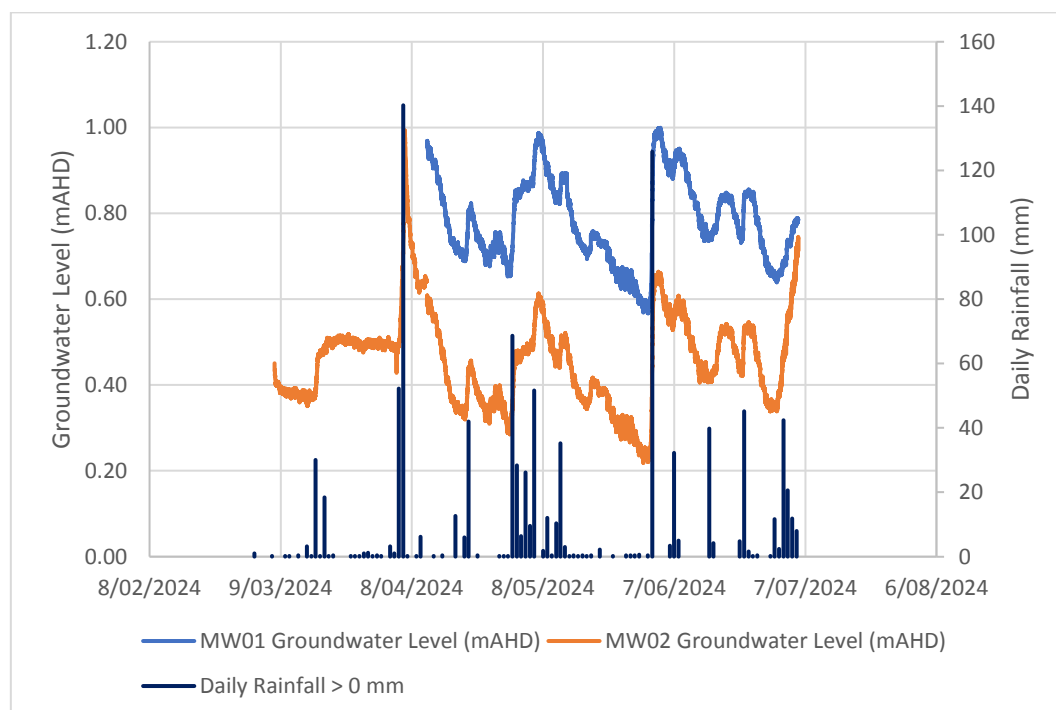
**Table 3:** 'Dip' groundwater measurement summary.

Date	Groundwater levels			
	MW01		MW02	
	mbgl	mAHD	mbgl	mAHD
4 April, 2024	1.31	0.69	1.52	0.48
11 April 2024	1.13	0.87	1.4	0.6
13 May 2024	1.15	0.85	1.45	0.55
13 June 2024	1.29	0.71	1.54	0.46
5 July 2024	1.19	0.81	1.41	0.59

**Table 4:** Monitoring data summary (7/03/2024 – 5/07/2024).

Monitoring Well	Surface Level (mAHD)	Groundwater Level (mbgl / mAHD)			Range (m)
		Minimum	Mean	Maximum	
MW01 <sup>1</sup>	2.00	-1.43 / 0.57	-1.22 / 0.78	-1.00 / 1.00	0.43
MW02	2.00	-1.78 / 0.22	-1.54 / 0.47	-1.01 / 0.99	0.78

<sup>1</sup> Note: MW01 was only monitored between 11 April 2024 – 5 July 2024.



**Figure 1:** Plot of groundwater level data.

Some amount of groundwater level variation was recorded throughout the monitoring period. Rapid groundwater level response was observed during heavy or prolonged rainfall with increases in groundwater levels closely reacting to rainfall recharge. It is noted that the monitoring period was conducted during a period of consistent and at times heavy rainfall which is likely the reason for observed groundwater level variance. During dry periods with little to no rainfall, Site groundwater levels would be expected to remain generally stable.

The groundwater gradient across the Site was observed to be relatively flat with a slight gradient to the east (noting only two monitoring wells).

## 2.4 Groundwater Quality Testing

### 2.4.1 Testing Methodology

Groundwater was sampled from each monitoring well to allow initial data assessment of groundwater quality in accordance with NSW DPIE (2022). All wells were sampled during Site inspection on 11 April, 2024.

Each well was purged using low flow peristaltic pump, with water quality parameters continually assessed through a flow cell unit until pH, EC, DO, turbidity and temperature measurements stabilised. Field screening of parameters was undertaken and groundwater samples were collected in laboratory supplied bottles with appropriate preservations.

Two groundwater samples were submitted to a NATA accredited laboratory (EnviroLab Pty Ltd) and tested for the following:

- Ionic Balance (Ca, K, Mg, Na, OH, CO<sub>3</sub>, HCO<sub>3</sub>, total alkalinity, Cl, SO<sub>4</sub>)
- Nutrients (N, NO<sub>x</sub>, NH<sub>3</sub>, P, PO<sub>4</sub>)
- TOC
- Microbes (faecal coliforms, enterococci, E. coli)
- Hydrocarbons (BTEX, TRH, PAH)
- Physical Parameters (pH, EC, DO, SAR, TDS, TSS, turbidity)
- Heavy metals (aluminium, antimony, arsenic barium, beryllium, boron, cadmium, chromium, cobalt, copper, iron lead, lithium, manganese, mercury, molybdenum, nickel, selenium, silver, strontium, uranium, vanadium, zinc, silicon).

## 2.4.2 Testing Results

Laboratory results for pH, electrical conductivity (EC) and chloride (Cl) are summarised in Table 5.

**Table 5:** Summary of pH, EC and Cl results.

Monitoring well	pH	EC (µS / cm)	Chloride (mg / L)
MW01	7.0	12,000	3,900
MW02	7.2	2,300	420

Based on the above results, groundwater at the Site is brackish, and neutral.

Groundwater sampled for the Site Contamination Assessment (MA, 2024a) were assessed against the ANZG (2018) marine water 95% guideline. This guideline was adopted as the closest major water way from the Site is South Creek, which drains from Narrabeen Lagoon into the Pacific Ocean. To assess potential vapour risk from the adjacent service station (which may present an offsite risk to Site groundwater), results were also compared against health screening levels (**HSL**) provided in NEPM (2013).

Laboratory results found concentrations of all COPC to meet the adopted testing criteria for all analytes. Notably, contamination associated with services station use were reported below the laboratory detection limit.

A detailed table of results showing individual contaminant concentrations compared to adopted testing criteria is provided in Appendix E, and chain of custody documentation and laboratory certificates are provided in Appendix F.

## 2.5 Hydraulic Conductivity

Rising and falling head slug tests were attempted on MW01 and MW04 on 11 April and 13 May 2024. Slug tests were unable to provide reliable hydraulic conductivity ( $k$ ) data for the Site. Therefore, using values taken from E. Scott Bair and Lahm, 2006 hydraulic conductivity of medium sand was estimated to be of the order 5 - 15 m / day.

## 3 Groundwater Dewatering Management Plan

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### 3.1 Collection of Groundwater

Groundwater seepage into the basement, lift well and flood storage excavations is expected to be collected via appropriately located spoon drains and sump(s). A submersible pump in the sump(s) shall direct water to Council stormwater provided baseline data confirmation (Section 2.4.2). During warmer / dry weather, evaporate loss may result in less groundwater being collected during construction.

### 3.2 Anticipated Extent of Groundwater Interception

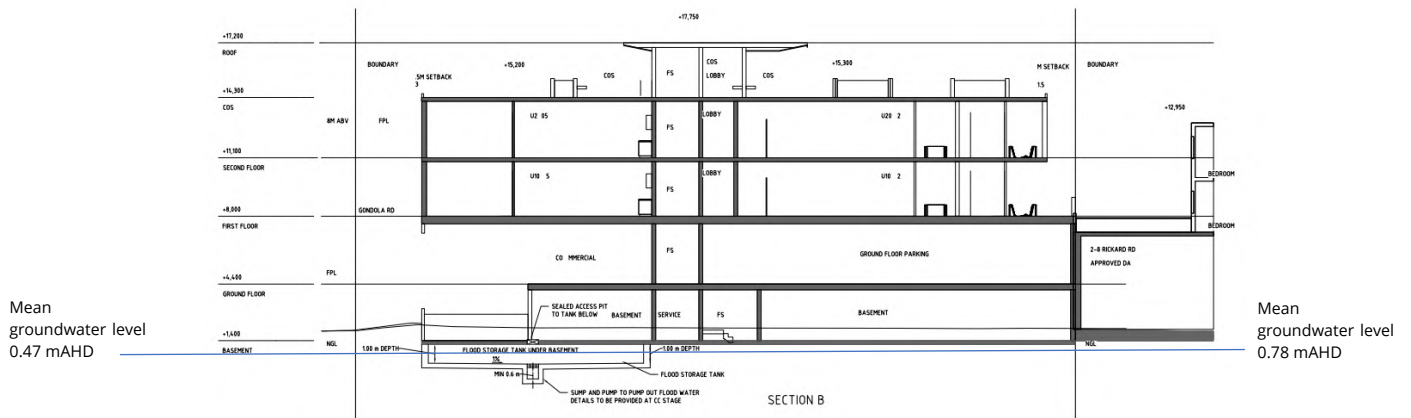
Groundwater level data collected during the primary monitoring period (Section 2.3) indicate that the average groundwater level across the Site ranged between approximately 0.46 mAHD and 0.76 mAHD with upper bound levels reaching approximately 0.99 mAHD to 1.00 mAHD.

Bulk excavation for basement construction will be taken to approximately 1.2 mAHD (allowing for a 300 mm slab to be constructed), which is not expected to intercept groundwater at the Site. Excavation for lift wells is expected to be taken to -0.1.

To accommodate flood storage infrastructure, a bulk excavation to approximately 0.0 mAHD for the storage void and -0.6 mAHD required for the storage sump, including an allowance for a 200 mm slab in both cases.

Assuming a groundwater level at 0.5 mAHD, this equates to a groundwater interception of approximately 0.6 m for the lift wells, 0.5 m for the flood storage and 1.1 m for the storage sump.

A diagram showing approximate mean groundwater elevations across the Site is provided in Figure 2.



**Figure 2:** Expected mean groundwater level.

### 3.3 Dewatering Volume

Dewatering is only expected to be required during the flood storage construction works, including construction of storage and sump ground slabs and perimeter walling (including tanking). We anticipate that the dewatering timeframe will likely be in the order of one month.

Groundwater dewatering volume calculations are provided in Appendix D. Assuming a worst case scenario of 15 m / day conductivity, the following is noted:

- An inflow rate of approximately 37.52 ML / year is estimated for a maximum predicted groundwater take in the order of 3.13 ML over the dewatering timeframe of up to one month.
- Predicted volumes may depend somewhat on the rate of excavation progress and adjustment of groundwater profiles beyond the excavation as well as evaporation rates.
- Monitoring was completed following a period of significant rainfall; it is likely that actual groundwater table at the time of dewatering may be lower than predicted.
- Due to difficulties encountered during slug test attempts, hydraulic conductivity for medium sands are assumed and not Site specific, however the adopted conductivity rate of 15 m / day is expected to be conservative.

During dewatering works, total groundwater take should be measured and recorded on a (minimum) weekly basis by way of a calibrated flow metre located on the water pump line(s).

### 3.4 Anticipated Offsite Impacts

Anticipated offsite impacts of groundwater dewatering have been assessed as follows:

1. Groundwater flow impacts including mounding and flow diversion are likely to be minimal given the scale of the proposed basement, local flat hydraulic gradient and the permeability of underlying sand.
2. A review of the Bureau of Meteorology (2019) *Groundwater Dependent Ecosystems Atlas* indicates that there are groundwater dependent ecosystems (GDE) within 100 m of the Site. Due to the minimal nature of the proposed dewatering and, partial cut off walls such as diaphragm walls or secant pile walls noted in MA, 2024b impact on nearby GDEs are expected to be negligible.
3. Two acid sulfate soils (ASS) assessments were undertaken for the Site and documented in MA 2022 and MA 2024b. Based on laboratory testing of Site soils, ASS indicators (acid / sulfur trails) were identified in soils collected from depths below 1.2 mbgl. Given the temporary nature of the proposed dewatering and cut off walls noted in MA 2024b, anticipated dewatering to a level of approximately - 0.1 mAHD, risk to actual or potential ASS from dewatering is considered minimal. Any material and groundwater collected during excavation and dewatering process is to be managed in accordance with Site ASS Management Plan (MA, 2024c).
4. Assessment of settlement as a result of dewatering has been documented in the geotechnical and acid sulfate soils assessment (MA, 2024b). Impacts are considered acceptable, subject to recommendations provided in MA (2024b).

## 3.5 Dewatering Management

### 3.5.1 Treatment Requirements

On the basis of the groundwater sampling undertaken (which indicates that groundwater is brackish, neutral and meets ANZG (2018) guidelines) the following options for disposal of groundwater from the dewatering process will need to be considered:

1. Discharge to stormwater.
2. Discharge of groundwater to sewer under a trade waste license.

We note resampling of all groundwater wells at the Site be taken to confirm groundwater characterisation, noting only one round of sampling has been completed to date.

### 3.5.2 Licensing Requirements

Under Section 92 of the Water Management Act (2000), a Water Supply Works (**WSW**) approval will be required for the construction works given the proposal will intercept the groundwater table.

Based on preliminary calculations (Section 3.3), groundwater take may exceed 3 ML over the dewatering timeframe of up to one month, as such, a Water Access License (**WAL**) may be required from WaterNSW under the Water Management Act (2000). We note that monitoring completed as part of this assessment was conducted over a period of high

rainfall and further monitoring (see Section 3.5.3) is expected to provide a more accurate measurement of expected dewatering volume under 'typical' site conditions.

Applications for a WSW approval are to be submitted to WaterNSW for approval prior to construction dewatering being undertaken.

### **3.5.3 Monitoring Requirements**

Monitoring of groundwater levels, groundwater discharge quality and groundwater take will be required to be undertaken in accordance with NSW DPIE (2022) requirements. The scope of monitoring will be contingent on the type of treatment and disposal that is implemented in light of our recommendations in Section 3.5.1. Monitoring requirements shall be included as part of the final dewatering management plan which will be required to be submitted to WaterNSW for the Water Supply Work approval.

## **3.6 Comments**

Further works will need to be undertaken following development approval but prior to construction to meet the requirements of WaterNSW and NSW DPIE (2022) and to inform a WSW approval. This will include, but may not be limited to:

1. Appropriate monitoring and sampling of at least three monitoring wells prior to the commencement of construction works in accordance with NSW DPIE (2022) requirements.
2. Determination of baseline data.
3. Preparation of a detailed dewatering management and monitoring plan.

## 4 References

---

- Bureau of Meteorology (2019) *Groundwater Dependent Ecosystems Atlas*. <http://www.bom.gov.au/water/groundwater/gde/map.shtml>. Accessed July 2024.
- C & A Surveyors (2024) Detail & Boundary Identification Survey of Lot 187 & 188 in DP 16719, Located at No. 1-3 Gondola Road, North Narrabeen
- E. Scott Bair and Lahm, T.D. (2006). *Practical Problems in Groundwater Hydrology*. Prentice Hall.
- Herbert C (1983) Sydney 1:100 000 Geological Sheet 9130, 1st edition. Geological Survey of New South Wales, Sydney.
- Mackenzie Architects International (2024) *Multi Residential Development: 1 – 3 Gondola Rd North Narrabeen 2101*
- Martens and Associates (2022) *Geotechnical, Hydrogeological and Acid Sulfate Soil Assessment: 3 Gondola Road, North Narrabeen NSW* (ref: P2108694JR02V03).
- Martens and Associates (2024a) *Site Contamination Assessment: 1-3 Gondola Road, North Narrabeen NSW* (ref P2310036JR01V01).
- Martens and Associates (2024b) *Geotechnical and Acid Sulfate Soil Assessment: 1 – 3 Gondola Road, North Narrabeen, NSW* (ref P2310036JR02V01).
- Martens and Associates (2024c) *Acid Sulfate Management Plan: 1 – 3 Gondola Road, North Narrabeen, NSW* (ref P2310036JR04V01).
- NSW Department of Environment & Heritage (eSPADE, NSW soil and land information), [www.environment.nsw.gov.au](http://www.environment.nsw.gov.au). Accessed 26/04/2024.
- NSW Department of Planning, Industry & Environment (2022) *Minimum requirements for building site groundwater investigations and reporting*. Referred to as NSW DPIE (2022)
- Water Quality Australia (2018) *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*. Referred to as ANZG (2018).

## Appendix A – Mapset

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**Legend**

- Monitoring Well Locations
- Approximate Basement Extent
- Site Boundary



1:500 @ A4

Viewport A

Image: Nearmap (2024)  
Data Source: ELVIS DEM

Map Title / Figure:  
**Site Map**

**Map 01**  
1-3 Gondola Road, North Narrabeen, NSW  
Mixed Use Development  
Hydrogeological Assessment  
Brett Crowther  
08/07/2024

Map  
Site  
Project  
Sub-Project  
Client  
Date

## Appendix B – Site Survey and Architectural Plans

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LOT 172  
DP 16212

LOT 189  
DP 16719

LOT 188  
DP 16719  
638.6m<sup>2</sup>  
(STATED BY DP 16719)  
638.7m<sup>2</sup>  
(BY CALCULATION)

LOT 173  
DP 16212

LOT 174  
DP 16212

LOT 187  
DP 16719  
645.0m<sup>2</sup>  
(STATED BY DP 16719)  
650.5m<sup>2</sup>  
(BY CALCULATION)



LEGEND:

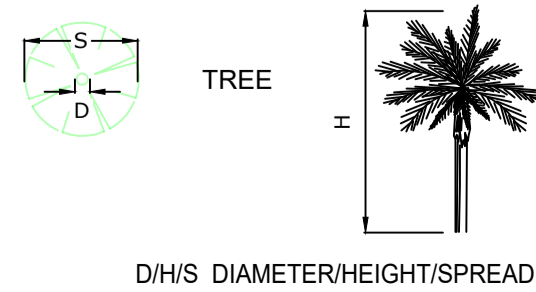
AHD	AUSTRALIAN HEIGHT DATUM
AWN	AWNING
BM	BENCH MARK
BOW	BOTTOM OF WALL
BRW	BOTTOM OF RETAINING WALL
CONC	CONCRETE
CS	CONCRETE SURFACE
D/H/S	DIAMETER/HEIGHT/SPREAD
EB	EDGE OF BITUMEN
EC	EDGE OF CONCRETE
EG	EAVE & GUTTER
EP	ELECTRICAL BOX
FL	FLOOR LEVEL
HYD	HYDRANT
IC	INSPECTION COVER
INV	INVERT LEVEL
KO	KERB OUTLET
LH	LAMP HOLE
LIP	LIP OF KERB
NS	NATURAL SURFACE
PP	POWER POLE
RL	REDUCED LEVEL
RTK	ROLLING TOP OF KERB
SL	SURFACE LEVEL
SIP	SEWER INSPECTION POINT
SMH	SEWER MAN HOLE
SV	STOP VALE
TEL	TELSTRA PIT
TK	TOP OF KERB
TOW/TW	TOP OF WALL
TRW	TOP OF RETAINING WALL
VC	VEHICLE CROSSING
W-B	WALL TO BOUNDARY
WM	WATER METER



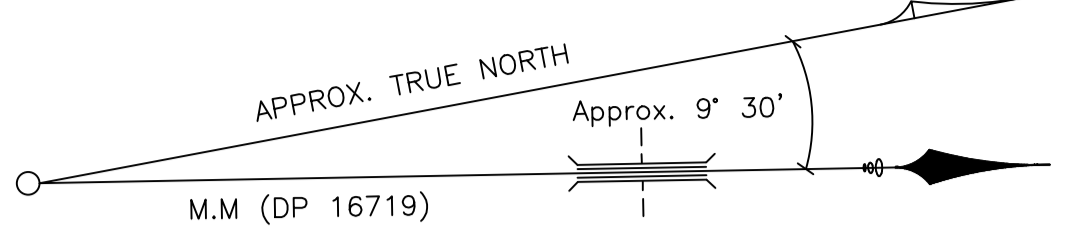
**C&A SURVEYORS**  
30 Grose Street, Parramatta, NSW 2150  
Ph: 96309299 email: Operations@candasurveyors.com.au  
www.candasurveyors.com.au

DETAIL & BOUNDARY IDENTIFICATION  
SURVEY OF  
LOT 187 & 188 IN DP 16719, LOCATED AT  
No. 1-3, GONDOLA ROAD, NORTH  
NARRABEEN.

S	— S —	APPROXIMATE LOCATION OF BURIED SEWER MAIN BY SYDNEY WATER DBYD RECORDS
W	— W —	APPROXIMATE LOCATION OF BURIED WATER MAIN (WM) BY SYDNEY WATER DBYD RECORDS
E	— E —	ELECTRIC LINE
TELSTRA PIT	STOP VALVE	POWER POLE
WATER METER	HYDRANT	



INSTRUCTING PARTY:		Joseph El-Hage @ Mackenzie Architects International	SURVEYED BY:		EH	DATUM:	AHD
LGA:	NORTHERN BEACHES	AREA BDY DP:	LOT 187-645.0 m <sup>2</sup> LOT 188-638.6 m <sup>2</sup>	DRAWN BY:	SU	CHECKED BY:	KO
SURVEY DATE:	29/02/2024	AREA BY CALC:	LOT 187-650.5 m <sup>2</sup> LOT 188-638.7 m <sup>2</sup>	SCALE:	1:100@A1	REF.NO:	31813-24 DET/ID
DATE DRAWN:	8/03/2024	CONTOUR INTERVAL:	0.2 m	REV No:	V1	SHEET:	1 OF 1



GONDOLA  
ROAD

TRENT JAMES VELLA  
(REGISTERED SURVEYOR)  
SURVEYOR ID No. 8959

THE SUBJECT TITLE NOTES : AS AT 28/02/2024 LOT 187 IN DP 16719  
1) RESERVATIONS AND CONDITIONS IN THE CROWN GRANT(S)  
2) D149502 COVENANT  
3) AT268282 CAVEAT BY CROWTHER INVESTMENTS (NSW) PTY LTD

THE SUBJECT TITLE NOTES : AS AT 28/02/2024 LOT 188 IN DP 16719  
1) RESERVATIONS AND CONDITIONS IN THE CROWN GRANT(S)  
2) D230687 COVENANT  
3) AP410549 LEASE TO MWP COMMUNITY AD LIMITED EXPIRES:  
27/6/2022. OPTION OF RENEWAL: 2 YEARS.

NOTES:  
A) BOUNDARIES OF THE SITE HAVE BEEN IDENTIFIED BY SURVEY  
B) SERVICES SHOWN HAVE BEEN DERIVED FROM VISUAL EVIDENCE APPARENT  
AT THE TIME OF SURVEY. SERVICES MAY EXIST WHICH ARE NOT SHOWN.  
THE RELEVANT SERVICE AUTHORITY SHOULD BE CONTACTED TO  
VERIFY THE EXISTENCE AND POSITION OF SERVICES PRIOR TO THE  
COMMENCEMENT OF ANY CONSTRUCTION OR EXCAVATION.  
C) DIAMETER, HEIGHT & SPREAD OF TREES ARE APPROXIMATE ONLY.  
D) LEVELS SHOWN ARE OF AUSTRALIAN HEIGHT DATUM.  
ORIGIN OF LEVELS : PM 5315, RL 1.631 (AHD), CLASS LC.  
E) USE STATED DIMENSIONS. DO NOT SCALE.  
F) THESE NOTES FORM PART OF THIS PLAN AND CANNOT BE REMOVED.  
G) NO COVENANTS AND/OR RESTRICTIONS HAVE BEEN INVESTIGATED  
BY C & A SURVEYORS PTY LTD.

REVISION No	DESCRIPTION	DATE
V1	PLAN ISSUED	8/03/2024
V2	.....	J.J.J.
V3	.....	J.J.J.
V4	.....	J.J.J.

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THIS PLAN HAS BEEN PREPARED FOR THE SOLE USE OF  
THE INSTRUCTING PARTY.



ALL FLOOD PROOF WALLS AND DOORS IN RESI. & COM. BIN ROOMS  
ALL BIN ROOMS TO BE:

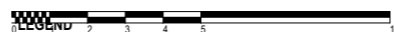
- SERVICED BY A WATER TAP
- CEMENTED RENDERED (SMOOTH ROUNDED CORNERS) AT THE WALL AND FLOOR INTERSECTIONS.
- GRADED AND DRAINED TO A SYDNEY WATER APPROVED DRAINAGE SYSTEM.
- CAPABLE OF BEING KEPT CLEAN AND TIDY AT ALL THE TIMES.
- BEING IN ACCORDANCE WITH THE BCA, RELEVANT AS AND LEGISLATION IN CHAPTER XII OF THE WASTE MANAGEMENT GUIDELINES.



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Nominated Architect No.6033  
ABN 76 091 107 201  
ACN 091107201



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AMENDMENTS			
No.	REVISION	BY	DATE
A	DA	J.E	03.04.2024
B	REVISED DA	M.M	12.09.2024
C	REVISED DA	M.M	25.10.2024
D	ADDITIONAL INFORMATION	M.M	13.12.2024
E	ISSUED FOR RFI	M.M	05.02.2025



**MULTI RESIDENTIAL DEVELOPMENT**  
PROJECT  
**1-3 Gondola Rd North**  
**Narrabeen 2101**

PROJECT NO.  
**15/19**

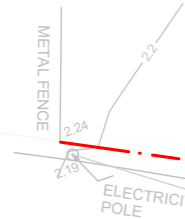
DRAWING:  
**BASEMENT PLAN**

DRAWN M.M
CHECKED D.M

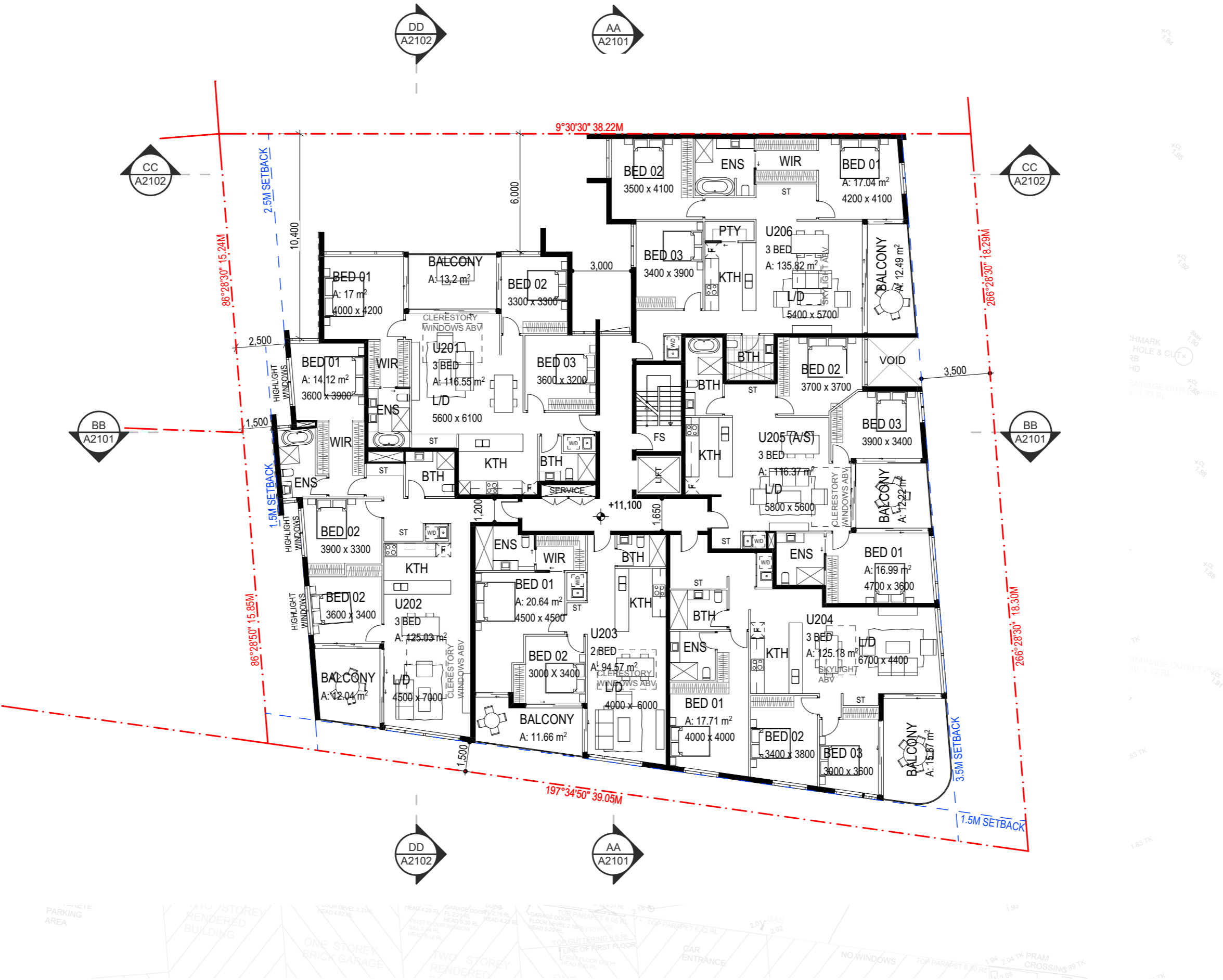
SCALE:  
1:200@A3

DRAWING NO.:  
**A1001**

SUE:  
E







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B	REVISED DA	M.M	12.09.2024
C	REVISED DA	M.M	25.10.2024

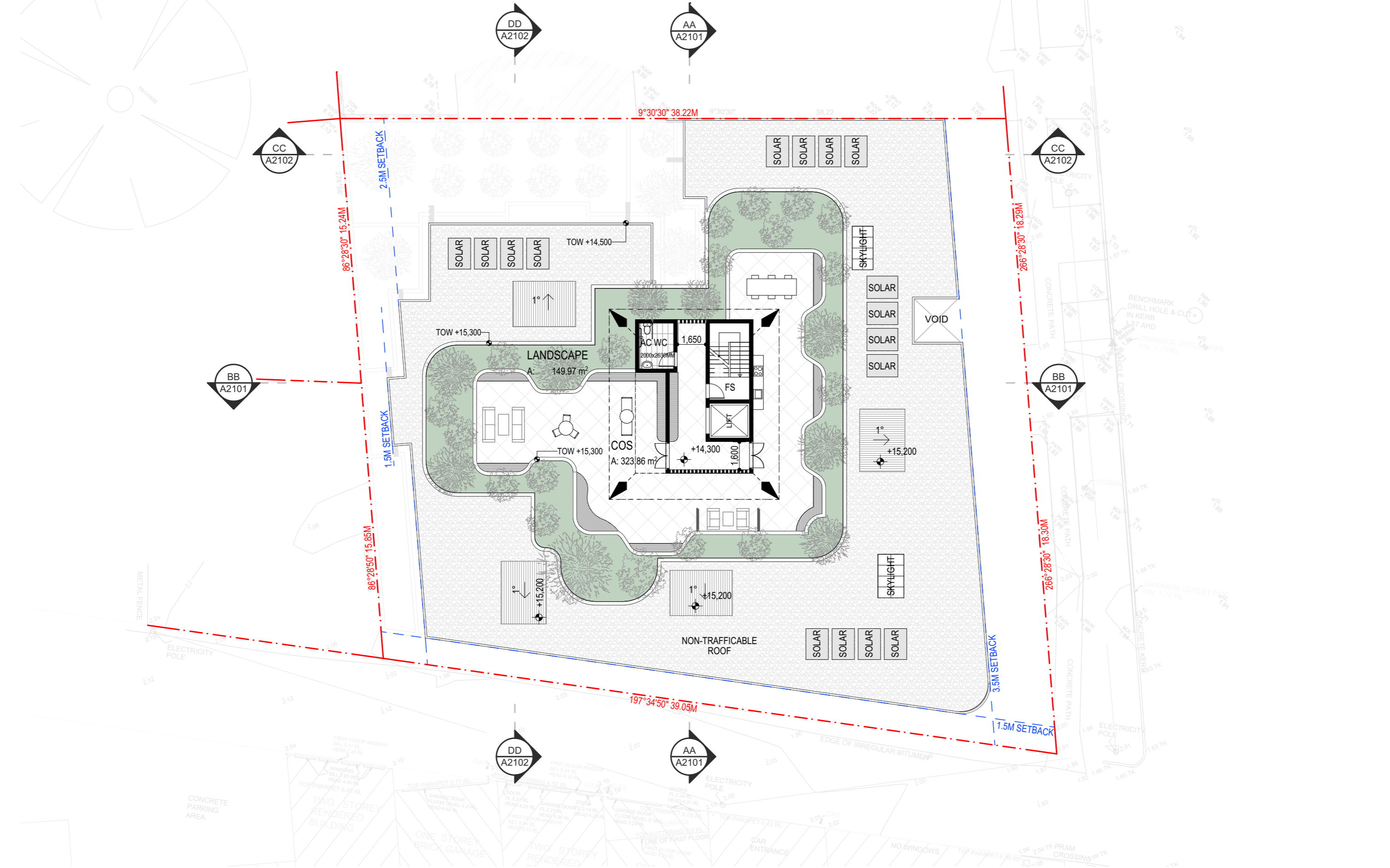


PROJECT NORTH

**MULTI RESIDENTIAL DEVELOPMENT**  
PROJECT  
1-3 Gondola Rd North  
Narrabeen 2101

PROJECT NO.  
15/19

DRAWING: SECOND FLOOR PLAN			
DRAWN BY M.M	SCALE 1:200@A3	DRAWING NO.: <b>A1004</b>	ISSUE: <b>C</b>
CHECKED BY D.M			



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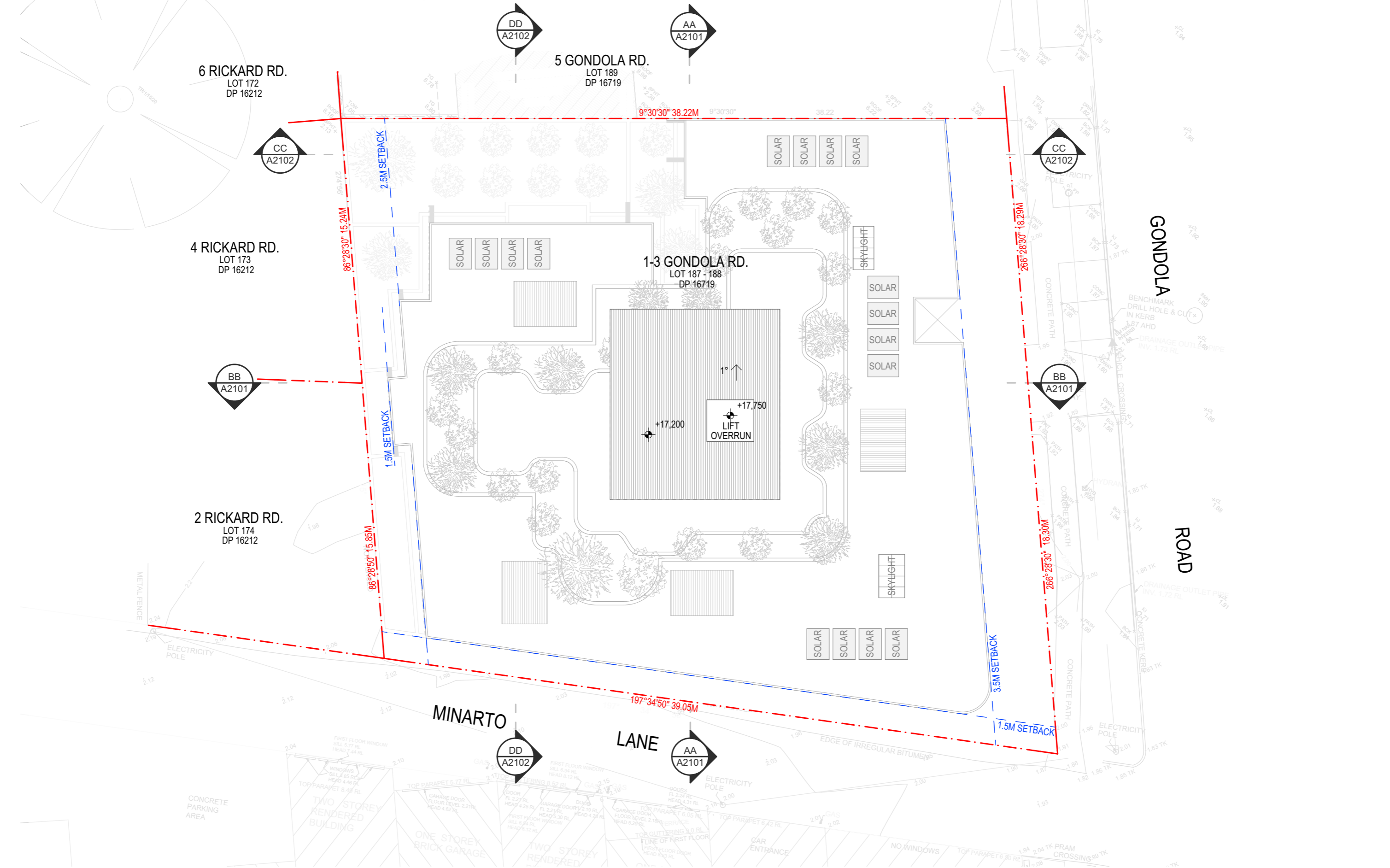
AMENDMENTS	REVISION	BY	DATE
No.			
A	DA	J.E	03.04.2024
B	REVISED DA	M.M	12.09.2024
C	REVISED DA	M.M	25.10.2024


PROJECT NORTH

**MULTI RESIDENTIAL DEVELOPMENT**  
PROJECT  
**1-3 Gondola Rd North**  
**Narrabeen 2101**

PROJECT NO.  
**15/19**

DRAWING: COS FLOOR PLAN	
DRAWN BY M.M	SCALE 1:200@A3
CHECKED BY D.M	DRAWING NO.: <b>A1005</b>
	ISSUE: <b>C</b>





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C	REVISED DA	M.M	25.10.2024

PROJECT NORTH



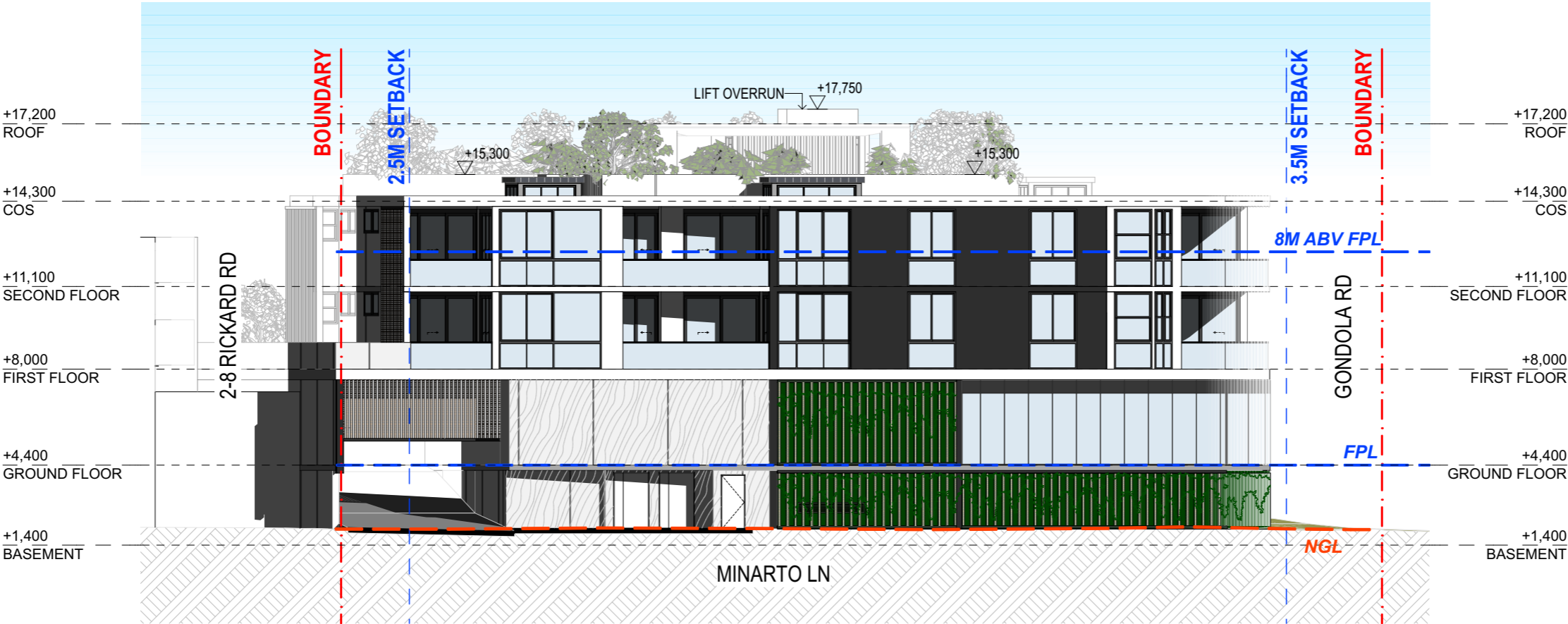
**MULTI RESIDENTIAL DEVELOPMENT**  
PROJECT  
1-3 Gondola Rd North  
Narrabeen 2101

PROJECT NO.  
15/19

DRAWING: ROOF PLAN		DRAWN BY	SCALE	DRAWING NO.	ISSUE
		M.M	1:200@A3	A1006	C
		D.M			



NORTH ELEVATION

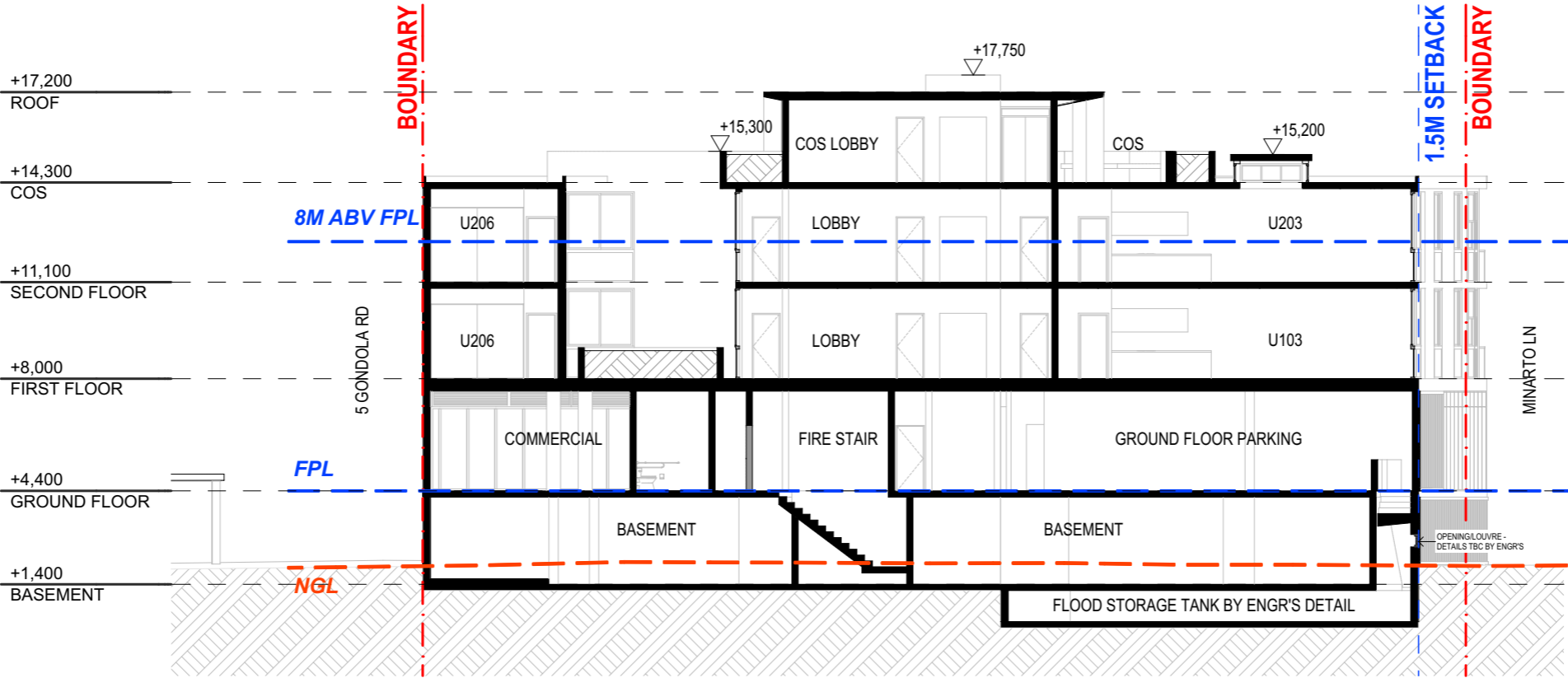


EAST ELEVATION

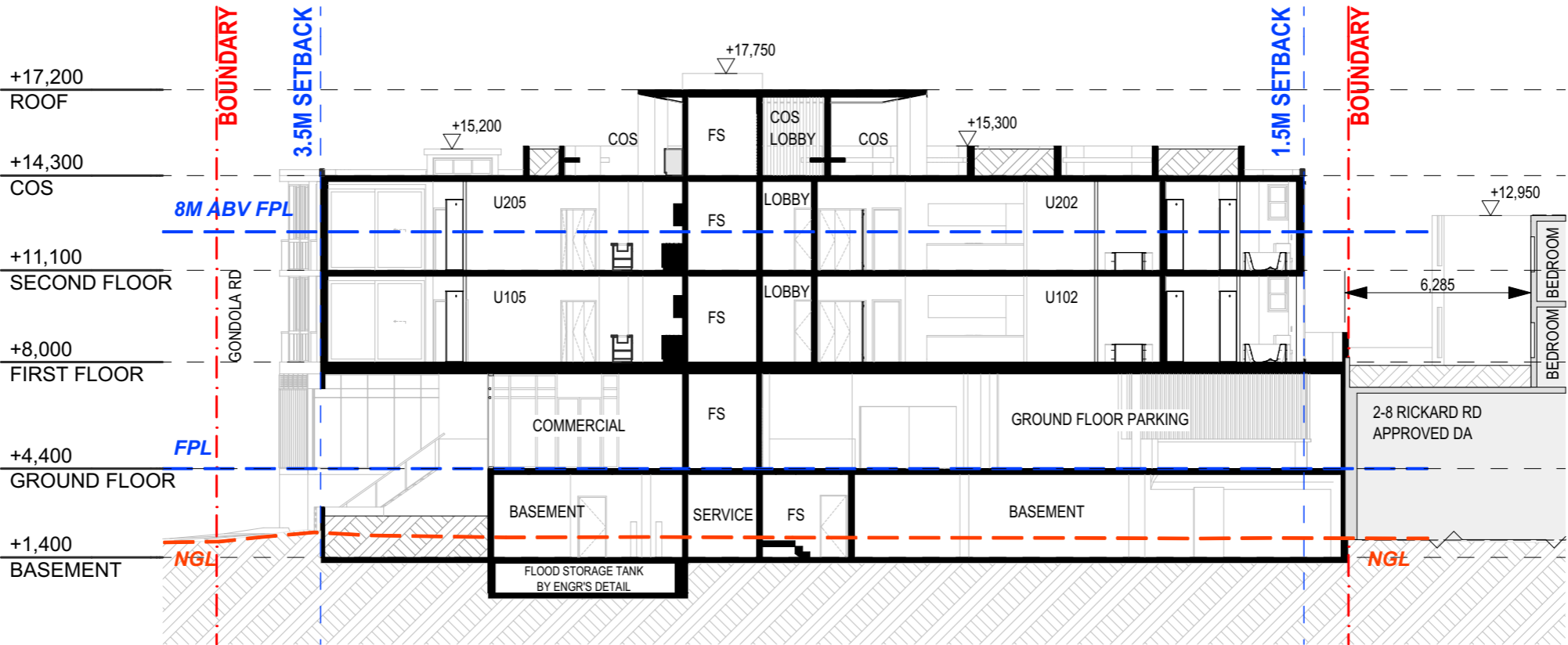
This architectural section drawing illustrates the vertical and horizontal dimensions of a building facade. The drawing is oriented with the building's exterior on the right and the interior on the left. Key features include:

- Vertical Levels (Right Side):**
  - Roof: +17,200
  - COS (Ceiling of Storey): +14,300
  - Second Floor: +11,100
  - First Floor: +8,000
  - Ground Floor: +4,400
  - Basement: +1,400
- Vertical Levels (Left Side):**
  - Roof: +17,200
  - COS: +14,300
  - Second Floor: +11,100
  - First Floor: +8,000
  - Ground Floor: +4,400
  - Basement: +1,400
- Horizontal Dimensions and Features:**
  - BOUNDARY:** Indicated by red dashed lines on both sides.
  - 3.5M SETBACK:** Indicated by a blue dashed line on the left side.
  - 2.5M SETBACK:** Indicated by a blue dashed line on the right side.
  - 8M ABV FPL:** Indicated by a blue dashed line on the left side, representing the height above the Finished Floor Level.
  - FPL:** Indicated by a blue dashed line on the left side, representing the Finished Floor Level.
  - NGL:** Indicated by a red dashed line on the left side, representing the Natural Ground Level.
  - 2-8 RICKARD RD:** Labeled on the right side, indicating the street level.
  - GONDOLA RD:** Labeled on the left side, indicating the street level.
  - LIFT OVERRUN:** Labeled at the top center, indicating the location of the lift overrun.
  - Roof Levels:** Specific roof levels are marked: +14,500, +17,750, +15,200, and +15,300.

	<b>mackenzie</b> architects international	<b>736 PACIFIC HWY</b> Gordon NSW 2072 Phone: (02) 9967 9966 Fax: (02) 9967 9977 <a href="http://www.mainternational.com.au">www.mainternational.com.au</a> <a href="mailto:info@mainternational.com.au">info@mainternational.com.au</a>	Nominated Architect No: 6033 ABN 76 091 107 201 ACN 091107201		<b>LEGEND</b> DO NOT SCALE DRAWINGS VERIFY ALL DIMENSIONS ON SITE BEFORE COMMENCING WORK  <b>COPYRIGHT</b> Mackenzie Architects International is the owner of the copyright subsisting in these drawings, plans, designs and specifications. They must not be used, reproduced or copied in whole or part without prior written consent of Mackenzie Architects International.	AMENDMENTS	REVISION	BY	DATE	<b>MULTI RESIDENTIAL DEVELOPMENT</b> <b>PROJECT</b> <b>1-3 Gondola Rd North</b> <b>Narrabeen 2101</b>  <b>PROJECT NO.</b> <b>15/19</b>	<b>DRAWING:</b> <b>SOUTH &amp; WEST ELEVATIONS</b>  <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 25%;"><b>DRAWN BY</b> M.M</td> <td style="width: 25%;"><b>SCALE:</b> 1:200@A3</td> <td style="width: 25%;"><b>DRAWING NO.:</b> <b>A2002</b></td> <td style="width: 25%;"><b>ISSUE:</b> <b>E</b></td> </tr> <tr> <td colspan="4"><b>CHECKED BY</b> D.M</td> </tr> </table>	<b>DRAWN BY</b> M.M	<b>SCALE:</b> 1:200@A3	<b>DRAWING NO.:</b> <b>A2002</b>	<b>ISSUE:</b> <b>E</b>	<b>CHECKED BY</b> D.M			
						<b>DRAWN BY</b> M.M	<b>SCALE:</b> 1:200@A3	<b>DRAWING NO.:</b> <b>A2002</b>	<b>ISSUE:</b> <b>E</b>										
<b>CHECKED BY</b> D.M																			
A	DA	J.E	03.04.2024																
B	REVISED DA	M.M	12.09.2024																
C	REVISED DA	M.M	25.10.2024																
E	ISSUED FOR RFI	M.M	05.02.2025																



SECTION AA



SECTION BB



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B	REVISED DA	M.M	12.09.2024
C	REVISED DA	M.M	25.10.2024
E	ISSUED FOR RFI	M.M	05.02.2025

**MULTI RESIDENTIAL DEVELOPMENT**  
PROJECT  
**1-3 Gondola Rd North**  
**Narrabeen 2101**  
PROJECT NO.  
**15/19**

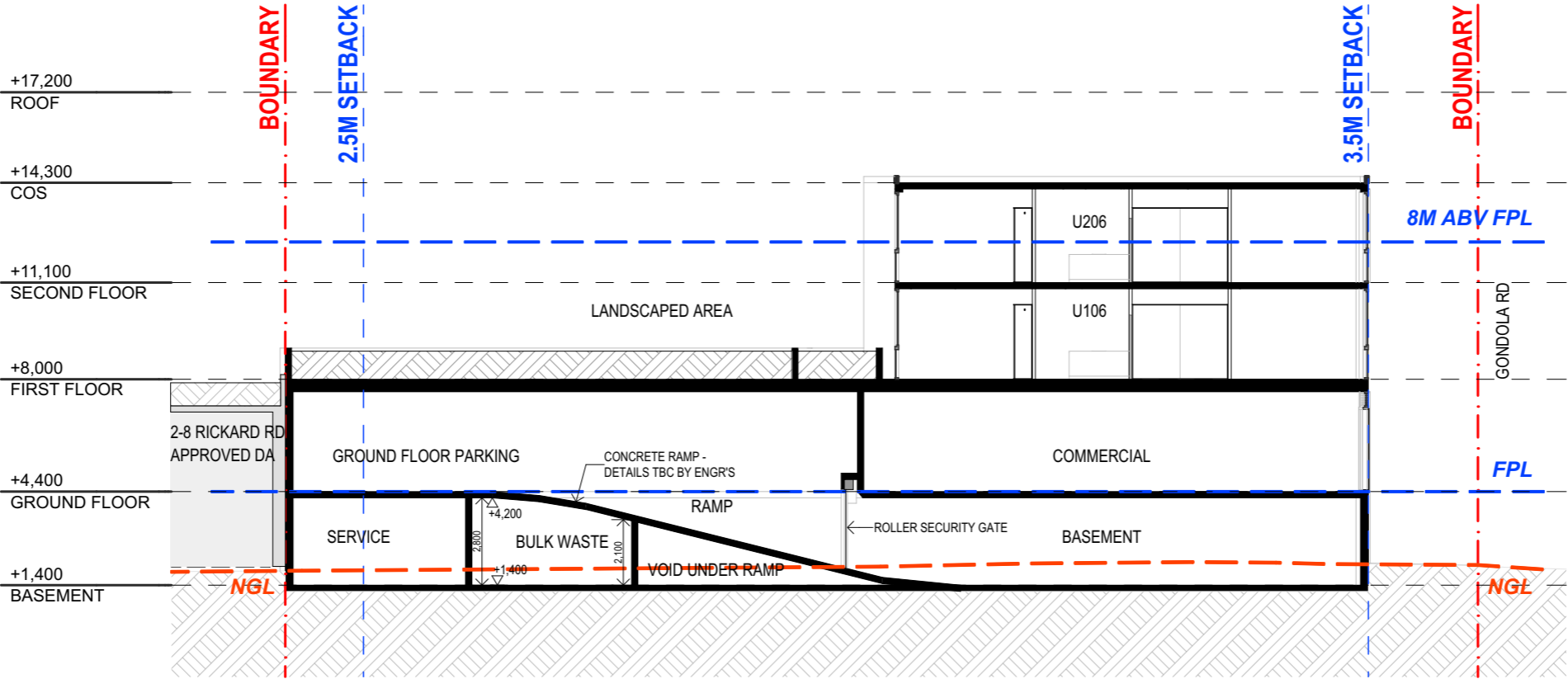
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**SECTIONS 01**

DRAWN BY  
M.M

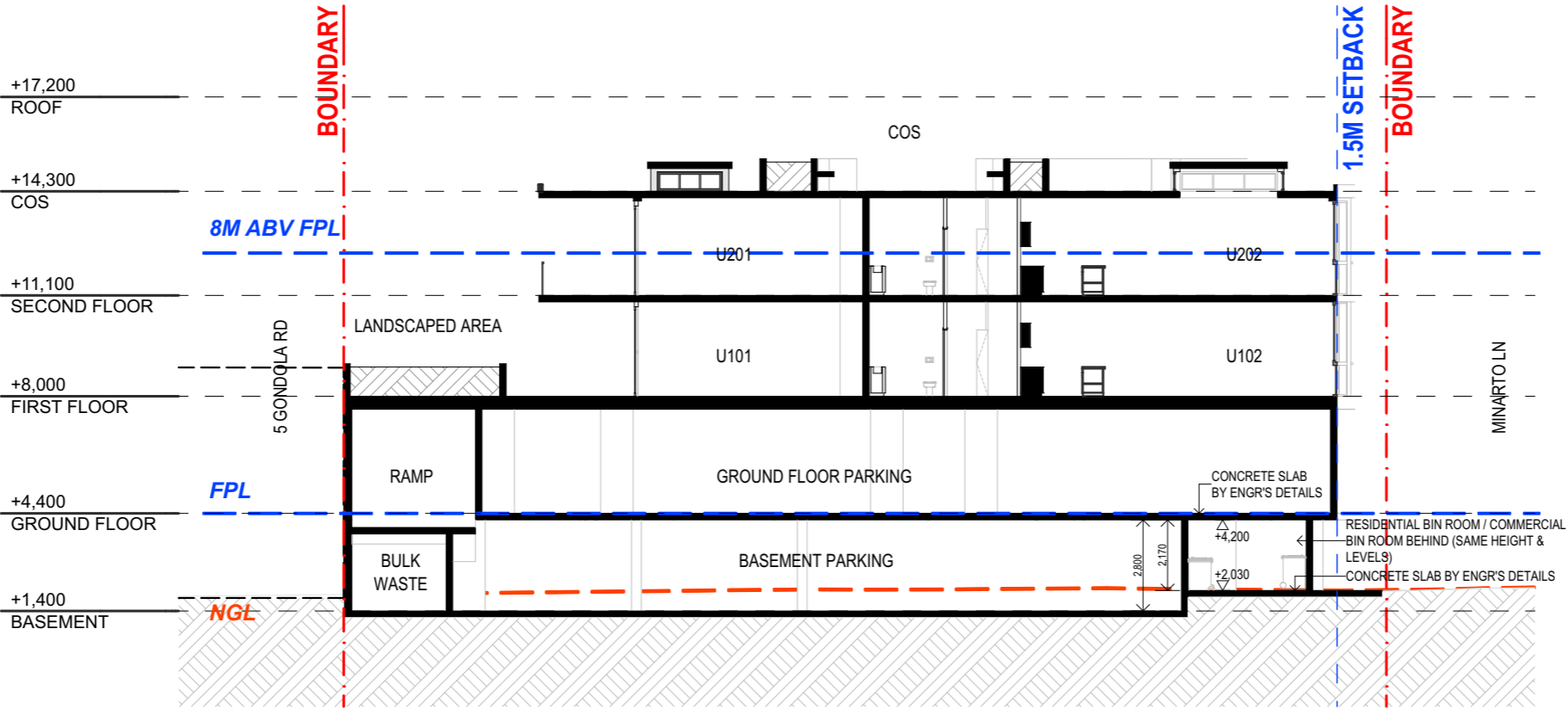
SCALE:  
1:200@A3

DRAWING NO.:  
**A2101**

ISSUE:  
**E**



SECTION CC



SECTION DD



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E	ISSUED FOR RFI	M.M	05.02.2025



**MULTI RESIDENTIAL DEVELOPMENT**  
PROJECT  
1-3 Gondola Rd North  
Narrabeen 2101  
PROJECT NO.  
15/19

DRAWING:  
**SECTIONS 02**

DRAWN BY  
M.M

SCALE:  
1:200@A3

DRAWING NO.:  
**A2102**

ISSUE:  
**E**

PROJECT: FLOOD ENGINEERING SERVICES

PLANSET: FLOOD STORAGE ASSESSMENT

CLIENT: BRETT CROWTHER

DRAWING LIST		
DWG No.	REV	DWG TITLE
GENERAL		
PS02-A000	B	COVER SHEET
FLOODING		
PS02-K200	B	FLOOD STORAGE VOLUME CALCULATIONS
PS02-KZ10	B	BASEMENT PLAN (FLOOD STORAGE DETAILS)
PS02-KZ20	B	FLOOD STORAGE (TANK SECTION AND DETAILS)



SITE PLAN  
N.T.S.

LGA: NORTHERN BEACHES COUNCIL

1-3 GONDOLA STREET, NORTH NARRABEEN, NSW

LOTS 187/DP16719 & 188/DP16719

DEVELOPMENT APPLICATION

REV	DESCRIPTION	DATE	DRAWN	DESIGNED	CHECKED	APPRVD
B	MINOR AMENDMENTS	31/01/2025	SSH	PD	JCF	GT
A	INITIAL RELEASE	24/01/2025	SSH	PD	GT	GT

SCALE

GRID	DATUM	PROJECT MANAGER
		GT
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CLIENT
BRETT CROWTHER
PROJECT NAME/PLANSET TITLE
FLOOD ENGINEERING SERVICES FLOOD STORAGE ASSESSMENT
1-3 GONDOLA STREET, NORTH NARRABEEN, NSW

	Consulting Engineers	
	Environment	Water
Suite 201, 20 George St, Hornsby, NSW 2077 Australia		Phone: (02) 9476 9999 Fax: (02) 9476 8767
Email: mail@martens.com.au		Internet: www.martens.com.au

DRAWING TITLE				
COVER PAGE				
PROJECT NO.	PLANSET NO.	RELEASE NO.	DRAWING NO.	REVISION
P2310036	PS02	R03	PS02-A000	B



EXISTING BUILT FOOTPRINT AREAS (SEE NOTE 1)

SCALE 1:200



PROPOSED BUILT FOOTPRINT AREAS (SEE NOTE 2)

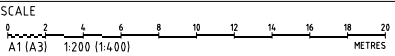
SCALE 1:200

FLOOD STORAGE		
AREAS		UNITS
EXISTING 'BUILT' FOOTPRINT	790	m <sup>2</sup>
PROPOSED 'BUILT' FOOTPRINT	1068	m <sup>2</sup>
FLOOD DATA	CURRENT 1% AEP	
GROUND LEVEL	2.03	mAHD
FLOOD LEVEL	3.03	mAHD
FLOOD DEPTH	1	m
FLOOD STORAGE OCCUPIED	CURRENT 1% AEP	
EXISTING	499	m <sup>3</sup>
DEVELOPED	221	m <sup>3</sup>
STORAGE SHORTFALL	278	m <sup>3</sup>
PROPOSED STORAGE VOLUME	278	m <sup>3</sup>

NOTES:

1. BASED ON GOOGLE EARTH AERIAL DATED 2007  
2. BASED ON ARCHITECTURAL PLANS DATED 13/12/2024

REV	DESCRIPTION	DATE	DRAWN	DESIGNED	CHECKED	APPRVD
B	MINOR AMENDMENTS	31/01/2025	SSH	PD	JCF	GT
A	INITIAL RELEASE	24/01/2025	SSH	PD	GT	GT



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FLOOD STORAGE ASSESSMENT
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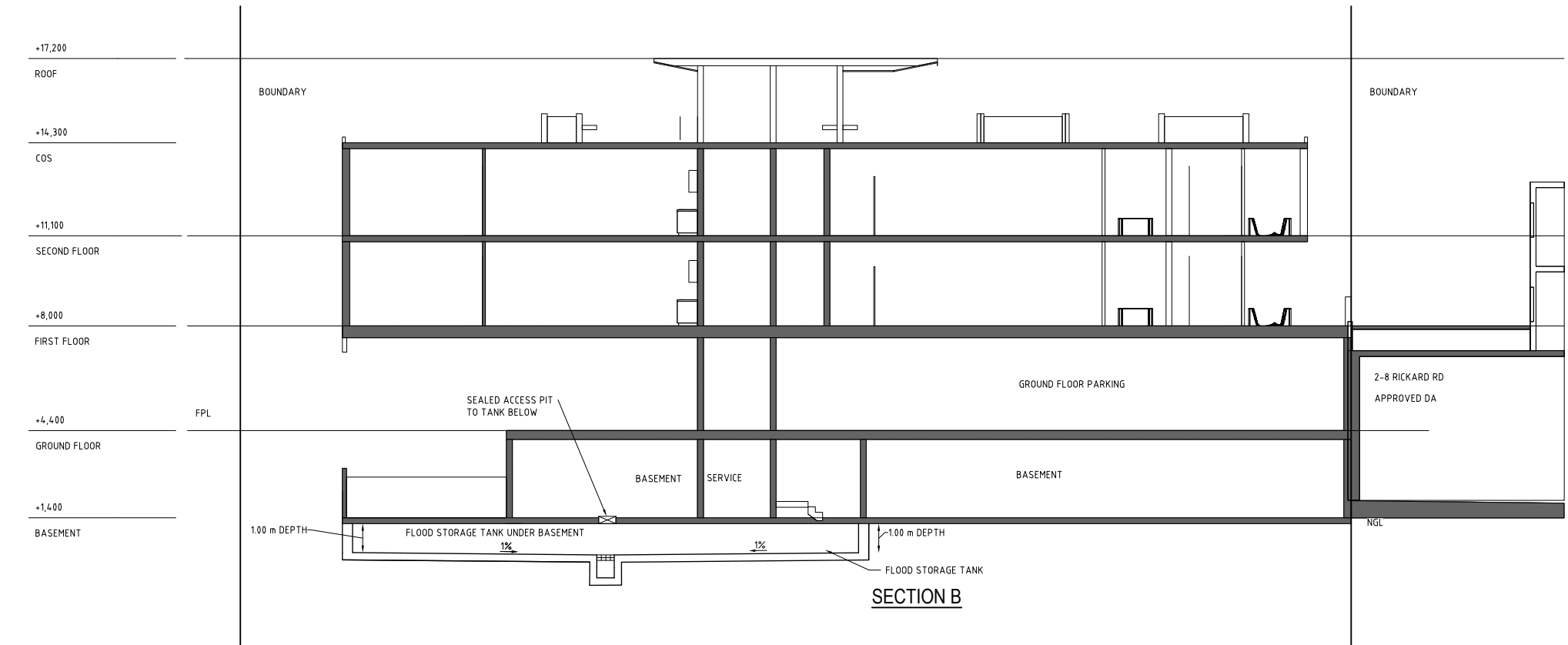
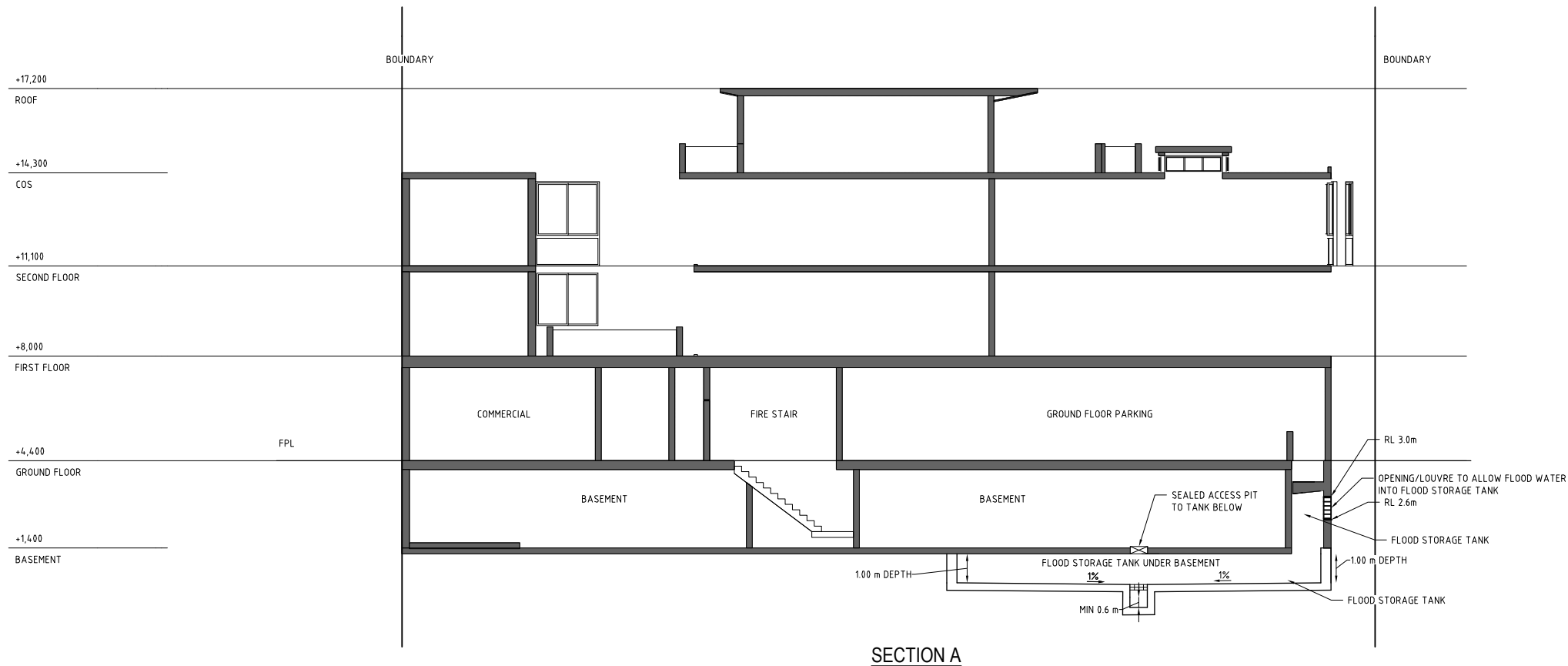
Consulting Engineers  
Environment  
Water  
Geotechnical  
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DEVELOPMENT APPLICATION

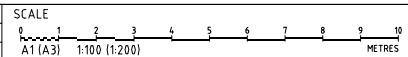
DRAWING TITLE				
FLOOD STORAGE VOLUME CALCULATIONS				
PROJECT NO.	PLANSET NO.	RELEASE NO.	DRAWING NO.	REVISION
P2310036	PS02	R03	PS02-KZ00	B





# DEVELOPMENT APPLICATION

REV	DESCRIPTION	DATE	DRAWN	DESIGNED	CHECKED	APPRVD
B	MINOR AMENDMENTS	31/01/2025	SSH	PD	JCF	GT
A	INITIAL RELEASE	24/01/2025	SSH	PD	GT	GT



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PROJECT NAME/PLANSET TITLE
FLOOD ENGINEERING SERVICES
FLOOD STORAGE ASSESSMENT
1-3 GONDOLA STREET, NORTH NARRABEEN, NSW



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Water  
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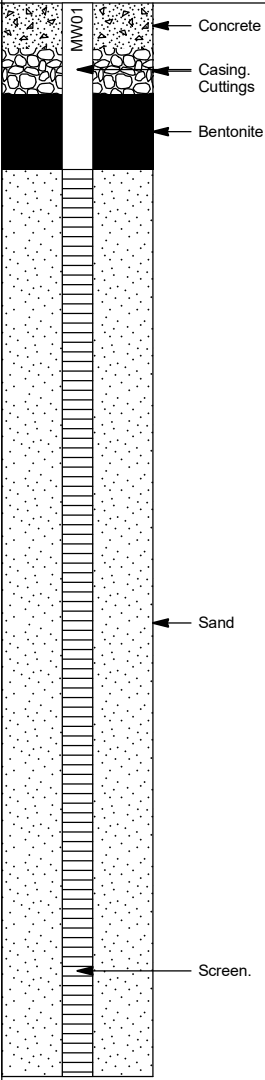
DRAWING TITLE				
FLOOD STORAGE TANK (SECTION AND DETAILS)				
PROJECT NO.	PLANSET NO.	RELEASE NO.	DRAWING NO.	REVISION
P2310036	PS02	R03	PS02-KZ20	B

## Appendix C – Monitoring Well Construction Logs

---



CLIENT	Mackenzie Architects International Pty Ltd	COMMENCED	14/07/2023	COMPLETED	14/07/2023	REF <b>BH201/MW01</b>  Sheet 1 OF 1 PROJECT NO. P2108694	
PROJECT	Preliminary Site Investigation	LOGGED	WX	CHECKED			
SITE	3 Gondola Road, North Narrabeen, NSW	GEOLOGY	Quaternary	VEGETATION	Nil		
EQUIPMENT	4WD truck-mounted hydraulic drill rig	LONGITUDE		RL SURFACE	m	DATUM	AHD
EXCAVATION DIMENSIONS	ø100 mm x 7.70 m depth	LATITUDE		ASPECT	North	SLOPE	<2%

Drilling				Sampling		Field Material Description							
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	PIEZOMETER DETAILS	
HSA		Inflow		0.25	0.3-0.5/S/Dupe02 D 0.30-0.50 m			SM	CONCRETE. FILL: Silty SAND; medium grained; brown; with shell inclusions.			<div>MW01</div> <div>Static Water Level</div> 	
				0.7-0.8/S/1 D 0.70-0.80 m									
			1	1.50			SP	SAND; brown, dark brown; with trace silt; trace shells.					
			2										
			3										
			4	4.00				Grey / brown.					
			5										
			6	6.00				Grey, occasional blackish grey / brown.					
			7										
				7.70									
			8					Hole Terminated at 7.70 m (Target depth reached)					
			9										

EXCAVATION LOG TO BE READ IN CONJUNCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS

## Appendix D – Dewatering Modelling

---

# 4.000

Method ST-na Revised 20.1.2022

## PROJECT DETAILS

Site **1-3 Gondola Road, North Narrabeen - Flood Storage**  
Project **Mixed use development**  
Project Ref **P2310036**

Date **23-Jan-25**  
Assessor **RM**  
Reviewer **GT**

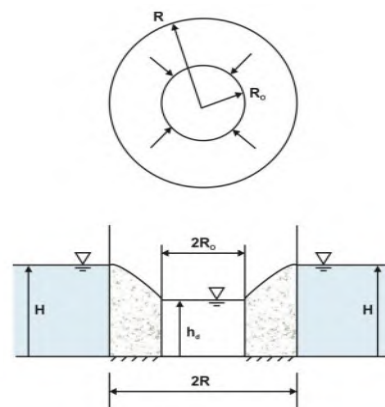
## SIDEWALL INFLOW

Method **Dupuit solution, Bear (1979)**

### FACTOR

	Enter Data	Unit
H - Average static head outside excavation	0.500	m
$h_d$ - Head in excavation (0 if dry)	0.000	m
$R_0$ - Equivalent excavation radius	9.270	m
R - Equivalent radius to constant head boundary	29.034	m
K - Hydraulic conductivity	15.000	m/d
Qs - Sidewall inflow	10.319	m <sup>3</sup> /d

$$Q = -\pi K \frac{(H^2 - h_d^2)}{\ln \left( \frac{R}{R_0} \right)}$$

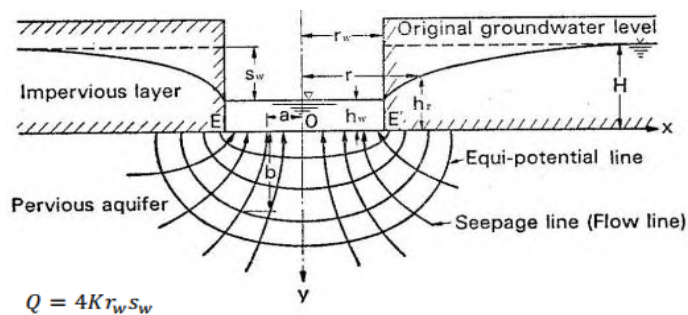


## EXCAVATION BASE INFLOW

Method **Forchheimer (1914)**

### FACTOR

	Enter Data	Unit
H - Average static head outside excavation	0.500	m
$h_d$ - Head in excavation (0 if dry)	0.000	m
$r_w (=R_0)$ - Equivalent excavation radius	9.270	m
Kh:Kv ratio	0.200	-
K - Hydraulic conductivity	3.000	m/d
$S_w$ - Head difference in excavation	0.500	m
Qb - Base inflow	55.620	m <sup>3</sup> /d



## SUMMARY

Qs - Sidewall inflow	10.319	m <sup>3</sup> /d
Qb - Base inflow	55.620	m <sup>3</sup> /d
Qtotal	65.939	m <sup>3</sup> /d
	24.068	ML/year

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# 4.000

Method ST-na Revised 20.1.2022

## PROJECT DETAILS

Site **1-3 Gondola Road, North Narrabeen - Lift Wells**  
Project **Mixed use development**  
Project Ref **P2310036**

Date **23-Jan-25**  
Assessor **RM**  
Reviewer **GT**

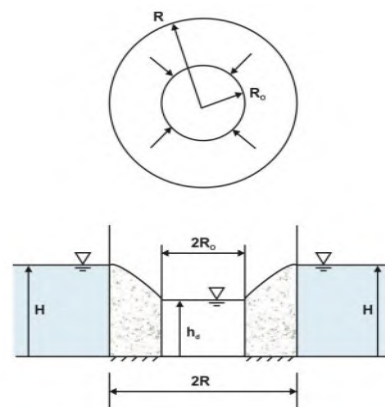
## SIDEWALL INFLOW

Method **Dupuit solution, Bear (1979)**

### FACTOR

	Enter Data	Unit
H - Average static head outside excavation	0.600	m
$h_d$ - Head in excavation (0 if dry)	0.000	m
$R_0$ - Equivalent excavation radius	1.450	m
R - Equivalent radius to constant head boundary	25.167	m
K - Hydraulic conductivity	15.000	m/d
Qs - Sidewall inflow	5.944	m <sup>3</sup> /d

$$Q = -\pi K \frac{(H^2 - h_d^2)}{\ln \left( \frac{R}{R_0} \right)}$$

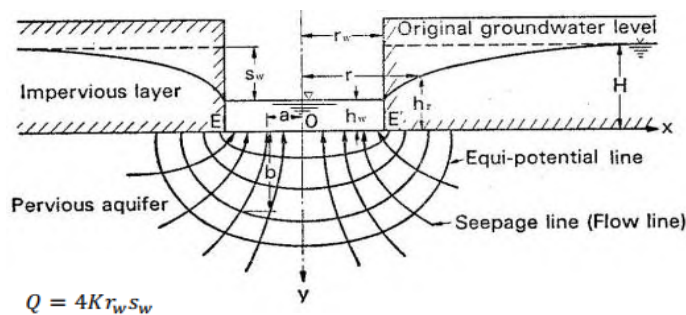


## EXCAVATION BASE INFLOW

Method **Forchheimer (1914)**

### FACTOR

	Enter Data	Unit
H - Average static head outside excavation	0.600	m
$h_d$ - Head in excavation (0 if dry)	0.000	m
$r_w (=R_0)$ - Equivalent excavation radius	1.450	m
Kh:Kv ratio	0.200	-
K - Hydraulic conductivity	3.000	m/d
$S_w$ - Head difference in excavation	0.600	m
Qb - Base inflow	10.440	m <sup>3</sup> /d



$$Q = 4Kr_w S_w$$

## SUMMARY

Qs - Sidewall inflow	5.944	m <sup>3</sup> /d
Qb - Base inflow	10.440	m <sup>3</sup> /d
Qtotal	16.384	m <sup>3</sup> /d
	5.980	ML/year

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Method ST-na Revised 20.1.2022

## PROJECT DETAILS

Site	1-3 Gondola Road, North Narrabeen - Flood Storage Sump
Project	Mixed use development
Project Ref	P2310036

Date	23-Jan-24
Assessor	RM
Reviewer	GT

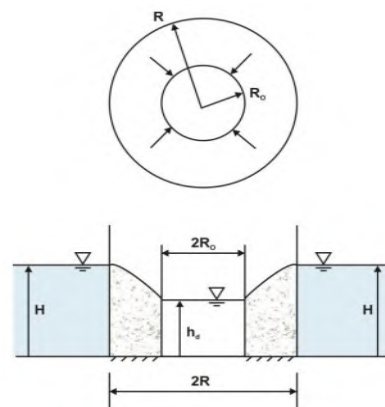
## SIDEWALL INFLOW

Method **Dupuit solution, Bear (1979)**

### FACTOR

	Enter Data	Unit
H - Average static head outside excavation	1.100	m
$h_d$ - Head in excavation (0 if dry)	0.000	m
$R_0$ - Equivalent excavation radius	0.560	m
R - Equivalent radius to constant head boundary	44.040	m
K - Hydraulic conductivity	15.000	m/d
Qs - Sidewall inflow	13.063	m <sup>3</sup> /d

$$Q = -\pi K \frac{(H^2 - h_d^2)}{\ln \left( \frac{R}{R_0} \right)}$$

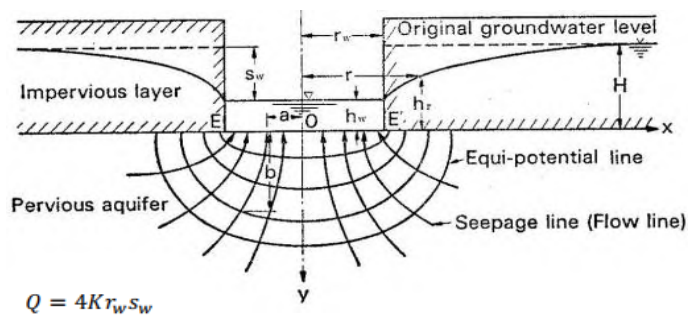


## EXCAVATION BASE INFLOW

Method **Forchheimer (1914)**

### FACTOR

	Enter Data	Unit
H - Average static head outside excavation	1.100	m
$h_d$ - Head in excavation (0 if dry)	0.000	m
$r_w (=R_0)$ - Equivalent excavation radius	0.560	m
Kh:Kv ratio	0.200	-
K - Hydraulic conductivity	3.000	m/d
$S_w$ - Head difference in excavation	1.100	m
Qb - Base inflow	7.392	m <sup>3</sup> /d



$$Q = 4Kr_w S_w$$

## SUMMARY

Qs - Sidewall inflow	13.063	m <sup>3</sup> /d
Qb - Base inflow	7.392	m <sup>3</sup> /d
Qtotal	20.455	m <sup>3</sup> /d
	7.466	ML/year

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## Appendix E – Laboratory Summary Table

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	Biological			Inorganics															
	Faecal Coliforms	E. Coli	Enterococci	Hardness (filtered)	Electrical Conductivity (Non Compensated)	Reactive Silica	Alkalinity (Bicarbonate as CaCO3)	Alkalinity (Carbonate as CaCO3)	Alkalinity (Hydroxide) as CaCO3	Alkalinity (total) as CaCO3	Ammonia as N (filtered)	Chloride	Dissolved Oxygen (Lab)	Ionic Balance	Kjeldahl Nitrogen Total	Nitrate (as N) (filtered)	Nitrite (as N) (filtered)	Organic Nitrogen as N	Nitrogen (Total Oxidised)
	CFU/100mL	cfu/100 ml	org/100ml	mg/L	µS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	%	mg/L	mg/L	mg/L	mg/L	mg/L
	1	1	1	3	1	0.1	5	5	5	5	0.005	1	0.1		0.1	0.005	0.005	0.2	0.005
ANZG Marine Water Toxicant DGVs LOSP 95% (July 2023)											0.91								
NEPM 2013 Table 1A(4) Comm/Ind HSL D GW for Vapour Intrusion, Sand																			

Field ID	Location Code	Date																			
MW01		11 Apr 2024	500	500		1,300	12,000	14	240	<5	<5	240	0.21	3,900	8.3	0	6.0	1.4	0.052	5.8	1.5
MW02		11 Apr 2024	<1,000	<1,000	<10	610	2,300	12	490	<5	<5	490	0.040	420	8.4	-3.0	0.4	8.0	0.036	0.4	8.1

Statistics																			
Number of Detects	1	1	0	2	2	2	2	0	0	2	2	2	2	2	2	2	2	2	2
Maximum Concentration	<1,000	<1,000	<10	1,300	12,000	14	490	<5	<5	490	0.21	3,900	8.4	0	6	8	0.052	5.8	8.1
Average Concentration *	500	500		955	7,150	13	365	2.5	2.5	365	0.12	2,160	8.4	-1.5	3.2	4.7	0.044	3.1	4.8
Median Concentration *	500	500	5	955	7,150	13	365	2.5	2.5	365	0.125	2,160	8.35	-1.5	3.2	4.7	0.044	3.1	4.8
Standard Deviation *	0	0		488	6,859	1.4	177	0	0	177	0.12	2,461	0.071	2.1	4	4.7	0.011	3.8	4.7

\* A Non Detect Multiplier of 0.5 has been applied.

Environmental Standards  
ANZG, July 2023, ANZG Marine Water Toxicant DGVs LOSP 95% (July 2023)  
2013, NEPM 2013 Table 1A(4) Comm/Ind HSL D GW for Vapour Intrusion, Sand

											Organic
	Nitrogen (Total)	pH (Lab)	Total Phosphorus (Organic Phosphate)	Reactive Phosphorus as P (Orthophosphate as P) (filtered)	Sodium (filtered)	Sodium Absorption Ratio	Sulphate	Total Dissolved Solids (Lab)	Total Suspended Solids (Lab)	Turbidity (Lab)	Total Organic Carbon
	mg/L	-	mg/L	mg/L	mg/L	-	mg/L	mg/L	mg/L	NTU	mg/L
EQL	0.1		0.05	0.005	0.5	0.01	1	5	5	0.1	1
ANZG Marine Water Toxicant DGVs LOSP 95% (July 2023)											
NEPM 2013 Table 1A(4) Comm/Ind HSL D GW for Vapour Intrusion, Sand											

Field ID	Location Code	Date											
MW01		11 Apr 2024	7.5	7.0	0.4	<0.005	2,300	27	590	8,800	90	120	9
MW02		11 Apr 2024	8.5	7.2	1.4	0.11	230	3.9	94	1,800	120	210	15

Statistics													
Number of Detects			2	2	2	1	2	2	2	2	2	2	2
Maximum Concentration			8.5	7.2	1.4	0.11	2,300	27	590	8,800	120	210	15
Average Concentration *			8	7.1	0.9	0.056	1,265	15	342	5,300	105	165	12
Median Concentration *			8	7.1	0.9	0.05625	1,265	15.45	342	5,300	105	165	12
Standard Deviation *			0.71	0.14	0.71	0.076	1,464	16	351	4,950	21	64	4.2

\* A Non Detect Multiplier of 0.5 has been applied.

Environmental Standards

ANZG, July 2023, ANZG Marine Water Toxicant DGVs LOSP 95% (July 2023)  
2013, NEPM 2013 Table 1A(4) Comm/Ind HSL D GW for Vapour Intrusion, Sand

	BTEX						TRH											
	Naphthalene (VOC)	Benzene	Toluene	Ethylbenzene	Xylene (m & p)	Xylene (o)	C6-C10 Fraction (F1)	C6-C10 (F1 minus BTEX)	>C10-C16 Fraction (F2)	>C10-C16 Fraction (F2 minus Naphthalene)	>C16-C34 Fraction (F3)	>C34-C40 Fraction (F4)	>C10-C40 Fraction (Sum)	Benzo(b+j+k)fluoranthene	Acenaphthene	Acenaphthylene	Anthracene	Benzo(a)anthracene
	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	µg/L	µg/L	µg/L	µg/L
EQL	0.001	1	1	1	2	1	10	10	50	50	100	100	50	0.0002	0.1	0.1	0.1	0.1
ANZG Marine Water Toxicant DGVs LOSP 95% (July 2023)	0.07	700	180	80													0.4	
NEPM 2013 Table 1A(4) Comm/Ind HSL D GW for Vapour Intrusion, Sand		5,000   5,000   5,000						6,000   6,000   7,000										

Field ID	Location Code	Date																	
MW01		11 Apr 2024	<0.001	<1	<1	<1	<2	<1	<10	<10	<50	<50	<100	<100	<50	<0.0002	<0.1	<0.1	<0.1
MW02		11 Apr 2024	<0.001	<1	<1	<1	<2	<1	<10	<10	<50	<50	<100	<100	<50	<0.0002	<0.1	<0.1	<0.1

Statistics																			
Number of Detects			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Maximum Concentration			<0.001	<1	<1	<1	<2	<1	<10	<10	<50	<50	<100	<100	<50	<0.0002	<0.1	<0.1	<0.1
Average Concentration *			0.0005	0.5	0.5	0.5	1	0.5	5	5	25	25	50	50	25	0.0001	0.05	0.05	0.05
Median Concentration *			0.0005	0.5	0.5	0.5	1	0.5	5	5	25	25	50	50	25	0.0001	0.05	0.05	0.05
Standard Deviation *			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

\* A Non Detect Multiplier of 0.5 has been applied.

Environmental Standards  
ANZG, July 2023, ANZG Marine Water Toxicant DGVs LOSP 95% (July 2023)  
2013, NEPM 2013 Table 1A(4) Comm/Ind HSL D GW for Vapour Intrusion, Sand

	PAH												TPH				
	Benzo(a) pyrene	Benzo(g,h,i) perylene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Naphthalene	Phenanthrene	Pyrene	Benzo(a)pyrene TEQ	PAHs (Sum of positives)	C6-C9 Fraction	C10-C14 Fraction	C15-C28 Fraction	C29-C36 Fraction	C10-C36 Fraction (Sum)
	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L	mg/L	µg/L	µg/L	µg/L	µg/L	µg/L
EQL	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0005	0.0001	10	50	100	100	50
ANZG Marine Water Toxicant DGVs LOSP 95% (July 2023)	0.2				1.4			70	2								
NEPM 2013 Table 1A(4) Comm/Ind HSL D GW for Vapour Intrusion, Sand																	

Field ID	Location Code	Date																		
MW01		11 Apr 2024	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.0005	<0.0001	<10	<50	<100	<100	<50
MW02		11 Apr 2024	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.0005	<0.0001	<10	<50	<100	<100	<50

Statistics																		
Number of Detects	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Maximum Concentration	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.0005	<0.0001	<10	<50	<100	<100	<50
Average Concentration *	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.00025	0.00005	5	25	50	50	25
Median Concentration *	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.00025	0.00005	5	25	50	50	25
Standard Deviation *	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

\* A Non Detect Multiplier of 0.5 has been applied.

Environmental Standards

ANZG, July 2023, ANZG Marine Water Toxicant DGVs LOSP 95% (July 2023)  
2013, NEPM 2013 Table 1A(4) Comm/Ind HSL D GW for Vapour Intrusion, Sand

	Metals																		
	Aluminium (filtered)	Antimony (filtered)	Arsenic (filtered)	Barium (filtered)	Beryllium (filtered)	Boron (filtered)	Cadmium (filtered)	Chromium (III+ VI) (filtered)	Cobalt (filtered)	Copper (filtered)	Iron (filtered)	Lead (filtered)	Lithium (filtered)	Manganese (filtered)	Mercury (filtered)	Molybdenum (filtered)	Nickel (filtered)	Selenium (filtered)	Silicon
	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	µg/L
EQL	0.01	0.001	0.001	0.001	0.0005	0.02	0.0001	0.001	0.001	0.001	0.01	0.001	0.001	0.005	0.00005	0.001	0.001	0.001	200
ANZG Marine Water Toxicant DGVs LOSP 95% (July 2023)							0.0055		0.001	0.0013		0.0044			0.0004		0.07		

Field ID	Location Code	Date																			
MW01		11 Apr 2024	<0.01	0.001	<0.001	0.056	<0.0005	0.52	<0.0001	<0.001	0.001	<0.001	<0.01	<0.001	0.027	0.25	<0.00005	0.003	<0.001	<0.001	3,900
MW02		11 Apr 2024	<0.01	0.002	0.005	0.023	<0.0005	0.07	<0.0001	<0.001	<0.001	0.001	0.02	<0.001	0.007	0.01	<0.00005	0.004	<0.001	<0.001	3,000

Statistics																				
Number of Results	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Number of Detects	0	2	1	2	0	2	0	0	1	1	1	0	2	2	0	2	0	0	0	2
Minimum Detect	ND	0.001	0.005	0.023	ND	0.07	ND	ND	0.001	0.001	0.02	ND	0.007	0.01	ND	0.003	ND	ND	ND	3,000
Maximum Concentration	<0.01	0.002	0.005	0.056	<0.0005	0.52	<0.0001	<0.001	0.001	0.001	0.02	<0.001	0.027	0.25	<0.00005	0.004	<0.001	<0.001	<0.001	3,900
Maximum Detect	ND	0.002	0.005	0.056	ND	0.52	ND	ND	0.001	0.001	0.02	ND	0.027	0.25	ND	0.004	ND	ND	ND	3,900
Median Concentration *	0.005	0.0015	0.00275	0.0395	0.00025	0.295	0.00005	0.0005	0.00075	0.00075	0.0125	0.0005	0.017	0.13	0.000025	0.0035	0.0005	0.0005	0.0005	3,450
Standard Deviation *	0	0.00071	0.0032	0.023	0	0.32	0	0	0.00035	0.00035	0.011	0	0.014	0.17	0	0.00071	0	0	0	636

\* A Non Detect Multiplier of 0.5 has been applied.

Environmental Standards

ANZG, July 2023, ANZG Marine Water Toxicant DGVs LOSP 95% (July 2023)

	Silver (filtered)	Strontium (filtered)	Uranium (filtered)	Vanadium (filtered)	Zinc (filtered)
	mg/L	mg/L	µg/L	mg/L	mg/L
EQL	0.001	0.001	0.5	0.001	0.001
ANZG Marine Water Toxicant DGVs LOSP 95% (July 2023)	0.0014			0.1	0.008

Field ID	Location Code	Date					
MW01		11 Apr 2024	<0.001	1.6	1.2	<0.001	0.003
MW02		11 Apr 2024	<0.001	1.5	3.2	0.012	<0.001

Statistics						
Number of Results	2	2	2	2	2	
Number of Detects	0	2	2	1	1	
Minimum Detect	ND	1.5	1.2	0.012	0.003	
Maximum Concentration	<0.001	1.6	3.2	0.012	0.003	
Maximum Detect	ND	1.6	3.2	0.012	0.003	
Median Concentration *	0.0005	1.55	2.2	0.00625	0.00175	
Standard Deviation *	0	0.071	1.4	0.0081	0.0018	

\* A Non Detect Multiplier of 0.5 has been applied.

Environmental Standards

ANZG, July 2023, ANZG Marine Water Toxicant DGVs LOSP 95% (July 2023)

## Appendix F – Laboratory Analytical Documentation

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## CHAIN OF CUSTODY FORM

Water Testing												
Name	P2310036 – 1-3 Gondola Road, North Narrabeen											
Martens Contact Officer	Trystan Richards						Contact Email	trichards@martens.com.au				
Sampling and Shipping	Sample Date	11/04/2024		Dispatch Date	11/04/2024		Turnaround Time	standard				
	Our Reference	P2310036COC03V01				Shipping Method (X)	Hand		Post		Courier	X
	On Ice (X)	X	No Ice (X)		Other (X)							
Laboratory												
Name	Envirolab											
Sample Delivery Address	12 Ashley Street, Chatswood											
Delivery Contact	Name				Phone	9910 6200		Fax			Email	samlerecept@envirolabservices.com.au
Please Send Report By (X)	Post		Fax		Email	X	Reporting Email Address		trichards@martens.com.au			
									gtaylor@martens.com.au			
									bmccgiffin@martens.com.au			

Sample ID	Ionic Balance	Nutrient Suite	Microbiology suite	Dissolved HM*	TRH, BTEXN, PAH	Dissolved SiO <sub>2</sub>	TSS	TOC	Turbidity	TDS	pH	EC	DO	SAR
MW01	X	X	X	X	X	X	X	X	X	X	X	X	X	X
MW02	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Note: \*Please filter for HM from non-preservative bottles.



Envirolab Services  
 12 Ashley St  
 Chatswood NSW 2067  
 Ph: (02) 9910 6200

Job No: 348642

Date Received: 11/4/24

Time Received: 1655

Received By: ew

Temp: Cool Ambient

Cooling: Ice Icepack

Security: Intact/Broken/None

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 MARTENS & ASSOCIATES P/L  
 ABN 85 070 240 890 ACN 070 240 890

## **CERTIFICATE OF ANALYSIS 348642**

### **Client Details**

<b>Client</b>	Martens & Associates Pty Ltd
<b>Attention</b>	Trystan Richards
<b>Address</b>	Suite 201, 20 George St, Hornsby, NSW, 2077

### **Sample Details**

<b>Your Reference</b>	<b><u>P2310036 - 1-3 Gondola Road, North Narrabeen</u></b>
<b>Number of Samples</b>	2 Water
<b>Date samples received</b>	11/04/2024
<b>Date completed instructions received</b>	11/04/2024

### **Analysis Details**

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

**Please refer to the last page of this report for any comments relating to the results.**

### **Report Details**

<b>Date results requested by</b>	18/04/2024
<b>Date of Issue</b>	19/04/2024
NATA Accreditation Number 2901. This document shall not be reproduced except in full.	
Accredited for compliance with ISO/IEC 17025 - Testing. <b>Tests not covered by NATA are denoted with *</b>	

#### **Results Approved By**

Diego Bigolin, Inorganics Supervisor  
 Dragana Tomas, Senior Chemist  
 Greta Petzold, Operation Manager  
 Hannah Nguyen, Metals Supervisor  
 Loren Bardwell, Development Chemist  
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#### **Authorised By**

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vTRH(C6-C10)/BTEXN in Water			
Our Reference		348642-1	348642-2
Your Reference	UNITS	MW01	MW02
Date Sampled		11/04/2024	11/04/2024
Type of sample		Water	Water
Date extracted	-	14/04/2024	14/04/2024
Date analysed	-	15/04/2024	15/04/2024
TRH C <sub>6</sub> - C <sub>9</sub>	µg/L	<10	<10
TRH C <sub>6</sub> - C <sub>10</sub>	µg/L	<10	<10
TRH C <sub>6</sub> - C <sub>10</sub> less BTEX (F1)	µg/L	<10	<10
Benzene	µg/L	<1	<1
Toluene	µg/L	<1	<1
Ethylbenzene	µg/L	<1	<1
m+p-xylene	µg/L	<2	<2
o-xylene	µg/L	<1	<1
Naphthalene	µg/L	<1	<1
Surrogate Dibromofluoromethane	%	131	130
Surrogate Toluene-d8	%	114	114
Surrogate 4-Bromofluorobenzene	%	91	91

svTRH (C10-C40) in Water			
Our Reference		348642-1	348642-2
Your Reference	UNITS	MW01	MW02
Date Sampled		11/04/2024	11/04/2024
Type of sample		Water	Water
Date extracted	-	15/04/2024	15/04/2024
Date analysed	-	16/04/2024	16/04/2024
TRH C <sub>10</sub> - C <sub>14</sub>	µg/L	<50	<50
TRH C <sub>15</sub> - C <sub>28</sub>	µg/L	<100	<100
TRH C <sub>29</sub> - C <sub>36</sub>	µg/L	<100	<100
Total +ve TRH (C10-C36)	µg/L	<50	<50
TRH >C <sub>10</sub> - C <sub>16</sub>	µg/L	<50	<50
TRH >C <sub>10</sub> - C <sub>16</sub> less Naphthalene (F2)	µg/L	<50	<50
TRH >C <sub>16</sub> - C <sub>34</sub>	µg/L	<100	<100
TRH >C <sub>34</sub> - C <sub>40</sub>	µg/L	<100	<100
Total +ve TRH (>C10-C40)	µg/L	<50	<50
Surrogate o-Terphenyl	%	93	86

PAHs in Water			
Our Reference		348642-1	348642-2
Your Reference	UNITS	MW01	MW02
Date Sampled		11/04/2024	11/04/2024
Type of sample		Water	Water
Date extracted	-	15/04/2024	15/04/2024
Date analysed	-	16/04/2024	16/04/2024
Naphthalene	µg/L	<0.1	<0.1
Acenaphthylene	µg/L	<0.1	<0.1
Acenaphthene	µg/L	<0.1	<0.1
Fluorene	µg/L	<0.1	<0.1
Phenanthrene	µg/L	<0.1	<0.1
Anthracene	µg/L	<0.1	<0.1
Fluoranthene	µg/L	<0.1	<0.1
Pyrene	µg/L	<0.1	<0.1
Benzo(a)anthracene	µg/L	<0.1	<0.1
Chrysene	µg/L	<0.1	<0.1
Benzo(b,j+k)fluoranthene	µg/L	<0.2	<0.2
Benzo(a)pyrene	µg/L	<0.1	<0.1
Indeno(1,2,3-c,d)pyrene	µg/L	<0.1	<0.1
Dibenzo(a,h)anthracene	µg/L	<0.1	<0.1
Benzo(g,h,i)perylene	µg/L	<0.1	<0.1
Benzo(a)pyrene TEQ	µg/L	<0.5	<0.5
Total +ve PAH's	µg/L	<0.1	<0.1
Surrogate <i>p</i> -Terphenyl-d14	%	87	94

HM in water - dissolved			
Our Reference		348642-1	348642-2
Your Reference	UNITS	MW01	MW02
Date Sampled		11/04/2024	11/04/2024
Type of sample		Water	Water
Date prepared	-	17/04/2024	17/04/2024
Date analysed	-	17/04/2024	17/04/2024
Arsenic-Dissolved	µg/L	<1	5
Cadmium-Dissolved	µg/L	<0.1	<0.1
Chromium-Dissolved	µg/L	<1	<1
Copper-Dissolved	µg/L	<1	1
Lead-Dissolved	µg/L	<1	<1
Mercury-Dissolved	µg/L	<0.05	<0.05
Nickel-Dissolved	µg/L	<1	<1
Zinc-Dissolved	µg/L	3	<1

Metals in Waters - Acid extractable			
Our Reference		348642-1	348642-2
Your Reference	UNITS	MW01	MW02
Date Sampled		11/04/2024	11/04/2024
Type of sample		Water	Water
Date prepared	-	15/04/2024	15/04/2024
Date analysed	-	16/04/2024	16/04/2024
Phosphorus - Total	mg/L	0.4	1.4

Miscellaneous Inorganics			
Our Reference		348642-1	348642-2
Your Reference	UNITS	MW01	MW02
Date Sampled		11/04/2024	11/04/2024
Type of sample		Water	Water
Date prepared	-	11/04/2024	11/04/2024
Date analysed	-	11/04/2024	11/04/2024
Ammonia as N in water	mg/L	0.21	0.040
Nitrate as N in water	mg/L	1.4	8.0
Nitrite as N in water	mg/L	0.052	0.036
NOx as N in water	mg/L	1.5	8.1
Total Nitrogen in water	mg/L	7.5	8.5
TKN in water	mg/L	6.0	0.4
Phosphate as P in water	mg/L	<0.005	0.11
Organic Nitrogen as N	mg/L	5.8	0.4
Total Organic Carbon	mg/L	9	15
Total Suspended Solids	mg/L	90	120
Turbidity	NTU	120	210
Sodium Adsorption Ratio	-	27	3.9
Total Dissolved Solids (grav)	mg/L	8,800	1,800
pH	pH Units	7.0	7.2
Electrical Conductivity	µS/cm	12,000	2,300
Dissolved Oxygen*	mg/L	8.3	8.4
Silica (Reactive - SiO <sub>2</sub> )	mg/L	14	12

Ion Balance			
Our Reference		348642-1	348642-2
Your Reference	UNITS	MW01	MW02
Date Sampled		11/04/2024	11/04/2024
Type of sample		Water	Water
Date prepared	-	11/04/2024	11/04/2024
Date analysed	-	11/04/2024	11/04/2024
Calcium - Dissolved	mg/L	150	180
Potassium - Dissolved	mg/L	76	7.3
Sodium - Dissolved	mg/L	2,300	230
Magnesium - Dissolved	mg/L	230	38
Hardness (calc) equivalent CaCO <sub>3</sub>	mg/L	1,300	610
Hydroxide Alkalinity (OH <sup>-</sup> ) as CaCO <sub>3</sub>	mg/L	<5	<5
Bicarbonate Alkalinity as CaCO <sub>3</sub>	mg/L	240	490
Carbonate Alkalinity as CaCO <sub>3</sub>	mg/L	<5	<5
Total Alkalinity as CaCO <sub>3</sub>	mg/L	240	490
Sulphate, SO <sub>4</sub>	mg/L	590	94
Chloride, Cl	mg/L	3,900	420
Ionic Balance	%	0	-3.0

Microbiological Testing			
Our Reference		348642-1	348642-2
Your Reference	UNITS	MW01	MW02
Date Sampled		11/04/2024	11/04/2024
Type of sample		Water	Water
Date of testing	-	12/04/2024	12/04/2024
Faecal Coliforms	cfu/100mL	500	<1000
E. coli	cfu/100mL	500	<1000
Enterococci	cfu/100mL	30 A	<10

Method ID	Methodology Summary
<b>Ext-008</b>	Subcontracted to Sonic Food & Water Testing. NATA Accreditation No. 4034.
<b>Inorg-001</b>	pH - Measured using pH meter and electrode. Please note that the results for water analyses are indicative only, as analysis outside of the APHA storage times.
<b>Inorg-002</b>	Conductivity and Salinity - measured using a conductivity cell.
<b>Inorg-006</b>	Alkalinity - determined titrimetrically in accordance with APHA latest edition, 2320-B.
<b>Inorg-018</b>	Total Dissolved Solids - determined gravimetrically. The solids are dried at 180+/-10°C.  NOTE: Where the EC of the sample is <100µS/cm, the TDS will typically be below 70mg/L (as the sample is very likely to be at least drinking water quality). Therefore to ensure data quality for TDS, the TDS is typically calculated as per the equation below:-  $\text{TDS} = \text{EC} * 0.6$
<b>Inorg-019</b>	Suspended Solids - determined gravimetrically by filtration of the sample. The samples are dried at 104+/-5°C.
<b>Inorg-022</b>	Turbidity - measured nephelometrically using a turbidimeter, in accordance with APHA latest edition, 2130-B.
<b>Inorg-040</b>	The concentrations of the major ions (mg/L) are converted to milliequivalents and summed. The ionic balance should be within +/- 15% ie total anions = total cations +/-15%.
<b>Inorg-055</b>	Nitrate - determined colourimetrically. Waters samples are filtered on receipt prior to analysis. Soils are analysed following a water extraction.
<b>Inorg-055</b>	Nitrite - determined colourimetrically based on APHA latest edition NO2- B. Waters samples are filtered on receipt prior to analysis. Soils are analysed following a water extraction.
<b>Inorg-055/062/127</b>	Total Nitrogen - Calculation sum of TKN and oxidised Nitrogen. Alternatively analysed by combustion and chemiluminescence.
<b>Inorg-057</b>	Ammonia - determined colourimetrically, based on APHA latest edition 4500-NH3 F. Waters samples are filtered on receipt prior to analysis. Soils are analysed following a KCl extraction.
<b>Inorg-060</b>	Phosphate determined colourimetrically based on EPA365.1 and APHA latest edition 4500 P E. Waters samples are filtered on receipt prior to analysis. Soils are analysed following a water extraction.
<b>Inorg-062</b>	TKN - determined colourimetrically based on APHA latest edition 4500 Norg. Alternatively, TKN can be derived from calculation (Total N - NOx).
<b>Inorg-079</b>	TOC determined using a TOC analyser using the combustion method. Dissolved requires filtering prior to determination. Analysis using APHA latest edition 5310B.
<b>Inorg-081</b>	Anions - a range of Anions are determined by Ion Chromatography, in accordance with APHA latest edition, 4110-B. Waters samples are filtered on receipt prior to analysis. Alternatively determined by colourimetry/turbidity using Discrete Analyser.
<b>Inorg-112</b>	Dissolved Oxygen using membrane electrode. Note this analysis should ideally be carried out immediately after sampling.
<b>INORG-120</b>	Reactive Silica (SiO2) determined colorimetrically. Waters samples are filtered on receipt prior to analysis.
<b>Metals-020</b>	Determination of various metals by ICP-AES.
<b>Metals-020</b>	Calcium and Magnesium analysed by ICP-AES and SAR calculated.
<b>Metals-021</b>	Determination of Mercury by Cold Vapour AAS.

Method ID	Methodology Summary
<b>Metals-022</b>	Determination of various metals by ICP-MS.  Please note for Bromine and Iodine, any forms of these elements that are present are included together in the one result reported for each of these two elements.  Salt forms (e.g. FeO, PbO, ZnO) are determined stoichiometrically from the base metal concentration.
<b>Org-020</b>	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis.
<b>Org-022/025</b>	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS/GC-MSMS. Benzo(a)pyrene TEQ as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater - 2013.
<b>Org-023</b>	Water samples are analysed directly by purge and trap GC-MS.
<b>Org-023</b>	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater.

QUALITY CONTROL: vTRH(C6-C10)/BTEXN in Water					Duplicate			Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W5	[NT]
Date extracted	-			14/04/2024	[NT]	[NT]	[NT]	[NT]	14/04/2024	[NT]
Date analysed	-			15/04/2024	[NT]	[NT]	[NT]	[NT]	15/04/2024	[NT]
TRH C <sub>6</sub> - C <sub>9</sub>	µg/L	10	Org-023	<10	[NT]	[NT]	[NT]	[NT]	107	[NT]
TRH C <sub>6</sub> - C <sub>10</sub>	µg/L	10	Org-023	<10	[NT]	[NT]	[NT]	[NT]	107	[NT]
Benzene	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	116	[NT]
Toluene	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	111	[NT]
Ethylbenzene	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	103	[NT]
m+p-xylene	µg/L	2	Org-023	<2	[NT]	[NT]	[NT]	[NT]	103	[NT]
o-xylene	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	105	[NT]
Naphthalene	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate Dibromofluoromethane	%		Org-023	121	[NT]	[NT]	[NT]	[NT]	107	[NT]
Surrogate Toluene-d8	%		Org-023	113	[NT]	[NT]	[NT]	[NT]	100	[NT]
Surrogate 4-Bromofluorobenzene	%		Org-023	96	[NT]	[NT]	[NT]	[NT]	94	[NT]

QUALITY CONTROL: svTRH (C10-C40) in Water					Duplicate			Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	348642-1
Date extracted	-			15/04/2024	[NT]	[NT]	[NT]	[NT]	15/04/2024	15/04/2024
Date analysed	-			15/04/2024	[NT]	[NT]	[NT]	[NT]	15/04/2024	16/04/2024
TRH C <sub>10</sub> - C <sub>14</sub>	µg/L	50	Org-020	<50	[NT]	[NT]	[NT]	[NT]	112	121
TRH C <sub>15</sub> - C <sub>28</sub>	µg/L	100	Org-020	<100	[NT]	[NT]	[NT]	[NT]	104	112
TRH C <sub>29</sub> - C <sub>36</sub>	µg/L	100	Org-020	<100	[NT]	[NT]	[NT]	[NT]	86	95
TRH >C <sub>10</sub> - C <sub>16</sub>	µg/L	50	Org-020	<50	[NT]	[NT]	[NT]	[NT]	112	121
TRH >C <sub>16</sub> - C <sub>34</sub>	µg/L	100	Org-020	<100	[NT]	[NT]	[NT]	[NT]	104	112
TRH >C <sub>34</sub> - C <sub>40</sub>	µg/L	100	Org-020	<100	[NT]	[NT]	[NT]	[NT]	86	95
Surrogate o-Terphenyl	%		Org-020	91	[NT]	[NT]	[NT]	[NT]	90	93

QUALITY CONTROL: PAHs in Water					Duplicate			Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W2	348642-1
Date extracted	-			15/04/2024	[NT]	[NT]	[NT]	[NT]	15/04/2024	15/04/2024
Date analysed	-			16/04/2024	[NT]	[NT]	[NT]	[NT]	16/04/2024	16/04/2024
Naphthalene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	87	83
Acenaphthylene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Acenaphthene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	78	76
Fluorene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	91	80
Phenanthrene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	75	74
Anthracene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Fluoranthene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	79	78
Pyrene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	94	83
Benzo(a)anthracene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Chrysene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	72	71
Benzo(b,j+k)fluoranthene	µg/L	0.2	Org-022/025	<0.2	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Benzo(a)pyrene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	86	87
Indeno(1,2,3-c,d)pyrene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Dibenzo(a,h)anthracene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Benzo(g,h,i)perylene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate p-Terphenyl-d14	%		Org-022/025	84	[NT]	[NT]	[NT]	[NT]	99	92

QUALITY CONTROL: HM in water - dissolved					Duplicate			Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			17/04/2024	[NT]	[NT]	[NT]	[NT]	17/04/2024	[NT]
Date analysed	-			17/04/2024	[NT]	[NT]	[NT]	[NT]	17/04/2024	[NT]
Arsenic-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	103	[NT]
Cadmium-Dissolved	µg/L	0.1	Metals-022	<0.1	[NT]	[NT]	[NT]	[NT]	104	[NT]
Chromium-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	104	[NT]
Copper-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	105	[NT]
Lead-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	106	[NT]
Mercury-Dissolved	µg/L	0.05	Metals-021	<0.05	[NT]	[NT]	[NT]	[NT]	97	[NT]
Nickel-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	106	[NT]
Zinc-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	99	[NT]

**Client Reference: P2310036 - 1-3 Gondola Road, North Narrabeen**

QUALITY CONTROL: Metals in Waters - Acid extractable						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	348642-2
Date prepared	-			15/04/2024	[NT]	[NT]	[NT]	[NT]	15/04/2024	15/04/2024
Date analysed	-			16/04/2024	[NT]	[NT]	[NT]	[NT]	16/04/2024	16/04/2024
Phosphorus - Total	mg/L	0.05	Metals-020	<0.05	[NT]	[NT]	[NT]	[NT]	89	89

QUALITY CONTROL: Miscellaneous Inorganics						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			11/04/2024	1	11/04/2024	11/04/2024		11/04/2024	[NT]
Date analysed	-			11/04/2024	1	11/04/2024	11/04/2024		11/04/2024	[NT]
Ammonia as N in water	mg/L	0.005	Inorg-057	<0.005	1	0.21	[NT]		103	[NT]
Nitrate as N in water	mg/L	0.005	Inorg-055	<0.005	1	1.4	[NT]		99	[NT]
Nitrite as N in water	mg/L	0.005	Inorg-055	<0.005	1	0.052	[NT]		101	[NT]
NOx as N in water	mg/L	0.005	Inorg-055	<0.005	1	1.5	[NT]		99	[NT]
Total Nitrogen in water	mg/L	0.1	Inorg-055/062/127	<0.1	1	7.5	[NT]		87	[NT]
TKN in water	mg/L	0.1	Inorg-062	<0.1	1	6.0	[NT]		[NT]	[NT]
Phosphate as P in water	mg/L	0.005	Inorg-060	<0.005	1	<0.005	[NT]		115	[NT]
Organic Nitrogen as N	mg/L	0.2	Inorg-055/062/127	<0.2	1	5.8	[NT]		[NT]	[NT]
Total Organic Carbon	mg/L	1	Inorg-079	<1	1	9	[NT]		84	[NT]
Total Suspended Solids	mg/L	5	Inorg-019	<5	1	90	83	8	97	[NT]
Turbidity	NTU	0.1	Inorg-022	<0.1	1	120	[NT]		100	[NT]
Sodium Adsorption Ratio	-	0.01	Metals-020	<0.01	1	27	[NT]		96	[NT]
Total Dissolved Solids (grav)	mg/L	5	Inorg-018	<5	1	8800	[NT]		102	[NT]
pH	pH Units		Inorg-001	[NT]	1	7.0	[NT]		99	[NT]
Electrical Conductivity	µS/cm	1	Inorg-002	<1	1	12000	[NT]		100	[NT]
Dissolved Oxygen*	mg/L	0.1	Inorg-112	<0.1	1	8.3	[NT]		[NT]	[NT]
Silica (Reactive - SiO <sub>2</sub> )	mg/L	0.1	INORG-120	<0.1	1	14	[NT]		95	[NT]

QUALITY CONTROL: Ion Balance					Duplicate			Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			11/04/2024	[NT]	[NT]	[NT]	[NT]	11/04/2024	[NT]
Date analysed	-			11/04/2024	[NT]	[NT]	[NT]	[NT]	11/04/2024	[NT]
Calcium - Dissolved	mg/L	0.5	Metals-020	<0.5	[NT]	[NT]	[NT]	[NT]	103	[NT]
Potassium - Dissolved	mg/L	0.5	Metals-020	<0.5	[NT]	[NT]	[NT]	[NT]	96	[NT]
Sodium - Dissolved	mg/L	0.5	Metals-020	<0.5	[NT]	[NT]	[NT]	[NT]	97	[NT]
Magnesium - Dissolved	mg/L	0.5	Metals-020	<0.5	[NT]	[NT]	[NT]	[NT]	104	[NT]
Hydroxide Alkalinity (OH <sup>-</sup> ) as CaCO <sub>3</sub>	mg/L	5	Inorg-006	<5	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Bicarbonate Alkalinity as CaCO <sub>3</sub>	mg/L	5	Inorg-006	<5	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Carbonate Alkalinity as CaCO <sub>3</sub>	mg/L	5	Inorg-006	<5	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Total Alkalinity as CaCO <sub>3</sub>	mg/L	5	Inorg-006	<5	[NT]	[NT]	[NT]	[NT]	105	[NT]
Sulphate, SO4	mg/L	1	Inorg-081	<1	[NT]	[NT]	[NT]	[NT]	117	[NT]
Chloride, Cl	mg/L	1	Inorg-081	<1	[NT]	[NT]	[NT]	[NT]	114	[NT]

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Samples for Microbiological analysis (not Amoeba forms) received outside of the 2-8°C temperature range do not meet the ideal cooling conditions as stated in AS2031-2012.

## Report Comments

Microbiology analysed by Sonic Food & Water Testing. Report No. W2408699 & W2408700

A: Approximate

The time between collection and the commencement of testing should not exceed 24 hours. Samples tested outside this time may have their results compromised

Dissolved Metals: no filtered, preserved sample was received, therefore the unpreserved sample was filtered through 0.45µm filter at the lab.

Note: there is a possibility some elements may be underestimated.

## **CERTIFICATE OF ANALYSIS 348642-A**

### **Client Details**

<b>Client</b>	Martens & Associates Pty Ltd
<b>Attention</b>	Trystan Richards
<b>Address</b>	Suite 201, 20 George St, Hornsby, NSW, 2077

### **Sample Details**

<b>Your Reference</b>	<b><u>P2310036 - 1-3 Gondola Road, North Narrabeen</u></b>
<b>Number of Samples</b>	Additional analysis
<b>Date samples received</b>	11/04/2024
<b>Date completed instructions received</b>	26/04/2024

### **Analysis Details**

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

**Please refer to the last page of this report for any comments relating to the results.**

### **Report Details**

<b>Date results requested by</b>	03/05/2024
<b>Date of Issue</b>	26/04/2024
NATA Accreditation Number 2901. This document shall not be reproduced except in full.	
Accredited for compliance with ISO/IEC 17025 - Testing. <b>Tests not covered by NATA are denoted with *</b>	

#### **Results Approved By**

Hannah Nguyen, Metals Supervisor

#### **Authorised By**

Nancy Zhang, Laboratory Manager

All metals in water-dissolved			
Our Reference		348642-A-1	348642-A-2
Your Reference	UNITS	MW01	MW02
Date Sampled		11/04/2024	11/04/2024
Type of sample		Water	Water
Date prepared	-	17/04/2024	17/04/2024
Date analysed	-	17/04/2024	17/04/2024
Aluminium-Dissolved	µg/L	<10	<10
Antimony-Dissolved	µg/L	1	2
Arsenic-Dissolved	µg/L	<1	5
Barium-Dissolved	µg/L	56	23
Beryllium-Dissolved	µg/L	<0.5	<0.5
Boron-Dissolved	µg/L	520	70
Cadmium-Dissolved	µg/L	<0.1	<0.1
Chromium-Dissolved	µg/L	<1	<1
Cobalt-Dissolved	µg/L	1	<1
Copper-Dissolved	µg/L	<1	1
Iron-Dissolved	µg/L	<10	20
Lead-Dissolved	µg/L	<1	<1
Lithium-Dissolved	µg/L	27	7
Manganese-Dissolved	µg/L	250	10
Mercury-Dissolved	µg/L	<0.05	<0.05
Molybdenum-Dissolved	µg/L	3	4
Nickel-Dissolved	µg/L	<1	<1
Selenium-Dissolved	µg/L	<1	<1
Silver-Dissolved	µg/L	<1	<1
Strontium-Dissolved	µg/L	1,600	1,500
Uranium-Dissolved	µg/L	1.2	3.2
Vanadium-Dissolved	µg/L	<1	12
Zinc-Dissolved	µg/L	3	<1

Metals in Water - Dissolved			
Our Reference		348642-A-1	348642-A-2
Your Reference	UNITS	MW01	MW02
Date Sampled		11/04/2024	11/04/2024
Type of sample		Water	Water
Date digested	-	17/04/2024	17/04/2024
Date analysed	-	17/04/2024	17/04/2024
Silicon*- Dissolved	mg/L	3.9	3.0

Method ID	Methodology Summary
<b>Metals-020</b>	Determination of various metals by ICP-AES.
<b>Metals-021</b>	Determination of Mercury by Cold Vapour AAS.
<b>Metals-022</b>	Determination of various metals by ICP-MS.  Please note for Bromine and Iodine, any forms of these elements that are present are included together in the one result reported for each of these two elements.  Salt forms (e.g. FeO, PbO, ZnO) are determined stoichiometrically from the base metal concentration.

QUALITY CONTROL: All metals in water-dissolved					Duplicate			Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			17/04/2024	[NT]	[NT]	[NT]	[NT]	17/04/2024	[NT]
Date analysed	-			17/04/2024	[NT]	[NT]	[NT]	[NT]	17/04/2024	[NT]
Aluminium-Dissolved	µg/L	10	Metals-022	<10	[NT]	[NT]	[NT]	[NT]	102	[NT]
Antimony-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	99	[NT]
Arsenic-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	103	[NT]
Barium-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	110	[NT]
Beryllium-Dissolved	µg/L	0.5	Metals-022	<0.5	[NT]	[NT]	[NT]	[NT]	95	[NT]
Boron-Dissolved	µg/L	20	Metals-022	<20	[NT]	[NT]	[NT]	[NT]	119	[NT]
Cadmium-Dissolved	µg/L	0.1	Metals-022	<0.1	[NT]	[NT]	[NT]	[NT]	104	[NT]
Chromium-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	104	[NT]
Cobalt-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	107	[NT]
Copper-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	105	[NT]
Iron-Dissolved	µg/L	10	Metals-022	<10	[NT]	[NT]	[NT]	[NT]	105	[NT]
Lead-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	106	[NT]
Lithium-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	106	[NT]
Manganese-Dissolved	µg/L	5	Metals-022	<5	[NT]	[NT]	[NT]	[NT]	106	[NT]
Mercury-Dissolved	µg/L	0.05	Metals-021	<0.05	[NT]	[NT]	[NT]	[NT]	97	[NT]
Molybdenum-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	104	[NT]
Nickel-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	106	[NT]
Selenium-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	97	[NT]
Silver-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	82	[NT]
Strontium-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	105	[NT]
Uranium-Dissolved	µg/L	0.5	Metals-022	<0.5	[NT]	[NT]	[NT]	[NT]	99	[NT]
Vanadium-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	105	[NT]
Zinc-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	99	[NT]

**Client Reference: P2310036 - 1-3 Gondola Road, North Narrabeen**

QUALITY CONTROL: Metals in Water - Dissolved					Duplicate			Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date digested	-			17/04/2024	[NT]	[NT]	[NT]	[NT]	17/04/2024	[NT]
Date analysed	-			17/04/2024	[NT]	[NT]	[NT]	[NT]	17/04/2024	[NT]
Silicon*- Dissolved	mg/L	0.2	Metals-020	<0.2	[NT]	[NT]	[NT]	[NT]	98	[NT]

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