

**OVERLAND FLOW
INVESTIGATION & REPORT
PROPOSED MIXED USE DEVELOPMENT
1010 – 1014 PITTWATER RD
COLLARROY**



Image - Gartner Trovato Architects

**Job No 240403
April 2024
Prepared by
Lucas Molloy
MIEAust / CPEng / NER /**

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1. INTRODUCTION

In association with the proposed shop top housing development at Nos 1010 – 1014 Pittwater Rd Collaroy (DA 2023 / 1395), Barrenjoey Consulting Engineers pty ltd have been commissioned to investigate the possible effects of overland flow (along Pittwater Rd) from localised stormwater runoff on the development.

Barrenjoey Consulting Engineers pty ltd inspected the site and surrounding stormwater management infrastructure on Friday 5th April 2024.

This investigation and report has been prepared in respect to Northern Beaches Councils Engineering Referral Response Officer comments (dated 28/11/2023) –

“The subject site may be affected by overland flows along Pittwater Road in the 1% AEP storm event, which may enter the basement via the proposed driveway. In this regard, the applicant's Engineer is to provide an overland flow report for all storms in excess of the 5% AEP, up to and including the 1% AEP storm event to determine if the subject site is affected by any overland flows. The report is to include measures to protect the site from flooding in accordance with the requirements of the Flood Prone Land clause of the DCP.”



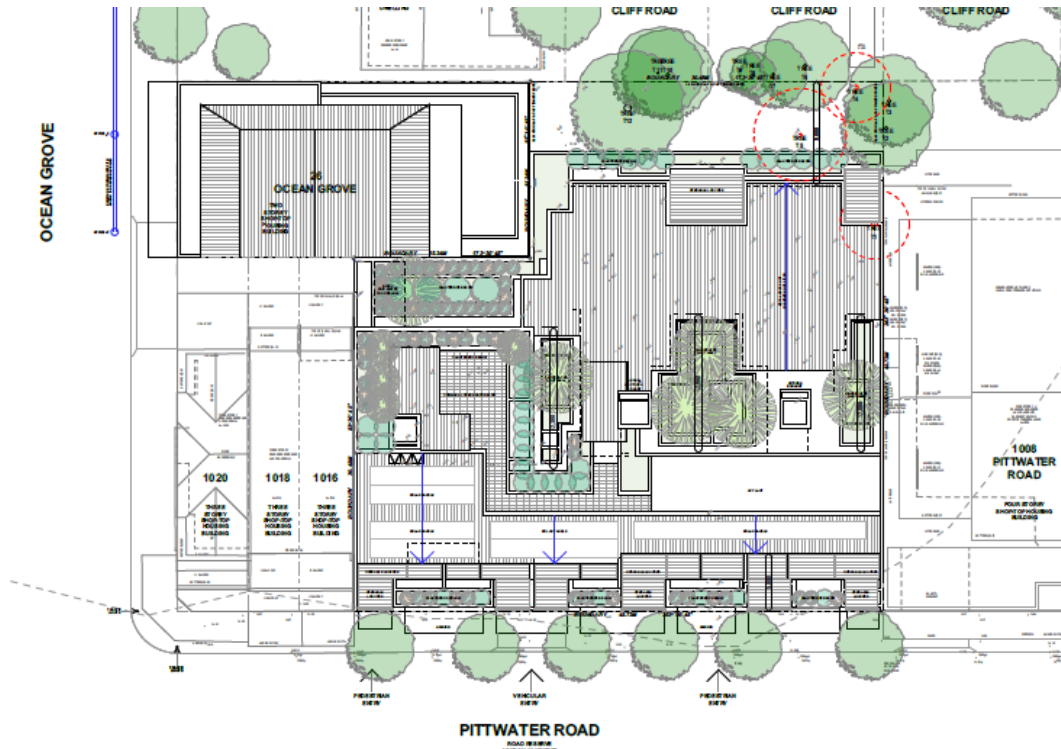
Aerial Image of No 1010 - 1014 Pittwater Rd Collaroy
(Northern Beaches Council web site)

Barrenjoey Consulting Engineers Pty Ltd
Stormwater Structural Civil

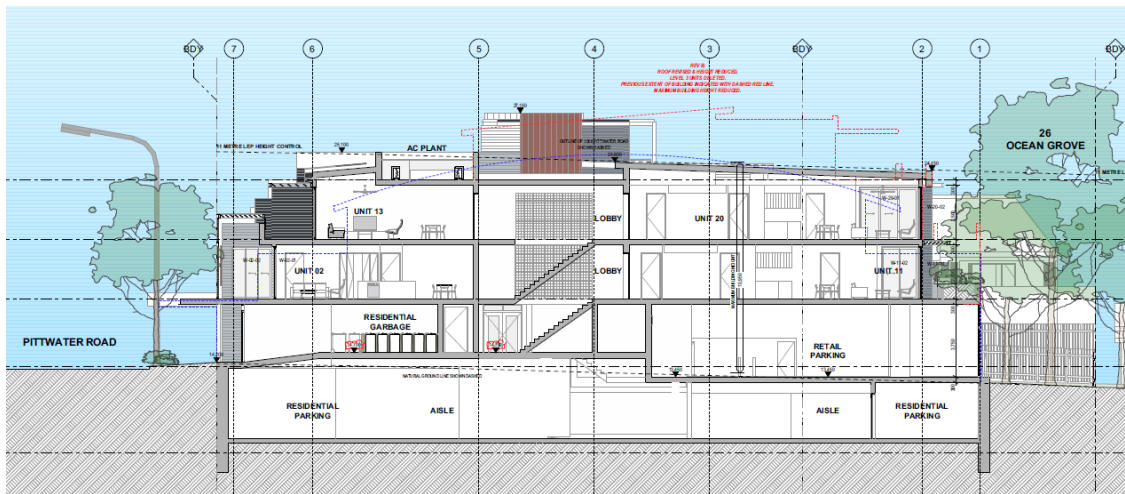
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The proposed development (refer architectural plans by Gartner Trovato Architects) consists of basement car parking, ground / street level commercial premises and two storeys of residential units.



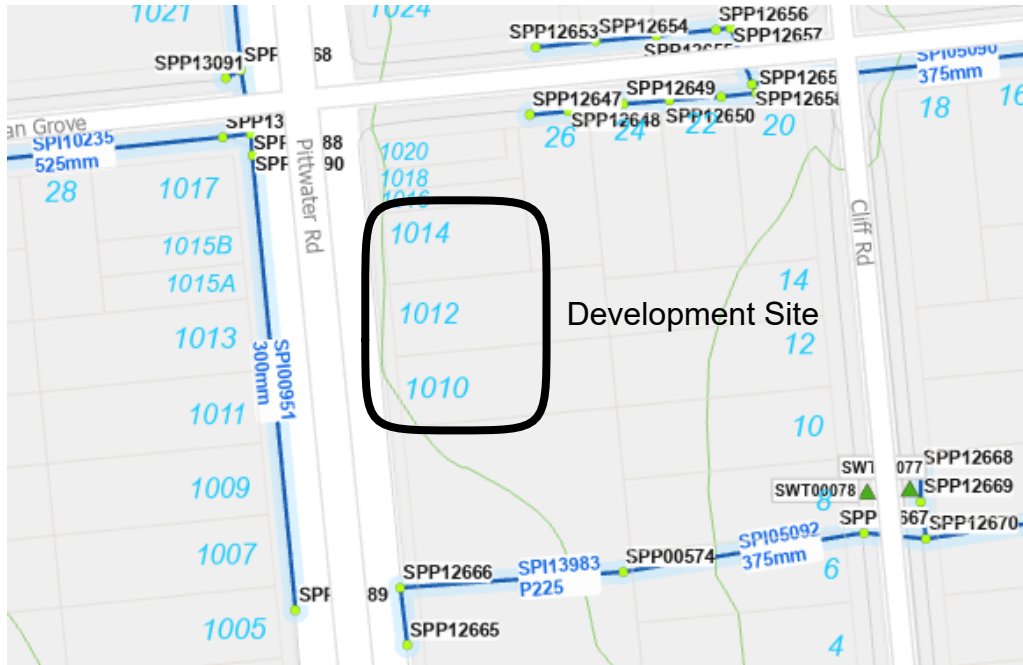
Development Site Plan
(Gartner Trovato Architects)



Development Section
(Gartner Trovato Architects)

2. INVESTIGATION

The development site is located on the eastern side of Pittwater Rd Collaroy, conventional stormwater management systems (road kerb / gutter, inlet pits and pipes) collect and direct runoff adjacent to the site.



Local stormwater infrastructure
 (Northern Beaches Council web site)

Stormwater runoff generated on the eastern lanes (south bound) of Pittwater Rd will be collected by the kerb / gutter, flow to the inlet pits SPP12665 / SPP12666 (and the pipe system through to Cliff Rd). Runoff surcharging the pits SPP12665 / SPP12666 will continue along Pittwater Rd past the site, these flows are those to be quantified and addressed within this Report. Noting conservative analysis has excluded the expected "leakage" of overland flows through Nos 1000- 1008 (ie driveway / basement / lobby areas).



Pittwater Rd eastern lanes kerb / gutter (Barrenjoey Consulting Engineers Pty Ltd)

Noting runoff and overland flows generated by the larger surrounding / uphill catchments will be directed along the western side of Pittwater Rd, down Ocean Grove (to the north) and Anzac Ave (to the south), as observed during a significant rain event on 5th April 2024.



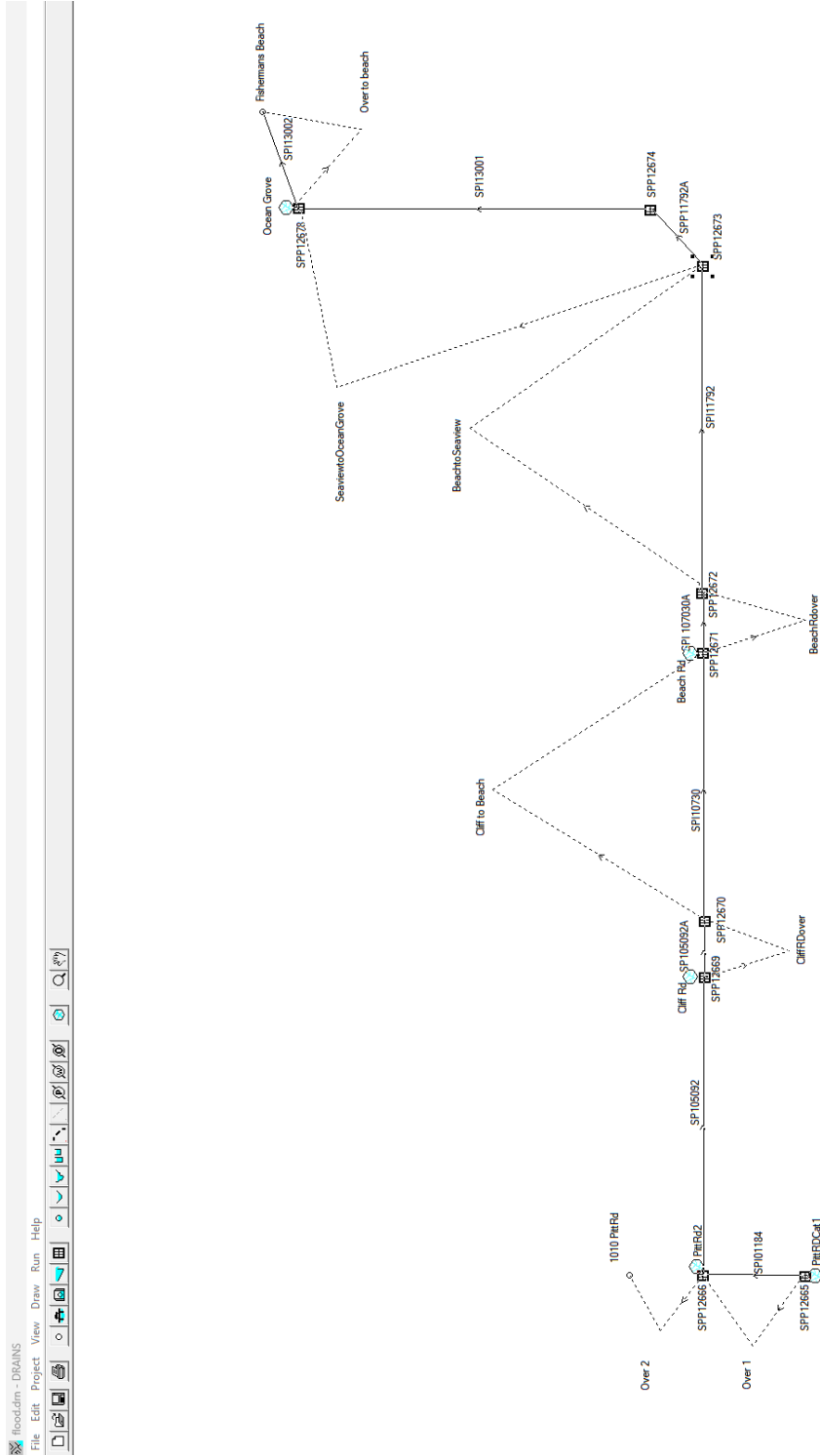
Surrounding / uphill catchment + associated indicative overland flow paths (Northern Beaches Council web site / Barrenjoey Consulting Engineers pty ltd)



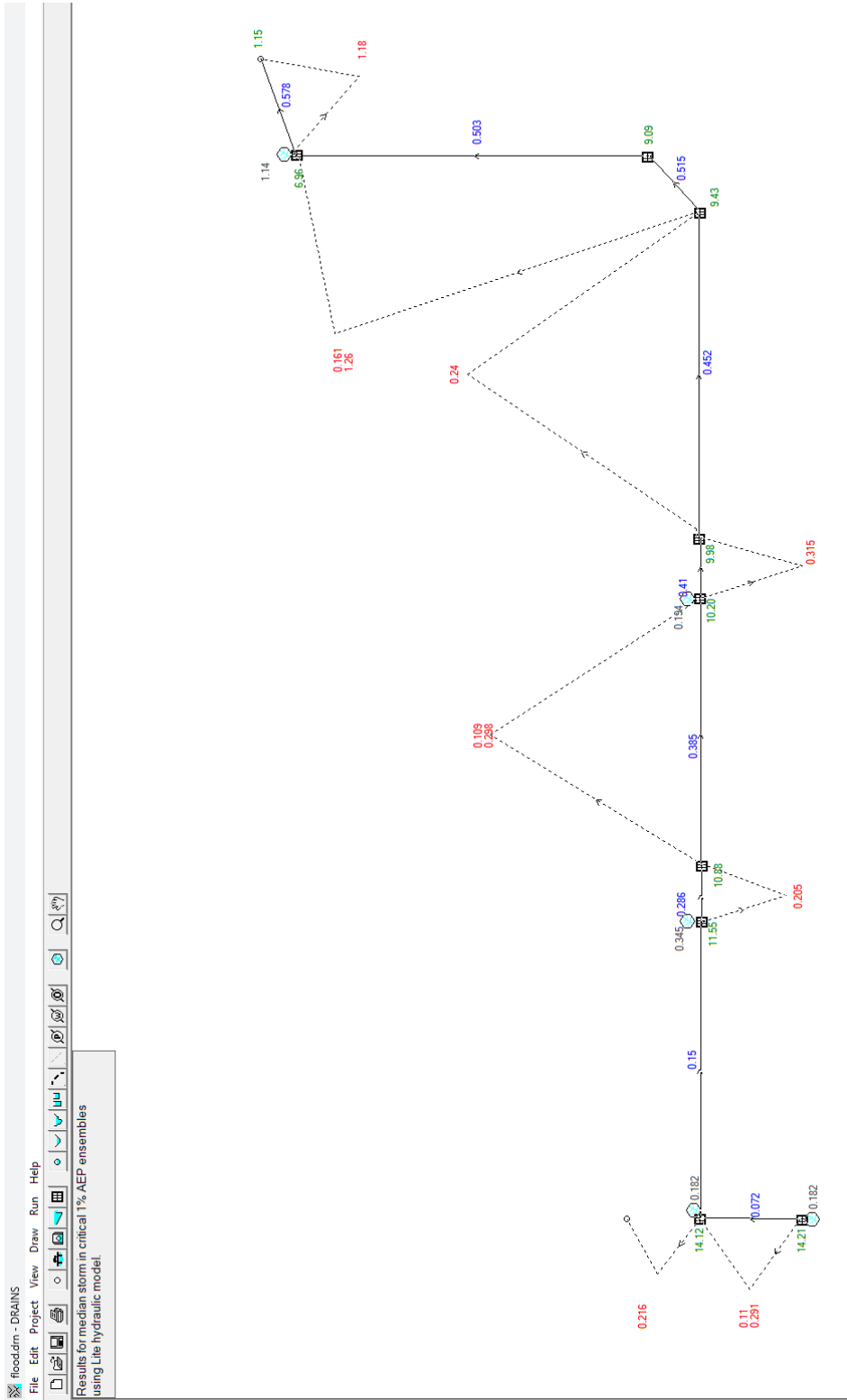
Pittwater Rd western lanes, note median strip directing uphill catchment overland flows to Ocean Grove (Barrenjoey Consulting Engineers pty ltd)

3. CALCULATIONS

DRAINS model of catchment and infrastructure -



DRAINS 1% AEP event analysis of catchment and infrastructure -



Note – 1% AEP event overflow adjacent to development site **216 l/s**

MANNINGS analysis of Pittwater Rd adjacent to development site –

Sheet1

MANNINGS CROSS - SECTION ANALYSIS

Site Address 1010 Pittwater Rd Collaroy
 Job No 240403
 Section location 1010 Pittwater Rd
 Design Flowrate Road Capacity to Boundary

SECTION 1 - gutter

Floodpath slope **0.002** Edge slopes Datum **13.960** TWL **14.100**
 Mannings No **0.015** s' **0.05**
 Breadth **0.30** s" **1000**
 Increments **0.01**

| Depth | b' | z' | b" | z" | Area | Perimeter | Radius | Q | V | LSV |
|-------|-------|-------|-------|-------|-------|-----------|--------|-------|-------|-------|
| 0.130 | 2.600 | 2.603 | 0.000 | 0.130 | 0.208 | 3.033 | 0.069 | 0.104 | 0.500 | 0.065 |
| 0.140 | 2.800 | 2.803 | 0.000 | 0.140 | 0.238 | 3.243 | 0.073 | 0.124 | 0.523 | 0.073 |
| 0.150 | 3.000 | 3.004 | 0.000 | 0.150 | 0.270 | 3.454 | 0.078 | 0.147 | 0.545 | 0.082 |

SECTION 2 - above kerb to boundary

Floodpath slope **0.002** Edge slopes Datum **14.100** TWL **14.140**
 Mannings No **0.015** s' **0.05**
 Breadth **6.3** s" **1000**
 Increments **0.01**

| Depth | b' | z' | b" | z" | Area | Perimeter | Radius | Q | V | LSV |
|-------|-------|-------|-------|-------|-------|-----------|--------|-------|-------|-------|
| 0.030 | 0.600 | 0.601 | 0.000 | 0.030 | 0.198 | 6.931 | 0.029 | 0.055 | 0.279 | 0.008 |
| 0.040 | 0.800 | 0.801 | 0.000 | 0.040 | 0.268 | 7.141 | 0.038 | 0.090 | 0.334 | 0.013 |
| 0.050 | 1.000 | 1.001 | 0.000 | 0.050 | 0.340 | 7.351 | 0.046 | 0.131 | 0.384 | 0.019 |

SECTION 3 - above section 2

Floodpath slope **0.002** Edge slopes Datum **14.140** TWL **14.150**
 Mannings No **0.015** s' **0.05**
 Breadth **7** s" **1000**
 Increments **0.01**

| Depth | b' | z' | b" | z" | Area | Perimeter | Radius | Q | V | LSV |
|-------|-------|-------|-------|-------|-------|-----------|--------|-------|---------|---------|
| 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 7.000 | 0.000 | 0.000 | #DIV/0! | #DIV/0! |
| 0.010 | 0.200 | 0.200 | 0.000 | 0.010 | 0.071 | 7.210 | 0.010 | 0.010 | 0.137 | 0.001 |
| 0.020 | 0.400 | 0.400 | 0.000 | 0.020 | 0.144 | 7.420 | 0.019 | 0.031 | 0.215 | 0.004 |

1% AEP event flow **224** l/s

Depth of Flow **0.190** m

TWL **14.150**

Page 1

Note - 1% AEP event predicted TWL **14.150m** AHD

4. CONCLUSION

1% AEP event overland flow adjacent to the development site-

| | |
|---------------|---|
| Catchment | <u>5000m²</u> (Eastern lanes of Pittwater Rd + Nos 996 – 1014 Pittwater Rd) |
| Flowrate | <u>216 l/s</u> |
| Depth of Flow | <u>190mm</u> |
| TWL | <u>14.150m AHD</u> |
| FPL | <u>14.650m AHD (inc 500mm freeboard)</u> |

Warringah Development Control Plan
Part E The Natural Environment
E11 Flood Prone Land
Section D6 Carparking

All enclosed car parks (including basement car parks) must be protected from inundation up to the Flood Planning Level. All access, ventilation, driveway crests and any other potential water entry points to any enclosed car parking shall be above the Flood Planning Level (ie 14.650m AHD).

5. SUMMARY

The development is to ensure the following areas are at or above RL 14.650m AHD -

- Entry driveway**
- Lobby area adjacent to Lifts**
- Basement access stair**
- Ventilation grills or such that front Pittwater Rd**
- Any other potential water entry points that front Pittwater Rd**

The development is to adhere to the recommendations within this Report and will therefore satisfy Northern Beaches Councils Engineering Referral Response Officer comments (dated 28/11/2023) in that the overland flows (in the 1% AEP storm event) along Pittwater Rd have been identified and adequate freeboard (500mm) is to be incorporated into the development to ensure these flows will not enter the basement via the proposed driveway.

It is to be noted that, due to the many complex factors that can affect a site, the subjective nature of a risk analysis, and the imprecise nature of the science of flood analysis, the risk of persons being injured, to life and property cannot be completely removed. The recommendations within this Report do not remove the risk associated with the predicted flooding event, though lower those risks to an acceptable level reasonably anticipated by the community in everyday life.

Regards
BARRENJOEY CONSULTING ENGINEERS Pty Ltd
Per Lucas Molloy (Director)
MIEAust / CPEng / NER / APEC / Engineer / IntPE(Aus)

Appendix A
Architectural plans
Gartner Trovato Architects

**DEVELOPMENT APPLICATION
 FOR PROPOSED SHOP-TOP HOUSING DEVELOPMENT
 1010 - 1014 PITTWATER ROAD COLLARROY NSW 2097**



- DEVELOPMENT SUMMARY**
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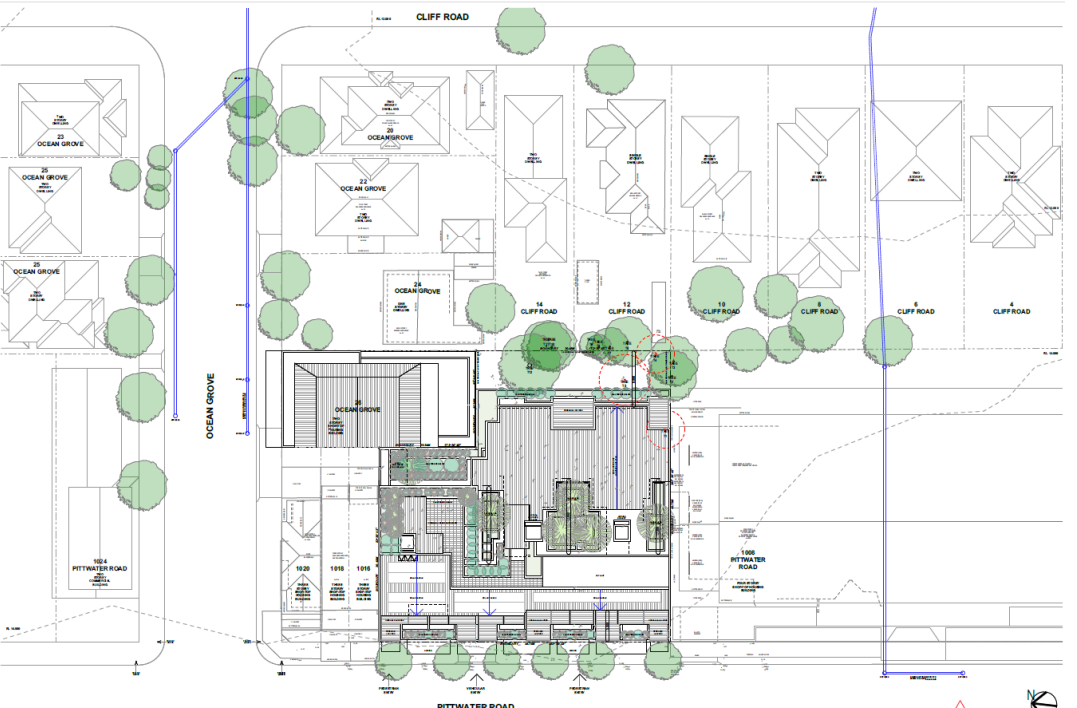
| UNIT NO. | UNIT TYPE | UNIT AREA | SOLAR ACCESS | NATURAL VENTILATION | ADAPTIVE (SUNSHADE, SHUTTER) |
|----------|-----------|-----------|--------------|---------------------|------------------------------|
| 1010 | SHOP | 1010 | YES | YES | NO |
| 1011 | RES | 1011 | YES | YES | NO |
| 1012 | RES | 1012 | YES | YES | NO |
| 1013 | RES | 1013 | YES | YES | NO |
| 1014 | RES | 1014 | YES | YES | NO |
| 1015 | RES | 1015 | YES | YES | NO |
| 1016 | RES | 1016 | YES | YES | NO |
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| 1018 | RES | 1018 | YES | YES | NO |
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| 1020 | RES | 1020 | YES | YES | NO |
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| 1100 | RES | 1100 | YES | YES | NO |

| UNIT TYPE | AREA |
|-----------|-----------|
| SHOP | 1010 |
| RES | 1011-1100 |
| TOTAL | 1010-1100 |

| DESCRIPTION | MARKING TITLE | POSITION |
|-------------|---------------|----------|
| 1 | CLIFF ROAD | 1010 |
| 2 | OCEAN GROVE | 1011 |
| 3 | OCEAN GROVE | 1012 |
| 4 | OCEAN GROVE | 1013 |
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| 90 | OCEAN GROVE | 1099 |
| 91 | OCEAN GROVE | 1100 |

| DEVELOPMENT SUMMARY | DEVELOPER | DESIGNER | REGULATORY | SOLAR ACCESS & NATURAL VENTILATION | ACCESSIBILITY |
|---------------------|-----------|-----------|------------|------------------------------------|---------------|
| 1010-1100 | 1010-1100 | 1010-1100 | 1010-1100 | 1010-1100 | 1010-1100 |

Project Information: 1010-1100 PITTWATER ROAD, COLLARROY NSW 2097. Date: 10/10/2023. Scale: 1:1000. Drawing No: 1010-1100-01. Status: DEVELOPMENT APPLICATION. Author: [Name]. Checker: [Name]. Approver: [Name].

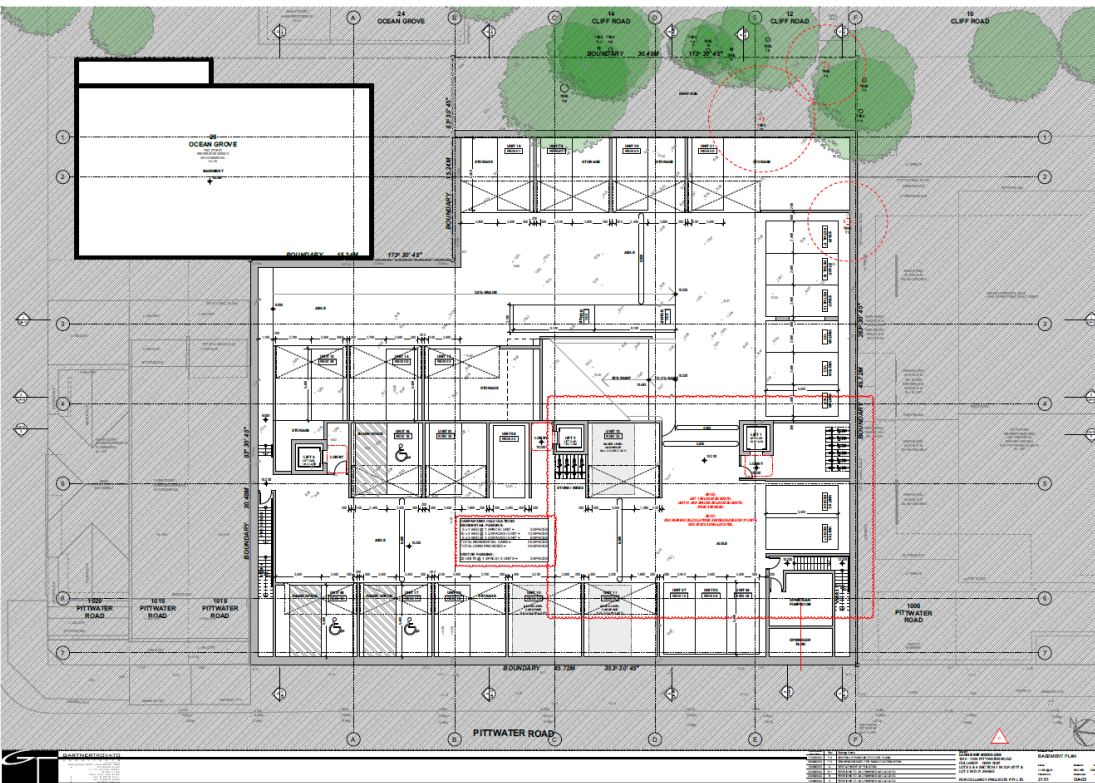
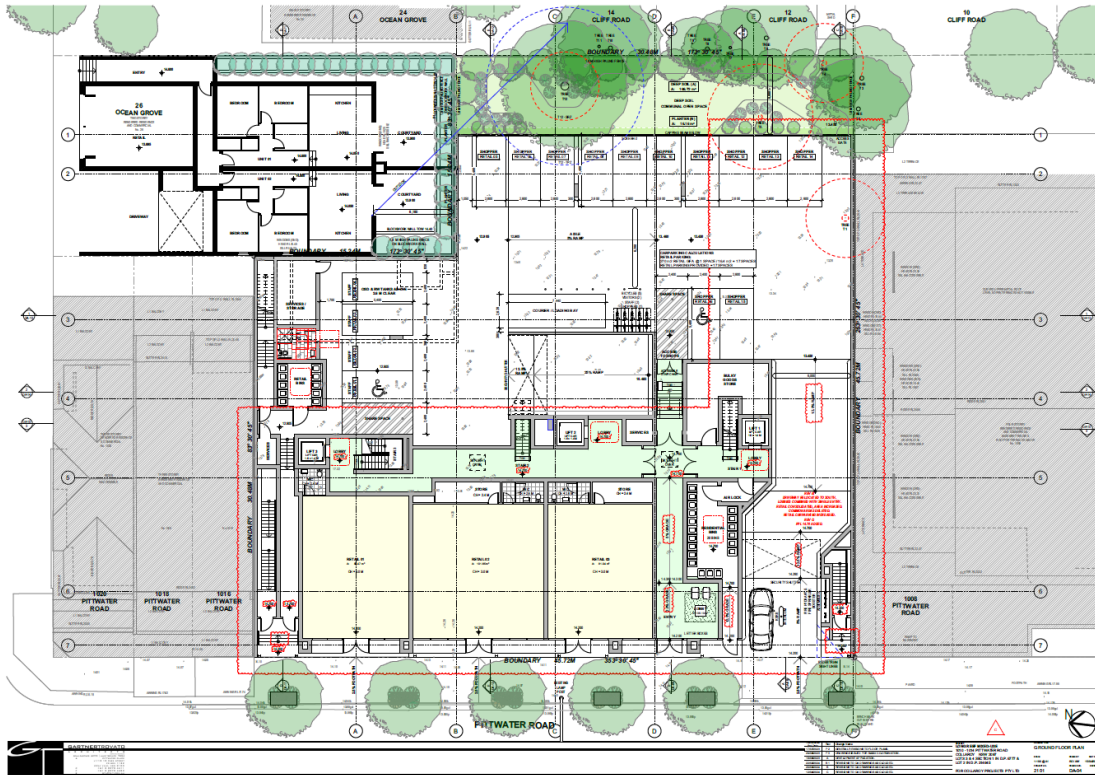


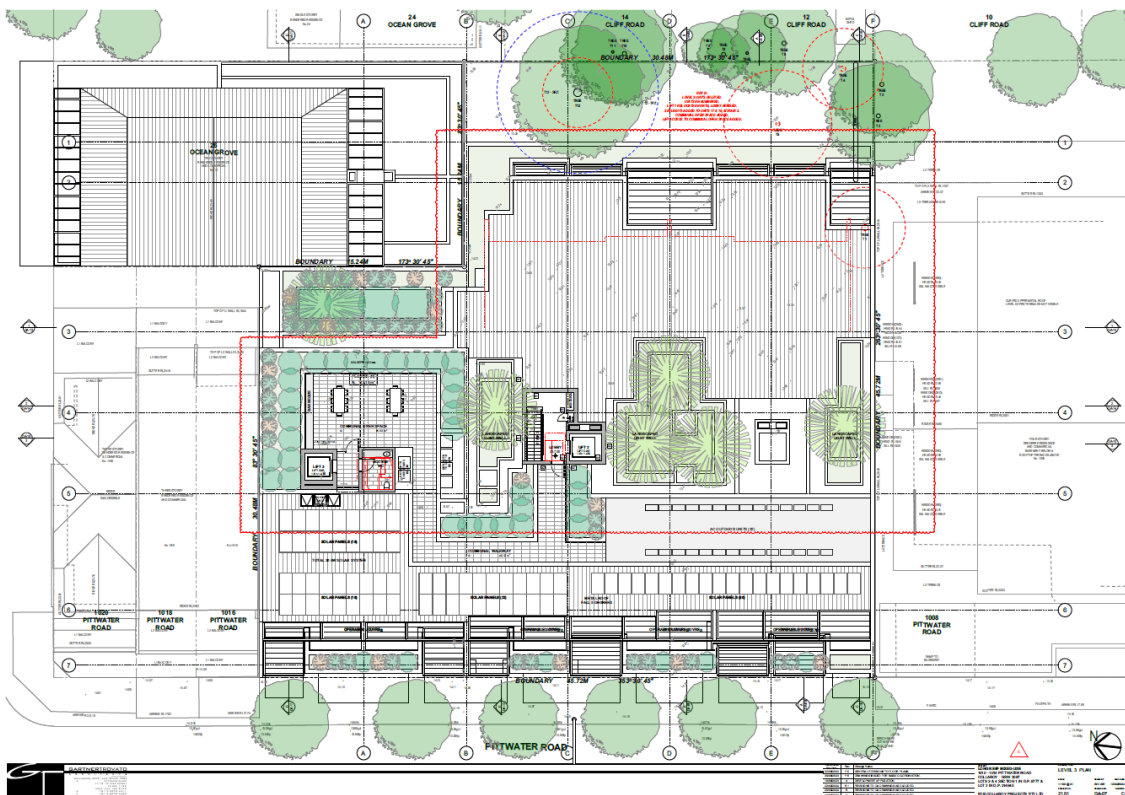
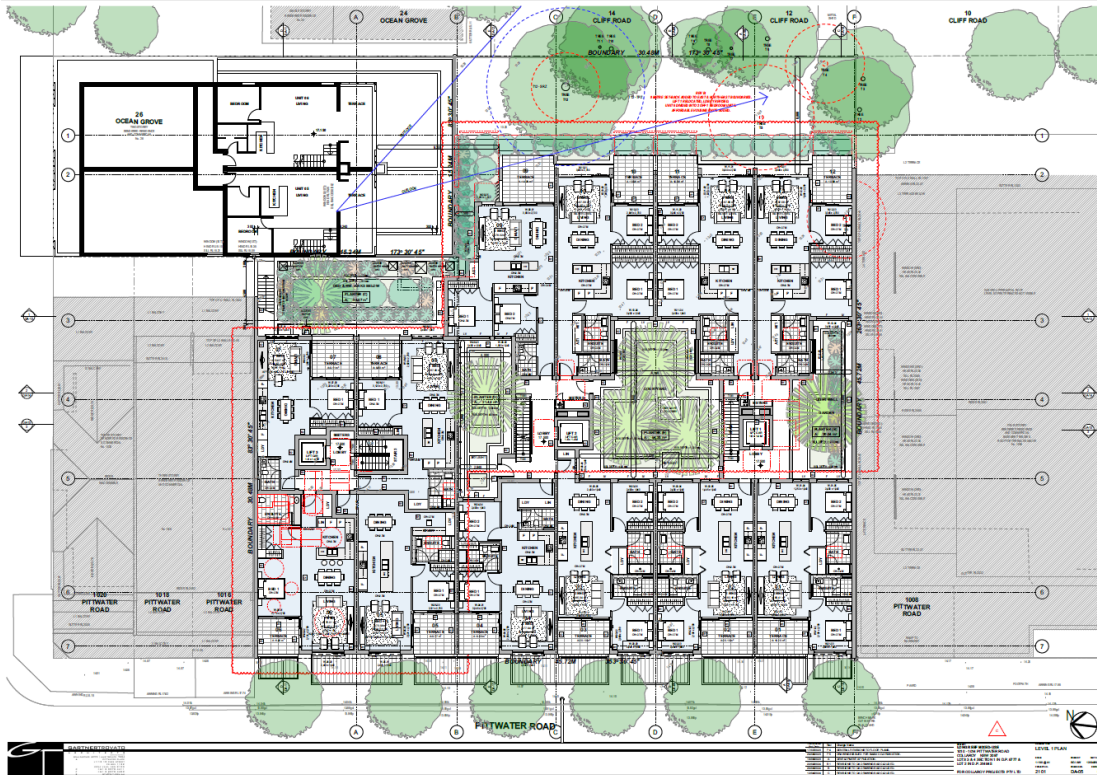
Project Information: 1010-1100 PITTWATER ROAD, COLLARROY NSW 2097. Date: 10/10/2023. Scale: 1:1000. Drawing No: 1010-1100-01. Status: DEVELOPMENT APPLICATION. Author: [Name]. Checker: [Name]. Approver: [Name].

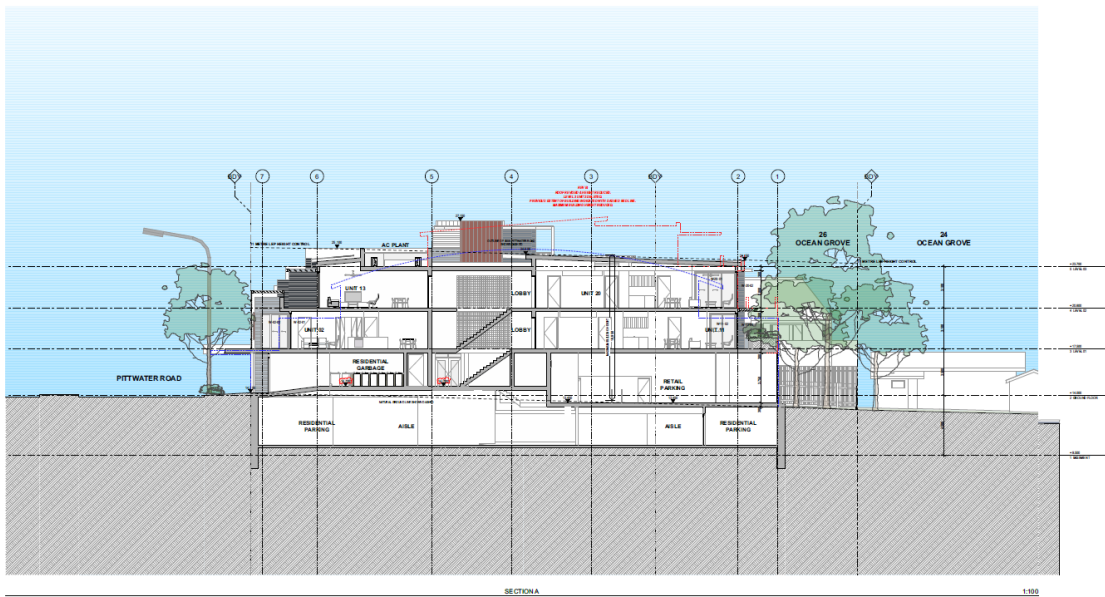
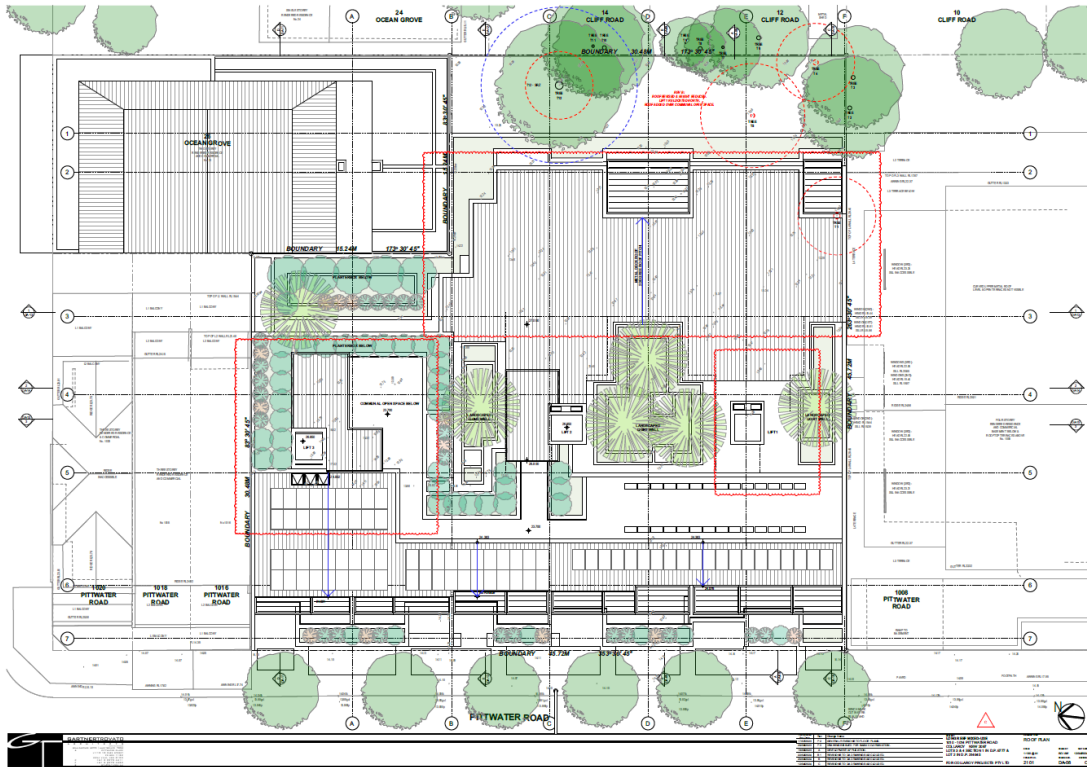
Barrenjoey Consulting Engineers Pty Ltd
Stormwater Structural Civil

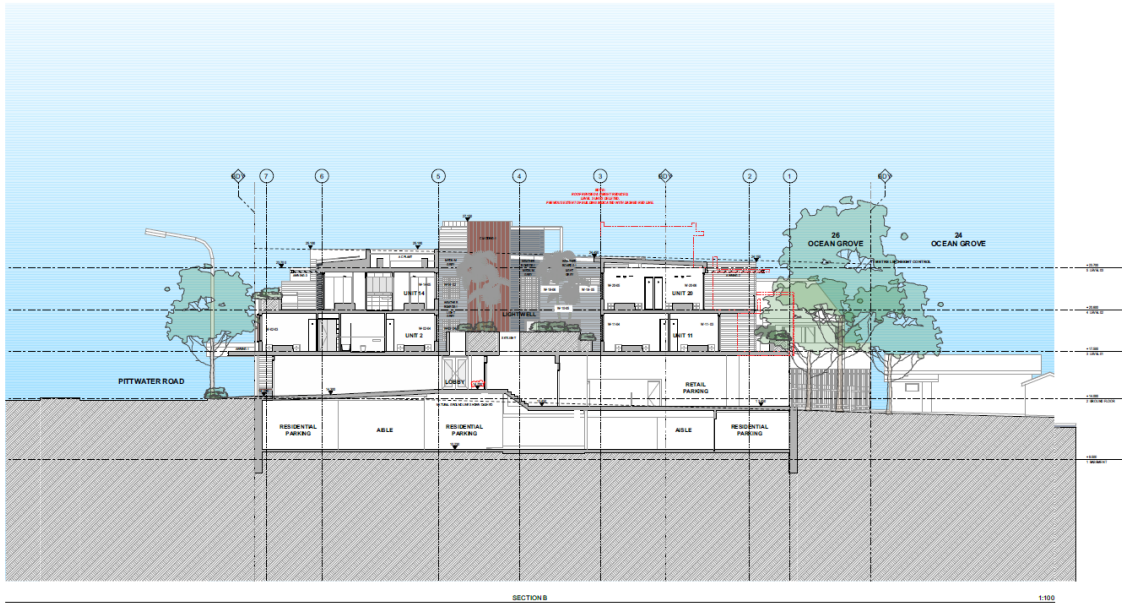
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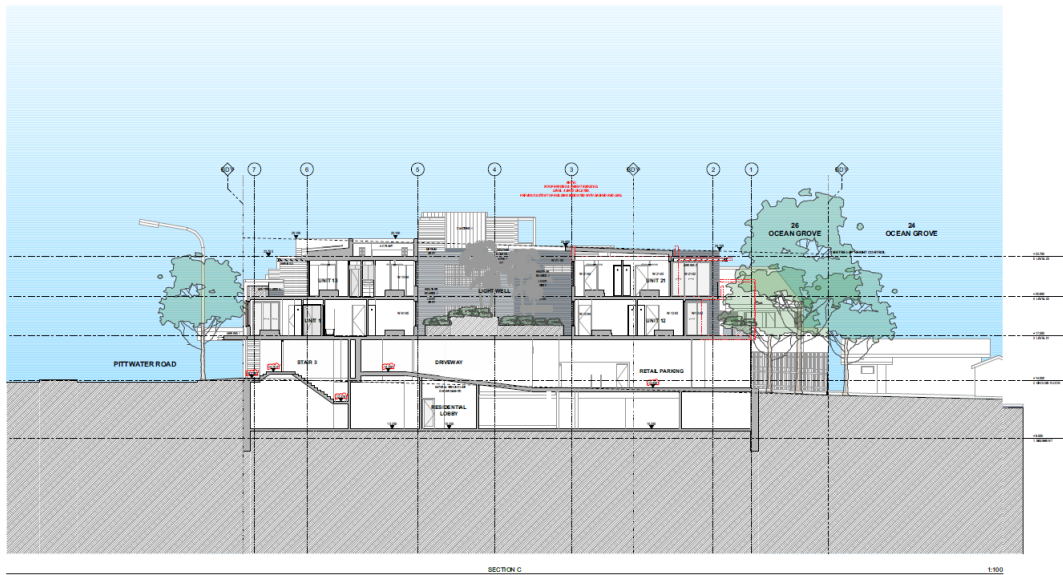




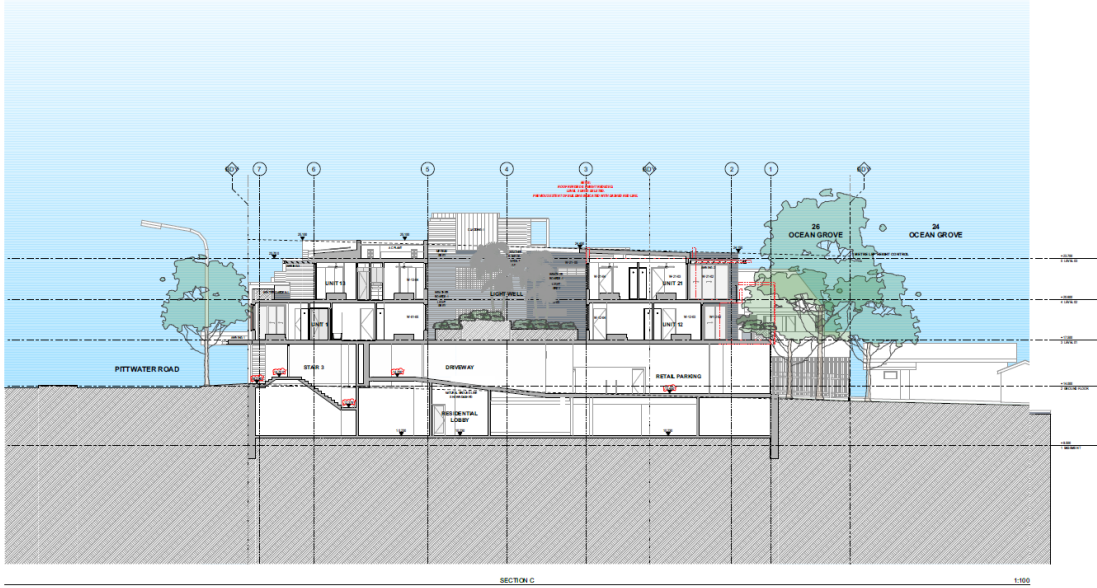




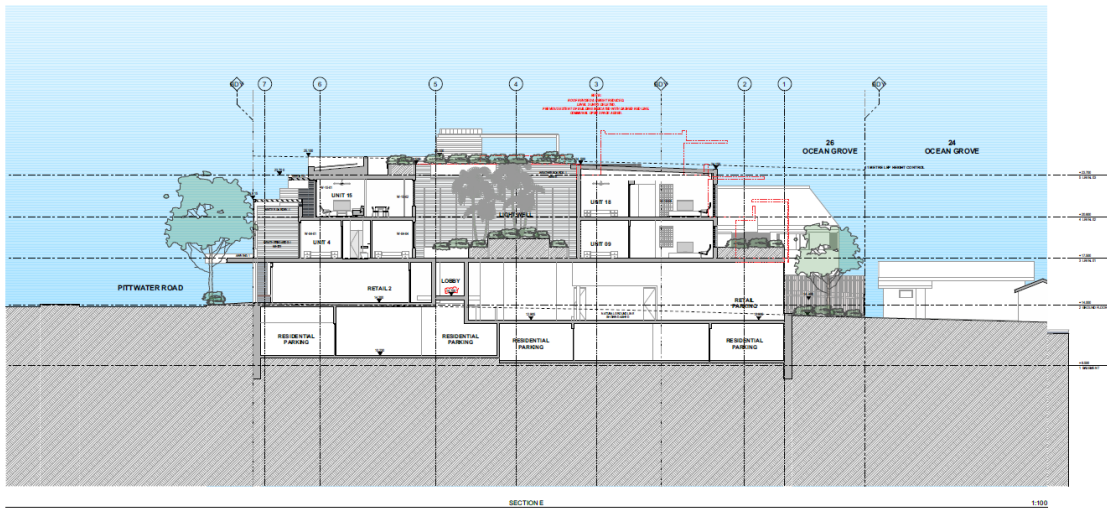
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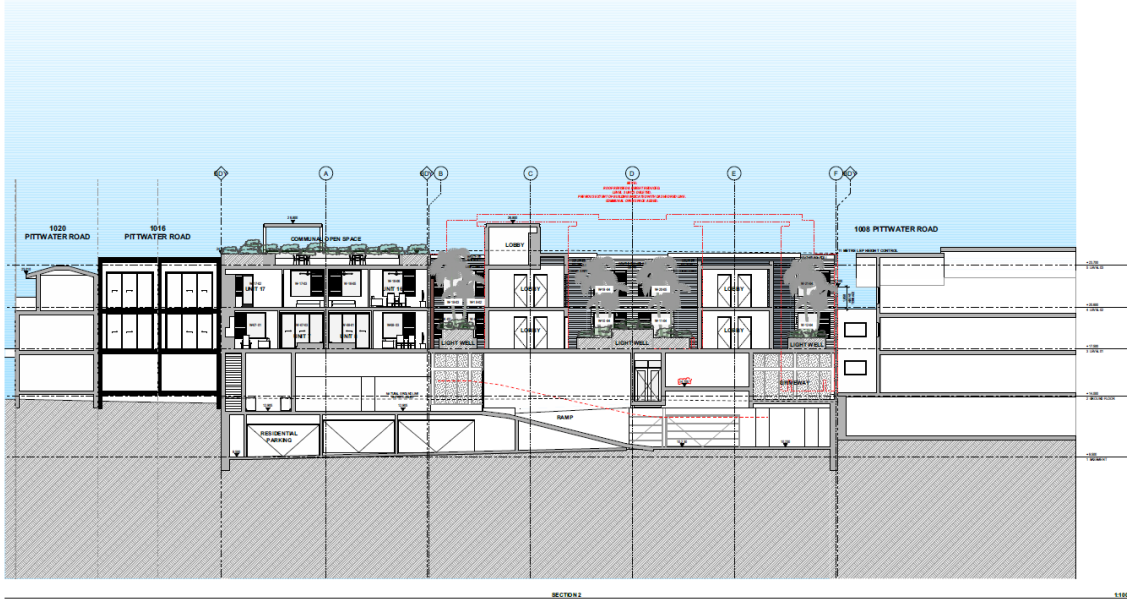
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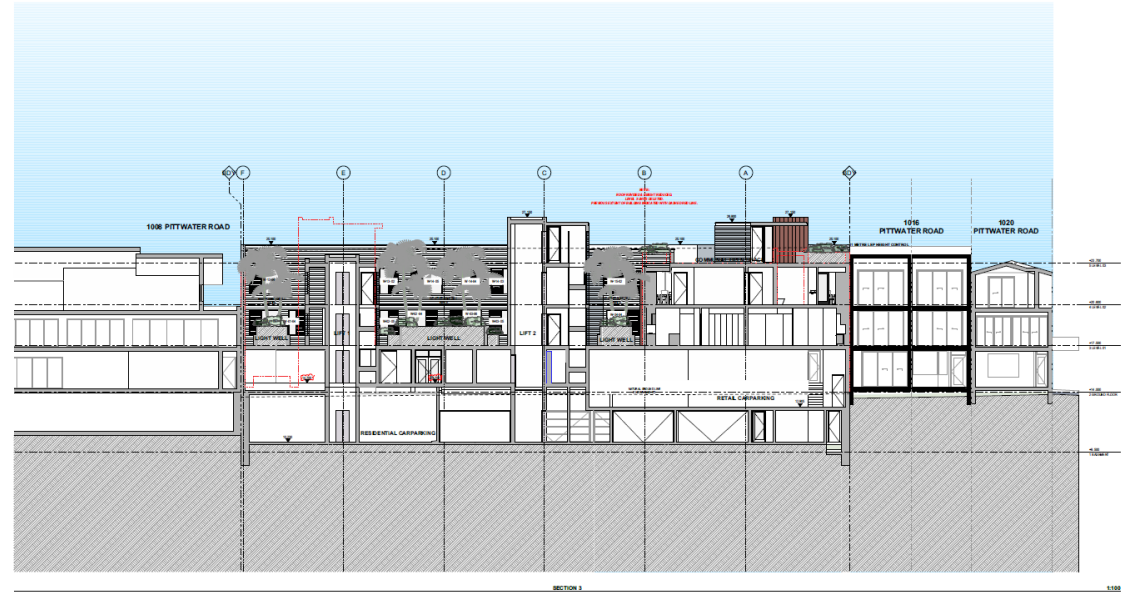
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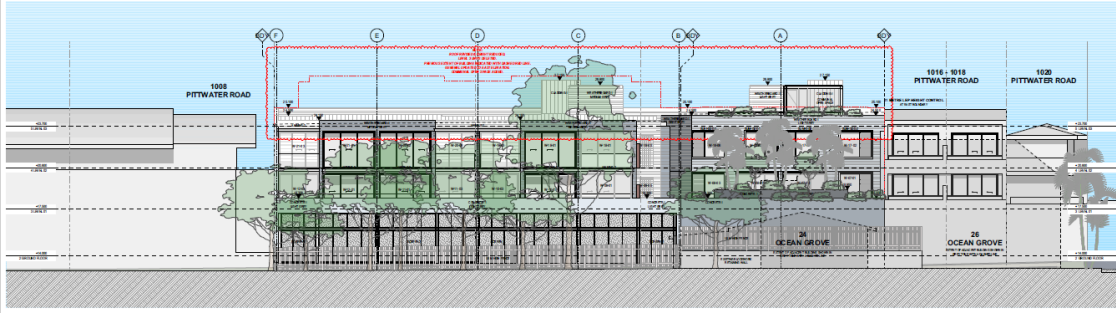
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| NO. | DESCRIPTION | DATE | BY | CHECKED |
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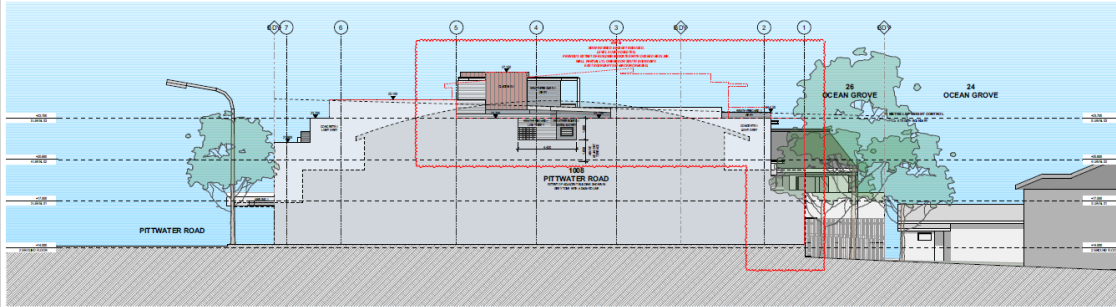


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| 6 | ... | ... | ... | ... |
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| 9 | ... | ... | ... | ... |
| 10 | ... | ... | ... | ... |



EAST ELEVATION

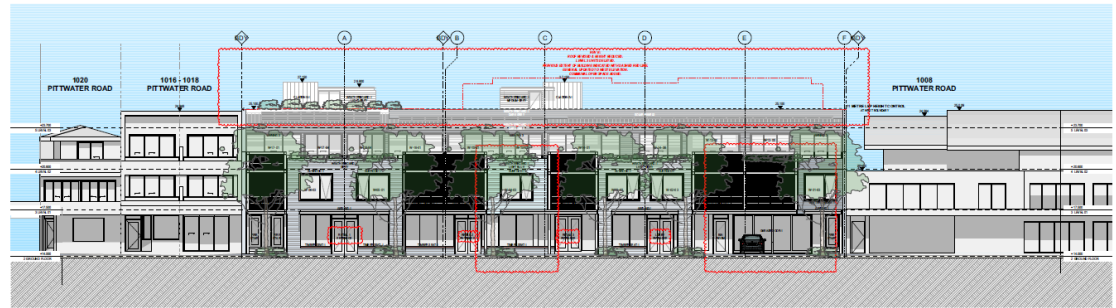
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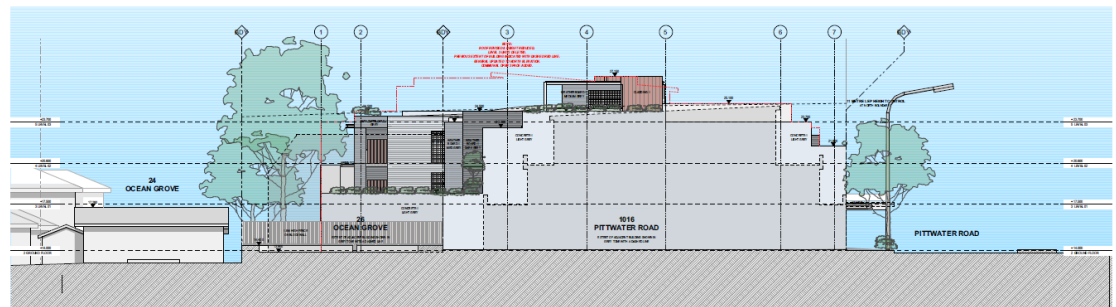
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| LIMITED PRODUCT LEGEND | | FINISHES | | COLORS | | GLASS | | ROOFING | |
|------------------------|----------|----------|-------|--------|-------|-------|-------|---------|----------|
| 1 | CONCRETE | 1 | WHITE | 1 | WHITE | 1 | GLASS | 1 | ASBESTOS |
| 2 | BRICK | 2 | RED | 2 | RED | 2 | GLASS | 2 | ASBESTOS |
| 3 | CONCRETE | 3 | WHITE | 3 | WHITE | 3 | GLASS | 3 | ASBESTOS |
| 4 | CONCRETE | 4 | WHITE | 4 | WHITE | 4 | GLASS | 4 | ASBESTOS |
| 5 | CONCRETE | 5 | WHITE | 5 | WHITE | 5 | GLASS | 5 | ASBESTOS |
| 6 | CONCRETE | 6 | WHITE | 6 | WHITE | 6 | GLASS | 6 | ASBESTOS |
| 7 | CONCRETE | 7 | WHITE | 7 | WHITE | 7 | GLASS | 7 | ASBESTOS |
| 8 | CONCRETE | 8 | WHITE | 8 | WHITE | 8 | GLASS | 8 | ASBESTOS |
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| 11 | CONCRETE | 11 | WHITE | 11 | WHITE | 11 | GLASS | 11 | ASBESTOS |
| 12 | CONCRETE | 12 | WHITE | 12 | WHITE | 12 | GLASS | 12 | ASBESTOS |
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| 15 | CONCRETE | 15 | WHITE | 15 | WHITE | 15 | GLASS | 15 | ASBESTOS |
| 16 | CONCRETE | 16 | WHITE | 16 | WHITE | 16 | GLASS | 16 | ASBESTOS |
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| 21 | CONCRETE | 21 | WHITE | 21 | WHITE | 21 | GLASS | 21 | ASBESTOS |
| 22 | CONCRETE | 22 | WHITE | 22 | WHITE | 22 | GLASS | 22 | ASBESTOS |
| 23 | CONCRETE | 23 | WHITE | 23 | WHITE | 23 | GLASS | 23 | ASBESTOS |
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| 27 | CONCRETE | 27 | WHITE | 27 | WHITE | 27 | GLASS | 27 | ASBESTOS |
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| 95 | CONCRETE | 95 | WHITE | 95 | WHITE | 95 | GLASS | 95 | ASBESTOS |
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| 99 | CONCRETE | 99 | WHITE | 99 | WHITE | 99 | GLASS | 99 | ASBESTOS |
| 100 | CONCRETE | 100 | WHITE | 100 | WHITE | 100 | GLASS | 100 | ASBESTOS |



WEST ELEVATION

1:100



NORTH ELEVATION

1:100

| LIMITED PRODUCT LEGEND | | FINISHES | | COLORS | | GLASS | | ROOFING | |
|------------------------|----------|----------|-------|--------|-------|-------|-------|---------|----------|
| 1 | CONCRETE | 1 | WHITE | 1 | WHITE | 1 | GLASS | 1 | ASBESTOS |
| 2 | BRICK | 2 | RED | 2 | RED | 2 | GLASS | 2 | ASBESTOS |
| 3 | CONCRETE | 3 | WHITE | 3 | WHITE | 3 | GLASS | 3 | ASBESTOS |
| 4 | CONCRETE | 4 | WHITE | 4 | WHITE | 4 | GLASS | 4 | ASBESTOS |
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| 7 | CONCRETE | 7 | WHITE | 7 | WHITE | 7 | GLASS | 7 | ASBESTOS |
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| 12 | CONCRETE | 12 | WHITE | 12 | WHITE | 12 | GLASS | 12 | ASBESTOS |
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| 31 | CONCRETE | 31 | WHITE | 31 | WHITE | 31 | GLASS | 31 | ASBESTOS |
| | | | | | | | | | |

Appendix B
Site Survey
SDG Land Development Solutions
REF 8351

Appendix C
DRAINS data
Barrenjoey Consulting Engineer Pty Ltd

| PIT / NODE DETAILS | | | | | | | | | | | | | |
|-----------------------|----------------|-------------------------|-------------|---|--|--|--|----------------------|-----------------|----------|---------|---------------|-----|
| Name | Type Part Full | Family Inflow | Size Pit is | Version 15 Ponding Internal Volume Width (cu.m) | Pressure Inflow is Change Misaligned Coeff. Ku (m) | Surface Minor Safe Elev (m) Pond Depth | Max Pond Major Safe Depth (m) Pond Depth | Base Inflow (cu.m/s) | Blocking Factor | x | y | Bolt-down lid | lid |
| SPP12665 | OnGrade | NSW RTA Pits - 1% slope | 1 x Ku | SA1 (Type 2) - 1% longitudinal slope | New | 1.5 | 14.4 | 0 | 0.5 | 17.544 | -28.834 | | |
| SPP12666 | OnGrade | NSW RTA Pits - 1% slope | 1 x Ku | SA1 (Type 2) - 1% longitudinal slope | New | 1.5 | 14.35 | 0 | 0.5 | 17.669 | -20.770 | | |
| SPP12669 | OnGrade | NSW RTA Pits - 1% slope | 1 x Ku | SA1 (Type 2) - 1% longitudinal slope | New | 1.5 | 11.7 | 0 | 0 | 41.201 | -20.853 | | |
| SPP12670 | OnGrade | NSW RTA Pits - 1% slope | 1 x Ku | SA1 (Type 2) - 1% longitudinal slope | New | 1.5 | 11.6 | 0 | 0 | 45.646 | -20.853 | | |
| SPP12671 | OnGrade | NSW RTA Pits - 1% slope | 1 x Ku | SA1 (Type 2) - 1% longitudinal slope | New | 1.5 | 10.20 | 0 | 0.5 | 66.871 | -20.710 | | |
| SPP12672 | OnGrade | NSW RTA Pits - 1% slope | 1 x Ku | SA1 (Type 2) - 1% longitudinal slope | New | 1.5 | 10.00 | 0 | 0.5 | 71.603 | -20.638 | | |
| SPP12673 | OnGrade | NSW RTA Pits - 1% slope | 1 x Ku | SA1 (Type 2) - 1% longitudinal slope | New | 1.5 | 9.80 | 0 | 0.5 | 97.488 | -20.710 | | |
| SPP12674 | OnGrade | NSW RTA Pits - 1% slope | 1 x Ku | SA1 (Type 2) - 1% longitudinal slope | New | 1.5 | 9.8 | 0 | 0.5 | 101.934 | -16.551 | | |
| SPP12678 | OnGrade | NSW RTA Pits - 1% slope | 1 x Ku | SA1 (Type 2) - 1% longitudinal slope | New | 1.5 | 8 | 0 | 0.5 | 102.077 | 11.270 | | |
| Fishermans Beach Node | No | | | | | 1 | 0 | 109.677 | 14.138 | 36717373 | | | |
| 1010 PittRd | No | | | | | 14.1 | 0 | 17.627 | -14.919 | 36717439 | | | |

| DETENTION BASIN DETAILS | | | | | | | | | | | | | | |
|-------------------------|-------------------------|----------------------------|--------------------|-------------------------|-------------------------|-------------------------|-------------------------|---------------------|-----------------------------------|--------------------------------------|------------------|-----------------|----------------|-------------|
| Name | Elev | Surf. Area Crest Length(m) | Not Used | Outlet Type | K | Dia(mm) | Centre RL | Pit Family | Pit Type | x | y | HED | Crest RL | |
| SUB-CATCHMENT DETAILS | | | | | | | | | | | | | | |
| Name | Pit or Paved Area Slope | Paved Area Rough (ha) | Paved Area Rough % | Grass Supp Area Rough % | Grass Supp Area Rough % | Supp Lag Time or Factor | Paved Gutter Length (m) | Grass Slope (min) % | Supp Gutter Time FlowFactor (min) | Paved Rainfall Length Multiplier (m) | Grass Length (m) | Supp Length (m) | Paved Slope(%) | Grass Slope |
| PittRDCat1 | SPP12665 | 0.2500 | 100.0 | 0.0 | 0.0 | 0.0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 |
| PittRd2 | SPP12666 | 0.2500 | 100.0 | 0.0 | 0.0 | 0.0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 |
| Cliff Rd | SPP12669 | 0.8000 | 50.0 | 50.0 | 0.0 | 5 | 15 | 0 | 0 | 1 | 0 | 0 | 1 | 0 |
| Beach Rd | SPP12671 | 0.4500 | 50.0 | 50.0 | 0.0 | 5 | 15 | 0 | 0 | 1 | 0 | 0 | 1 | 0 |
| Ocean Grove | SPP12678 | 3.6000 | 50.0 | 50.0 | 0.0 | 10 | 60 | 2 | 1 | 1 | 0 | 0 | 1 | 0 |

| PIPE DETAILS | | | | | | | | | | | | | |
|--------------|-------------|---------------------|---------------|----------------|---------------|---------------|---------------------------|----------|-----------|-------|---------|-----------|----------|
| Name | From At Chg | To Chg | Length RI (m) | U/S IL Chg (m) | D/S IL RL (m) | Slope etc (%) | Type | Dia (mm) | I.D. (mm) | Rough | Pipe Is | No. Pipes | Chg From |
| SPI01184 | SPP12665 | SPP12666 | 3 | 13.900 | 13.850 | 1.67 | Concrete, under roads | 300 | 300 | 300 | 0.3 | New | 1 |
| SPI05092 | SPP12666 | SPP12669 | 80 | 13.800 | 11.000 | 3.50 | Concrete, not under roads | 375 | 375 | 375 | 0.3 | New | 1 |
| SPI05092A | SPP12669 | SPP12670 | 10 | 11.000 | 10.600 | 4.00 | Concrete, not under roads | 375 | 375 | 375 | 0.3 | New | 1 |
| SPI10730 | SPP12670 | SPP12671 | 66 | 10.000 | 9.200 | 1.21 | Concrete, not under roads | 525 | 525 | 525 | 0.3 | New | 1 |
| SPI 107030A | SPP12671 | SPP12672 | 10 | 9.200 | 9.000 | 2.00 | Concrete, under roads | 525 | 525 | 525 | 0.3 | New | 1 |
| SPI11792 | SPP12672 | SPP12673 | 102 | 9.000 | 8.800 | 0.20 | Concrete, not under roads | 600 | 600 | 600 | 0.3 | New | 1 |
| SPP11792A | SPP12673 | SPP12674 | 20 | 8.800 | 8.600 | 1.00 | Concrete, not under roads | 600 | 600 | 600 | 0.3 | New | 1 |
| SPI13001 | SPP12674 | SPP12678 | 100 | 8.600 | 7.000 | 1.60 | Concrete, not under roads | 750 | 750 | 750 | 0.3 | New | 1 |
| SPI13002 | SPP12678 | Fishermans Beach 25 | 0 | 6.500 | 1.000 | 22.00 | Concrete, not under roads | 750 | 750 | 750 | 0.3 | New | 1 |

| DETAILS OF SERVICES CROSSING PIPES | | | | | | | | | | | | | |
|------------------------------------|---------|-----------------|-----------------------|------------|-----------------|-----------------------|-----------|-----------------|-----------------------|------------------|-----------------|-----------------------|--------|
| Pipe | Chg (m) | Bottom Elev (m) | Height of Service (m) | Chg (m) | Bottom Elev (m) | Height of Service (m) | Chg (m) | Bottom Elev (m) | Height of Service (m) | Chg (m) | Bottom Elev (m) | Height of Service (m) | etc |
| CHANNEL DETAILS | From | To | Type | Length (m) | U/S IL (m) | D/S IL (m) | Slope (%) | Base Width (m) | L.B. Slope (1:?) | R.B. Slope (1:?) | Manning n | Depth (m) | Roofed |

| OVERFLOW ROUTE DETAILS | | | | | | | | | | | | | |
|------------------------|----------|----------------------|-------------------|-----------------|------------------|---------------|---------------|----------------|---------------|----------|---------------|----------|----------------|
| Name | From id | To | Travel Time (min) | Spill Level (m) | Crest Length (m) | Weir Coeff. C | Cross Section | Safe Depth (m) | SafeDepth (m) | Safe (m) | Bed Slope (%) | D/S Area | Contributing % |
| Over 1 | SPP12665 | SPP12666 | 0.1 | 3 | | | Dummy1 | 0.3 | 0.3 | 0.4 | 1 | 100 | 100 |
| Over 2 | 37116793 | 1010 PittRd | 0.2 | 20 | | | Dummy1 | 0.3 | 0.3 | 0.4 | 1 | 100 | 100 |
| CliffRdover | SPP12669 | SPP12670 | 0.1 | 15 | | | Dummy1 | 0.3 | 0.3 | 0.4 | 1 | 100 | 100 |
| Cliff to Beach | 38944153 | SPP12671 | 0.5 | 66 | | | Dummy1 | 0.3 | 0.3 | 0.4 | 1 | 100 | 100 |
| BeachRdover | SPP12671 | SPP12672 | 0.1 | 15 | | | Dummy1 | 0.3 | 0.3 | 0.4 | 1 | 100 | 100 |
| BeachtoSeaview | SPP12672 | SPP12673 | 0.8 | 102 | | | Dummy1 | 0.3 | 0.3 | 0.4 | 1 | 100 | 100 |
| SeaviewtoOceanGrove | 40002987 | SPP12673 | SPP12678 | 0.8 | 100 | | Dummy1 | 0.3 | 0.3 | 0.4 | 1 | 100 | 100 |
| Over to beach | SPP12678 | Fishermans Beach 0.2 | 0.2 | 25 | | | Dummy1 | 0.3 | 0.3 | 0.4 | 1 | 100 | 100 |

| PIPE COVER DETAILS | | | | | | | | | | | | | |
|--------------------|---------------------------|----------|----------------|-----------|--------|--|--|--|--|--|--|--|--|
| Name | Type | Dia (mm) | Safe Cover (m) | Cover (m) | | | | | | | | | |
| SPI01184 | Concrete, under roads | 300 | 0.6 | 0.17 | Unsafe | | | | | | | | |
| SPI05092 | Concrete, not under roads | 375 | 0.6 | 0.14 | Unsafe | | | | | | | | |
| SPI05092A | Concrete, not under roads | 375 | 0.6 | 0.29 | Unsafe | | | | | | | | |
| SPI10730 | Concrete, not under roads | 525 | 0.6 | 0.43 | Unsafe | | | | | | | | |
| SPI 107030A | Concrete, under roads | 525 | 0.6 | 0.43 | Unsafe | | | | | | | | |
| SPI11792 | Concrete, not under roads | 600 | 0.6 | 0.35 | Unsafe | | | | | | | | |
| SPP11792A | Concrete, not under roads | 600 | 0.6 | 0.35 | Unsafe | | | | | | | | |
| SPI13001 | Concrete, not under roads | 750 | 0.6 | 0.19 | Unsafe | | | | | | | | |
| SPI13002 | Concrete, not under roads | 750 | 0.6 | -0.81 | Unsafe | | | | | | | | |

This model has no pipes with non-return valves

DRAINS results prepared from Version 2021.02

Barrenjoey Consulting Engineers Pty Ltd
 Stormwater Structural Civil
 abn 13124694917 acn 124694917

PIT / NODE DETAILS

| Name | Max HGL | Max Pond HGL | Max Surface Flow Arriving (cu.m/s) | Max Pond Volume (cu.m) | Version 8 Min Freeboard (m) | Overflow (cu.m/s) | Constraint |
|-----------------------|---------|--------------|------------------------------------|------------------------|-----------------------------|-------------------|----------------|
| SPP12665 | 14.21 | | 0.214 | | 0.19 | 0.110 | Inlet Capacity |
| SPP12666 | 14.12 | | 0.351 | | 0.23 | 0.216 | Inlet Capacity |
| SPP12669 | 11.55 | | 0.476 | | 0.15 | 0.205 | Inlet Capacity |
| SPP12670 | 10.88 | | 0.332 | | 0.72 | 0.109 | Inlet Capacity |
| SPP12671 | 10.20 | | 0.455 | | 0.00 | 0.315 | Outlet System |
| SPP12672 | 9.98 | | 0.505 | | 0.02 | 0.240 | Inlet Capacity |
| SPP12673 | 9.43 | | 0.430 | | 0.37 | 0.161 | Inlet Capacity |
| SPP12674 | 9.09 | | 0.000 | | 0.71 | | None |
| SPP12678 | 6.96 | | 1.492 | | 1.04 | 1.184 | Inlet Capacity |
| Fishermans Beach 1.15 | | | 1.371 | | | | |

SUB-CATCHMENT DETAILS

| Name | Max Flow Q (cu.m/s) | Paved Max Q (cu.m/s) | Grassed Max Q (cu.m/s) | Paved Tc (min) | Grassed Tc (min) | Supp. Tc (min) | Due to Storm |
|-------------|---------------------|----------------------|------------------------|----------------|------------------|----------------|-------------------------------|
| PitRDCat1 | 0.182 | 0.182 | 0.000 | 1.00 | 0.00 | 0.00 | 1% AEP, 5 min burst, Storm 1 |
| PitRD2 | 0.182 | 0.182 | 0.000 | 1.00 | 0.00 | 0.00 | 1% AEP, 5 min burst, Storm 1 |
| Cliff Rd | 0.345 | 0.234 | 0.111 | 5.00 | 15.00 | 0.00 | 1% AEP, 10 min burst, Storm 7 |
| Beach Rd | 0.194 | 0.132 | 0.062 | 5.00 | 15.00 | 0.00 | 1% AEP, 10 min burst, Storm 7 |
| Ocean Grove | 1.138 | 1.014 | 0.124 | 10.00 | 60.00 | 2.00 | 1% AEP, 10 min burst, Storm 8 |

PIPE DETAILS

| Name | Max Q (cu.m/s) | Max V (m/s) | Max U/S HGL (m) | Max D/S HGL (m) | Due to Storm |
|-------------|----------------|-------------|-----------------|-----------------|--------------------------------|
| SPI01184 | 0.072 | 1.23 | 14.131 | 14.120 | 1% AEP, 5 min burst, Storm 1 |
| SPI05092 | 0.150 | 1.67 | 14.984 | 11.550 | 1% AEP, 5 min burst, Storm 1 |
| SPI05092A | 0.286 | 3.29 | 11.355 | 10.875 | 1% AEP, 5 min burst, Storm 1 |
| SPI10730 | 0.385 | 1.78 | 10.605 | 10.200 | 1% AEP, 5 min burst, Storm 1 |
| SPI 107030A | 0.410 | 1.89 | 10.022 | 9.981 | 1% AEP, 5 min burst, Storm 1 |
| SPI11792 | 0.452 | 1.60 | 9.796 | 9.432 | 1% AEP, 5 min burst, Storm 1 |
| SPP11792A | 0.515 | 2.18 | 9.268 | 9.089 | 1% AEP, 5 min burst, Storm 1 |
| SPI13001 | 0.503 | 3.28 | 9.035 | 7.284 | 1% AEP, 10 min burst, Storm 10 |
| SPI13002 | 0.578 | 8.89 | 6.964 | 1.154 | 1% AEP, 10 min burst, Storm 10 |

CHANNEL DETAILS

| Name | Max Q (cu.m/s) | Max V (m/s) | Due to Storm |
|------|----------------|-------------|--------------|
| | | | |

OVERFLOW ROUTE DETAILS

| Name | Max Q U/S | Max Q D/S | Safe Q | Max D | Max DxV | Max Width | Max V | Due to Storm |
|---------------------|-----------|-----------|--------|-------|---------|-----------|-------|------------------------------------|
| Over 1 | 0.110 | 0.291 | 2.953 | 0.046 | 0.04 | 7.40 | 0.86 | 1% AEP, 5 min burst, Storm 1 |
| Over 2 | 0.216 | 0.216 | 2.953 | 0.038 | 0.03 | 7.40 | 0.76 | 1% AEP, 5 min burst, Storm 1 |
| CliffRDover | 0.205 | 0.205 | 2.953 | 0.038 | 0.03 | 7.40 | 0.74 | 1% AEP, 10 min burst, Storm 7 |
| Cliff to Beach | 0.109 | 0.298 | 2.953 | 0.047 | 0.04 | 7.40 | 0.86 | 1% AEP, 10 min burst, Storm 7 |
| BeachRDover | 0.315 | 0.315 | 2.953 | 0.049 | 0.04 | 7.41 | 0.87 | 1% AEP, 10 min burst, Storm 7 |
| BeachtoSeaview | 0.240 | 0.240 | 2.953 | 0.041 | 0.03 | 7.40 | 0.78 | 1% AEP, 10 min burst, Storm 7 |
| SeaviewtoOceanGrove | 0.161 | 0.161 | 1.261 | 2.953 | 0.112 | 0.17 | 7.41 | 1.52 1% AEP, 10 min burst, Storm 7 |
| Over to beach | 1.184 | 1.184 | 2.953 | 0.108 | 0.16 | 7.41 | 1.48 | 1% AEP, 10 min burst, Storm 4 |

DETENTION BASIN DETAILS

| Name | Max WL | Max Vol | Max Q Total | Max Q Low Level | Max Q High Level |
|------|--------|---------|-------------|-----------------|------------------|
| | | | | | |

Run Log for flood.drn run at 13:47:51 on 11/4/2024 using version 2021.02
 Upwelling occurred at: SPP12671
 Freeboard was less than 0.15m at SPP12672
 Flows were safe in all overflow routes.

Appendix D
Curriculum Vitae 2024
Lucas Molloy

Curriculum Vitae 2024

Lucas Molloy

MIEAust / CPEng / NER / APEC / Engineer / IntPE(Aus)

Education -

- 1988 Higher School Certificate
Pittwater High School NSW Australia
- 1995 Bachelor of Engineering (Civil)
University of Wollongong NSW Australia

Employment -

- May 2007 to date
Barrenjoey Consulting Engineers Pty Ltd
Director / Engineer / Draftsman
- April 2003 to April 2007
Northern Beaches Consulting Engineers Pty Ltd
Director / Engineer
- Feb 1997 to April 2003
Northern Beaches Consulting Engineers Pty Ltd
Engineer
- Dec 1988 to Dec 1993
Jack Hodgson Consulting Engineers
Undergraduate trainee / Engineer

For last sixteen years Director / Engineer / Draftsman of the structural and civil engineering practice Barrenjoey Consulting Engineers Pty Ltd (est 2007). I am responsible for the structural and civil (including stormwater management) design, documentation, investigation and construction supervision of predominately residential developments.

The spectrum of projects I have consulted on, vary from a 6 square meter timber framed deck extension of a residential house (budget ~ \$1,500) to 8 storey commercial development (budget of ~ \$10,000,000).

During my career I have been active in the preparation and issuing of –

- 250+ stormwater management plans inc on site detention
- 50+ overflow / flood analysis using DRAINS / HECRAS / AR+R
- 25+ flood inundation & risk assessment reports

End of Document