NB Consulting Engineers

STRUCTURAL - CIVIL - STORMWATER - REMEDIAL

... STRUCTURALLY SOUND

Flood Risk Management Report

31 Kooloora Avenue, Freshwater

Job no. 2404032

Issue A

17 May 2024

Prepared for: Chris Hudson & Judy Tsu

Prepared by: Hannah Stubley

Flood Risk Management Report

Project no: 2404032

Issue: A

Date: 17/05/2024

Client: Chris Hudson & Judy Tsu

Engineer: Hannah Stubley

Principal review: Michael Wachjo

Council: Northern Beaches Council (Region 2)

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Document History

Issue	Engineer	Checked	Description	Date
A	H.Stubley	M.Wachjo	Flood Risk Management Report	17.05.2024

Contents

Figures

Summary

Northern Beaches Consulting Engineers were engaged by Chris Hudson & Judy Tsu to prepare a revised Flood Risk Management report. The purpose of the report is to determine the effects of a proposed development on the existing flooding regime within the development site and neighbouring properties. The development site is located at 31 Kooloora Avenue in Freshwater. The subject site is located within an existing flood zone, however, the area within which the development site is located has not been identified as a flood affected area in any of Council's available land zoning mapping or flood information, and therefore has not been strictly assessed against the Northern Beaches Council (Warringah area) flood controls. The criteria used in this report has been provided within the Engineer Referral Response for DA2024/0004.

To effectively assess the anticipated flooding effects, a hydraulic model was constructed of the Freshwater catchment using sub-catchments and infiltration basins within DRAINS software to determine the peak flood depth within the subject site up to the 1% Annual Exceedance Probability (AEP) storm event. The hydraulic modelling results were used to determine any potential adverse flooding effects associated with the development up to the 1% AEP storm event.

Concluding the results from the DRAINS analysis, further calculations were prepared to determine the extent of flood storage losses as a result of the proposed works. The development is not expected to cause a net loss of flood storage or adverse flooding effects to neighbouring properties should the recommendations in this report be adopted. The results from the analysis are detailed in the report below.

1. Introduction

Northern Beaches Consulting Engineers were engaged by Chris Hudson & Judy Tsu to undertake a hydrologic and hydraulic investigation into the effects of a proposed residential development at 31 Kooloora Avenue in Freshwater. The assessment involved analysing localised flooding behaviour within the Freshwater catchment up to the 1% AEP storm event.

Christian Ferry and Michael Wachjo of Northern Beaches Consulting Engineers (NBCE) conducted a site inspection at the above address on 13 November 2019. The site inspection was carried out to both observe and measure the existing drainage infrastructure within the development site and critical elements of Council's stormwater drainage infrastructure within the Freshwater catchment. The premises have been assessed in accordance with the requirements of the Engineering Referral Response dated 04/04/2024 for DA2024/0004, the Council supplied flood information and the *NSW Government Floodplain Management Manual 2005*.

1.1 Aim

The purpose of this report is to determine the peak flood depth within the subject site up to the 1% AEP storm event within an acceptable design criterion and assess the potential flooding impacts within the development site and neighbouring properties as a result of the proposed works. An analysis was undertaken to assess the extent of flooding envisaged to occur through the subject site and examine strategies to mitigate any impacts from flood waters during heavy rainfall events. Note, the analysis utilised the results of 1% AEP storm event modelling using IFD (Intensity Frequency Duration) design rainfall data based on AR&R 2019 (Australian Rainfall & Runoff) methodology.

The calculations and recommendations presented in this report have been prepared in general accordance with the following policies:

- *Australian Rainfall and Runoff: A Guide to Flood Estimation 2019*
- *NSW Government Floodplain Management Manual 2005*

1.2 Site Characteristics

The 376.8m^2 site is located on the corner of Kooloora Avenue and Gore Street in Freshwater within the Northern Beaches Council (Warringah) LGA and is bounded by residential properties along the north-western and south-western boundaries of the site.

Topographical information indicates that the subject site is located within a flood storage area at the bottom of the Freshwater catchment. The base of the Freshwater catchment forms a localised basin, bounded by the vegetated sand dunes west of the Freshwater Beach foreshore which becomes a temporary flood storage zone in heavy rainfall events. The primary cause of flooding is due to the inadequate hydraulic capacity of the existing Council stormwater drainage infrastructure which discharges to Freshwater beach. The impact of the inadequate discharge capacity is exacerbated when peak storm events occur in conjunction with high tides.

The existing stormwater drainage network consists of a series of pits and pipes which conveys public stormwater from the upstream catchment through to the catchment discharge point at the northern end of the Freshwater Beach foreshore. There are currently 2 x 1650mm & a 450mm diameter Council owned reinforced concrete pipeline (RCP) which extends through no. 44 Kooloora Avenue towards Freshwater Beach (refer Appendix C for details). These pipes discharge into 2 x 1800mm diameter pipes which outlet onto the Freshwater Beach foreshore. These outlet pipelines convey collected runoff from the upstream catchment which extends west of 44 Kooloora Avenue up to the crest on McDonald street approximately 1350m away.

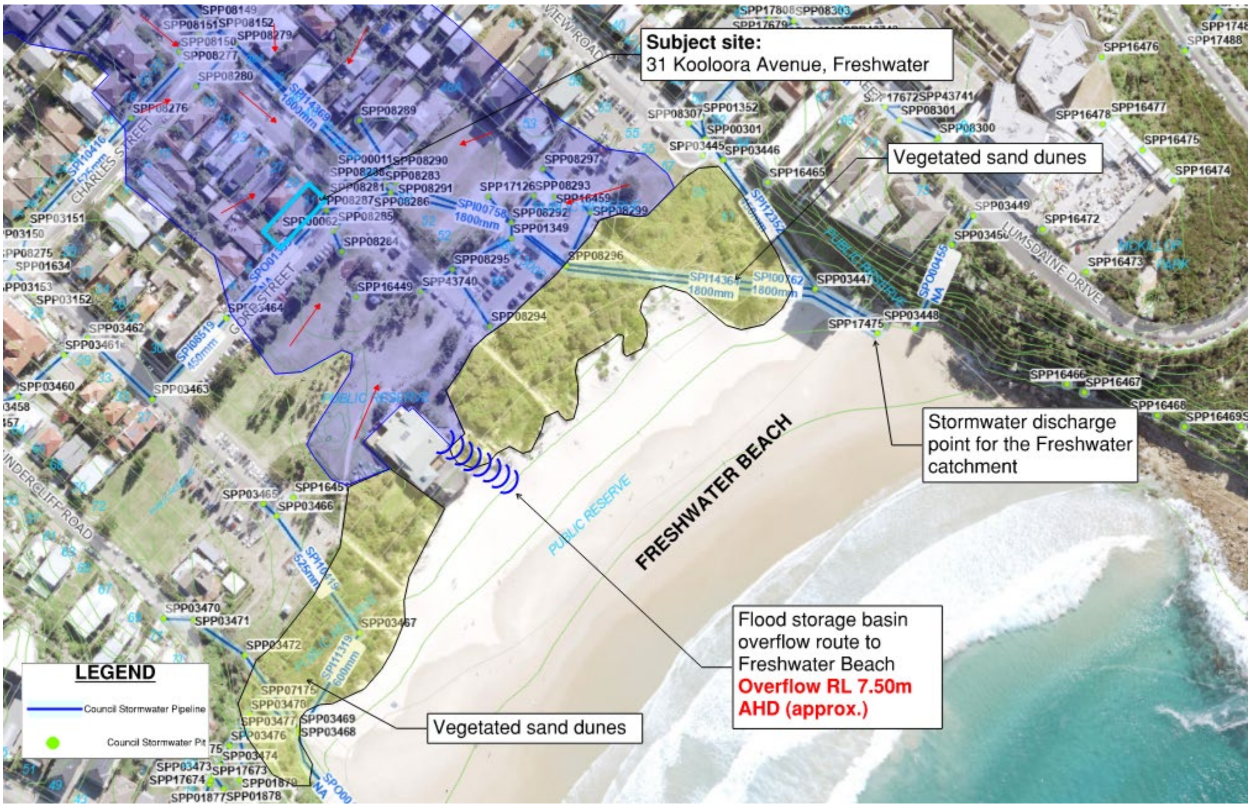


Figure 1 - Subject Site Location and Surroundings. Source: SIX Maps (NSW)

2. Flooding

2.1 Methodology

The flooding extent was modelled using the computer program DRAINS. A combination of LiDAR (Light Detection and Ranging) survey data, survey levels prepared by TTS Total Surveying Solutions and SIX Maps (NSW) government website information were used to estimate the total catchment area. The peak stormwater runoff rates within each of the contributing sub-catchments upstream of the subject site and the resulting flood depth within the flood storage area was modelled in the computer program DRAINS for the 1% AEP storm event considering tailwater effects, incoming catchment flows, outgoing absorption flows and outgoing pipe flows.

2.2 Hydraulic Modelling Parameters

Multiple assumptions and parameters were considered in the construction of the hydraulic model. The modelling assumptions and parameters used are based on available survey data and on-site investigations.

2.2.1 Sub-Catchment Assumptions

Five sub-catchments were used in the analysis to effectively determine the flood behaviour within the wider catchment. The following assumptions are based on available survey information and recommended guidelines.

- An impervious ratio of 75% was used for 4 of the upper sub-catchment nodes (refer to Figure 2).
- An impervious ratio of 67% was used for the lower sub-catchment node at the bottom of the freshwater catchment (refer to Figure 2). This catchment also includes large grass park areas at the eastern end of Kooloora avenue.
- A roughness retardance coefficient of 0.012 and 0.33 was used for the impervious and pervious areas, respectively.

2.2.2 Pit and Pipe Blockage Factors

The following assumptions are based on available survey information and accepted guidelines. The below parameters are based upon the previously approved criterion within the flood risk report for 44 Kooloora Avenue, Freshwater prepared by NBCE.

- No blockage factors have been applied to the pipe in the hydraulic model. The velocities through the 2 x 1800mm diameter outlets at Freshwater beach are expected to fall between 3-4m/s during peak storm events. These high velocity rates will facilitate self-cleaning of the pipelines (refer to Appendix F for details).
- A blockage factor of 80% was applied to all sag pits within the hydraulic model.
- A constant outlet water level of 1.475m AHD was used to represent the king tide tailwater condition for the 2 x 1800mm diameter outlets at Freshwater Beach. The king tide level has been conservatively taken as the highest tidal level ever recorded in the Sydney area (refer to Figure 2 below). Source: Manly Hydraulics Laboratory (NSW Government website)

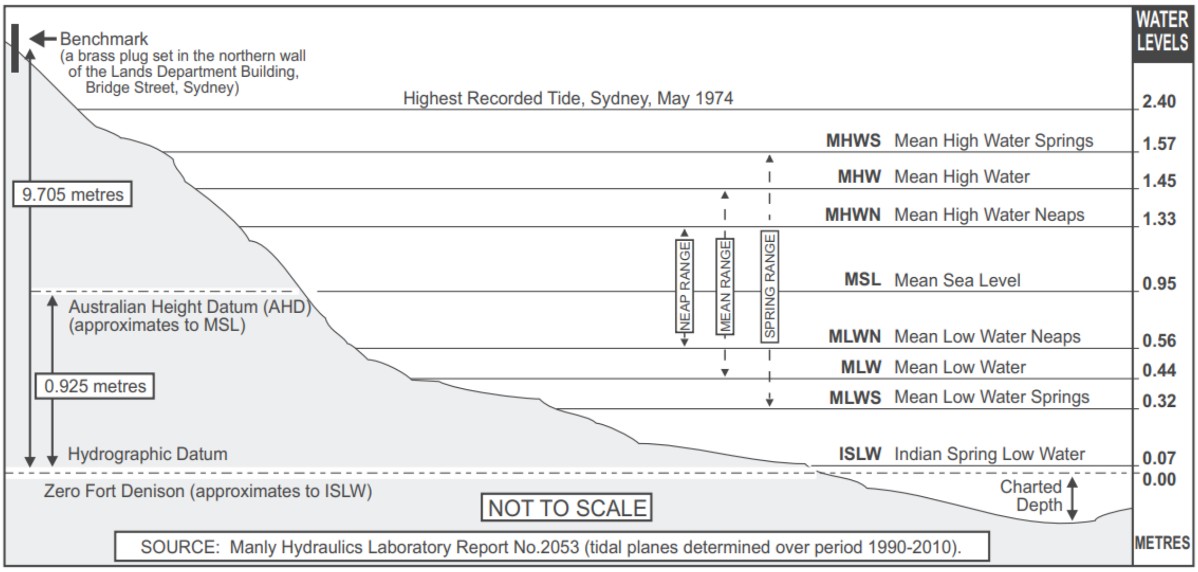


Figure 2 - NSW Tidal Charts (2020). Source: Manly Hydraulics Laboratory (NSW Government website)

2.2.3 Flood Storage Basin Parameters

To effectively represent the flood storage areas within the wider Freshwater catchment, storage basin nodes were used in a hydraulic model to accurately represent each of the critical temporary detention basins within the catchment, as these have a considerable impact on the hydraulic behaviour of stormwater runoff within the wider catchment. For the purpose of this report the following assumptions are made based on the available survey information and on site observations:

- Jacka Park Storage Basin 1 and Jacka Park Storage Basin 2 (Refer Figure 3) are located in Freshwater and are bound by Wyndora Avenue, Eric Street, Glen Street and Oliver Street. The two storage basins at Jacka Park are assumed to collect stormwater runoff from sub catchment A (refer Figure 4).
- Freshwater Storage Basin (Refer Figure 3) is located in Freshwater and bound by Albert Street, Moore Road and Ocean View Road. The Freshwater storage basin is assumed to collect stormwater runoff from sub-catchment E (refer Figure 4) and discharges through the council pipe at Freshwater beach.

Figure 3 - Storage Basin Locations within the Freshwater Catchment. Source: QGIS

2.2 Catchment Analysis

The subject site is located within the Freshwater catchment which conveys stormwater runoff to Freshwater Beach via Council's stormwater drainage infrastructure. The total contributing catchment affecting the subject site was measured in the computer program QGIS 2.18.8 using LiDAR data and is approximately 89.215 Ha.

The contributing catchment consists predominately of low-medium residential development. The catchment extends approximately 1500m upstream and reaches an elevation of approximately 68m AHD. QGIS 2.18.8 was also used to measure the average catchment slope. The manning's roughness 'n' values used for the analysis have been approximated based on observed site conditions (refer Table 1 below). Modelled results from a DRAINS analysis have been used to estimate the peak flow flood depth for the 1% AEP storm event.

Table 1 - Roughness Parameters used for DRAINS

Surface Type	Manning's Roughness (n)
Road / Paving	0.012
Grass	0.33

Five sub-catchments were considered in the analysis to appropriately represent the wider Freshwater catchment. The wider catchment was reduced to five critical sub-catchments for the purpose of providing a more accurate representation of the wider catchment flow behaviour. Each of the sub-catchments are listed below (refer to Figure 4).

- Jacka Park Sub-Catchment (Sub-Catchment A)
- Soldiers Avenue Sub-Catchment (Sub-Catchment B)
- Alfred Street Sub-Catchment (Sub-Catchment C)
- Ocean View Road Sub-Catchment (Sub-Catchment D)
- Freshwater Sub-Catchment (Sub-Catchment E)

Figure 4 – Critical Sub-Catchments within the Freshwater Catchment. Source: QGIS

3. Analysis & Results

3.1 Peak Flow Results

A DRAINS computation analysis was completed to determine the anticipated runoff through the subject site. The 1% AEP storm event was computed, and the peak runoff rates are shown in Table 2 below:

Table 2 - Catchment Flow Rates for the 1% AEP Storm Event

AEP	Sub-Catchment	Area (Ha)	Piped Flow (m^3/s)	Overflow (m^3/s)
1%	A	33.684	6.82	2.52
1%	B	8.372	0.131	4.02
1%	C	14.382	7.06	9.32
1%	D	3.739	2.13	0
1%	E	33.252	20.2	0

For further detail refer Appendix A.

3.2 Flooding Extent

The 1% AEP peak flood depth has been estimated using the computer program DRAINS. The 1% AEP storm event was computed, and the peak flood depths within the Freshwater Storage Basin within the Freshwater sub-catchment are shown in Table 3 below:

Table 3 - Flood Depths for the 1%, 2%, 5% & 0.2EY Storm Events

AEP / EY	Flood Depth (m AHD)
FPL (1% AEP + 500mm)	5.55
1% AEP	5.05
2% AEP	4.86
5%	4.63
0.2EY	4.20

3.3 Flood Storage Loss

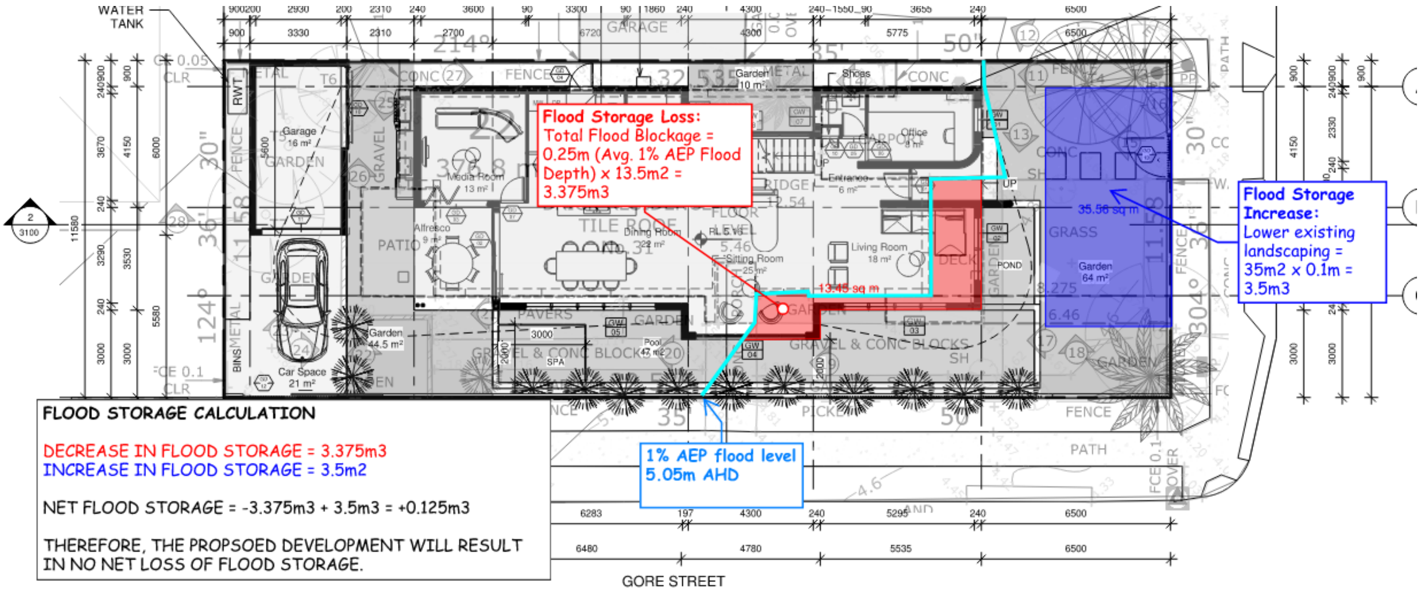


Figure 5 - Flood storage calculation

The footprint of the proposed new development details a minor increase to the footprint of the existing dwelling within the 1% AEP flood extent. The majority of the proposed development at the site appears to be located beyond the flood affected area (above the 1% AEP flood level of 5.05m AHD). The existing front yard is be lowered to provide an additional 3.5m3 (35m2 area x 0.1m deep) of flood storage to offset the loss of flood storage as a result of the increase in building footprint. If the above is adopted in construction, the proposed development is anticipated to result in no net loss of flood storage.

4. Recommendations

4.1 Floor Levels

The proposed ground floor level is located at the FPL 5.55m AHD and is therefore compliant with Northern Beaches Council Policy.

Further, the proposed garage is located RL 5.50m AHD which is located above the 1% AEP flood level RL 5.05m AHD.

4.2 Pool/Pond

The proposed pool and pond are located within the 1% AEP flood extent and hence are to be in-ground structures with the coping flush with natural ground level. This is to allow flood waters to flow unimpeded and results in no net loss of flood storage.

Additionally, any chemicals or electrical equipment associated with the pool must be stored at or above the FPL 5.55mAHD.

4.3 Fences

The proposed fencing located within the 1% AEP flood extent (Refer Appendix C) is to be of an open design to allow flood waters to flow unimpeded. At least 50% of the fence must be open with openings a minimum of 75mmx75mm.

4.4 Building Components and Structural Soundness

The proposed structures are recommended to be designed and inspected by a structural engineer to ensure the structure is adequate to withstand the forces of floodwaters up to the FPL with low velocity. New structures located below the FPL are to be designed to cater for the flood loads. Furthermore, the switchboard and main circuit unit must be fitted above the FPL. All new electrical equipment, power points, wiring, fuel lines, sewerage systems or any other service pipes and connections must be waterproofed and/or located above the FPL and conduits must be laid such that they are free draining. All existing electrical equipment and power points located below the FPL within the subject structure must have residual current devices installed that turn off all supply of electricity to the property when flood waters are detected. New structures located below the FPL are to be adequately flood proofed.

All buildings are to be designed and constructed in accordance with Reducing Vulnerability of Buildings to Flood Damage – Guidance on Building in Flood Prone Areas, Hawkesbury-Nepean Floodplain Management Steering Committee (2006). Any proposed fencing along the boundaries, alternative to pool type fencing, are to be certified and/or designed by a civil engineer to withstand hydrostatic forces up to and including the 1% AEP storm event. Openings are to be provided, excluding the property frontage, to ensure the 1% AEP floodwater is able to flow through the property unimpeded. Any changes to internal structures below the FPL are to be wet waterproofed.

4.5 Emergency Flood Response

The PMF level cannot be determined using the DRAINS however, the maximum depth of the Freshwater basin is RL 7.50m AHD (Flood storage basin overflow route to Freshwater Beach, refer Figure 1). Therefore, the PMF level has been assumed to be maximum RL 7.50m AHD.

The proposed bedroom 1 located on the first floor (RL 8.85m AHD) is recommended to provide an on-site refuge above the PMF (7.50m AHD). The on-site refuge must have appropriate access installed to enable access points from all areas within the development. The proposed on-site refuge is to be structurally adequate up to the PMF (7.50m AHD). Refer to figure 6 below for the proposed on-site refuge location.

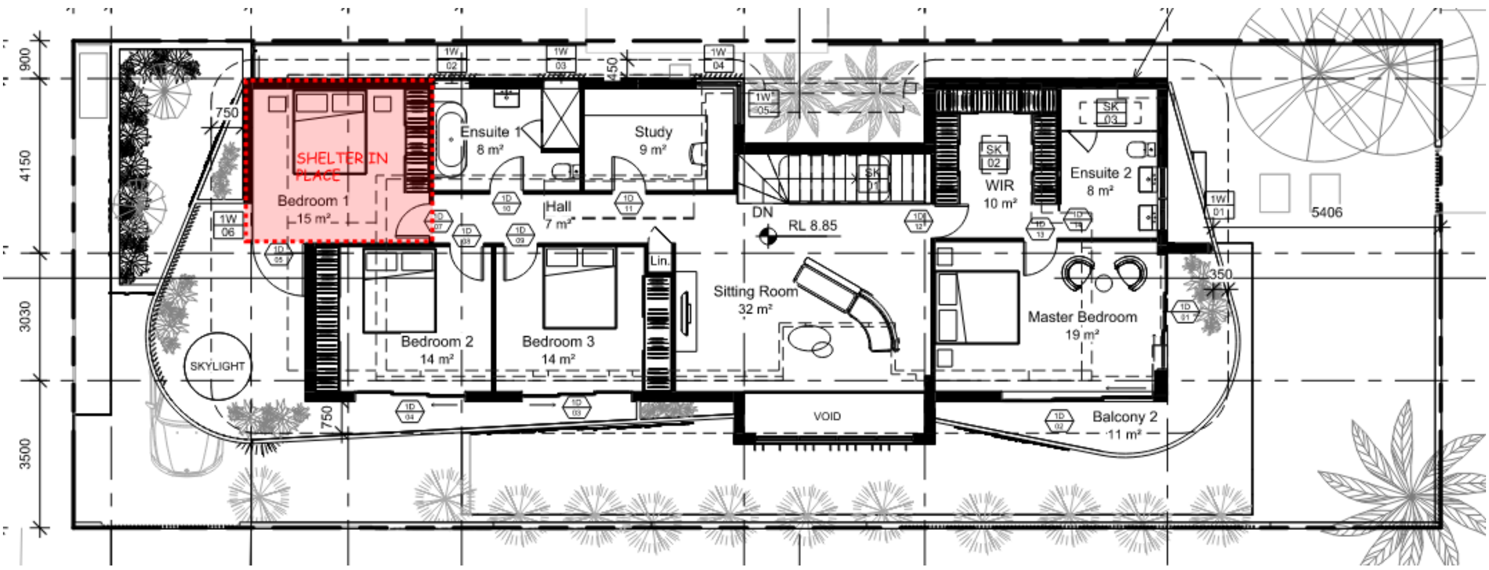


Figure 6 - On-site Refuge Location

5. Conclusion

In accordance with accepted engineering practice, NBCE has undertaken a flood study of the stormwater drainage system at 31 Kooloora Avenue in Freshwater and can confirm the accuracy of the calculated results based on the DRAINS modelling. The proposed development will be safeguarded from flooding and will not adversely affect other structures or properties as a result of the proposed development. Please contact the author if further clarification is required.

NORTHERN BEACHES CONSULTING ENGINEERS P/L
Michael Wachjo

BE(Civil) MIEAust

P:\2404032 31 KOOLOORA AVENUE, FRESHWATER\ENG Design\2404032 - 31 Kooloora Ave - Flood Report 2024-05-16.docx

APPENDIX A

DRAINS Results

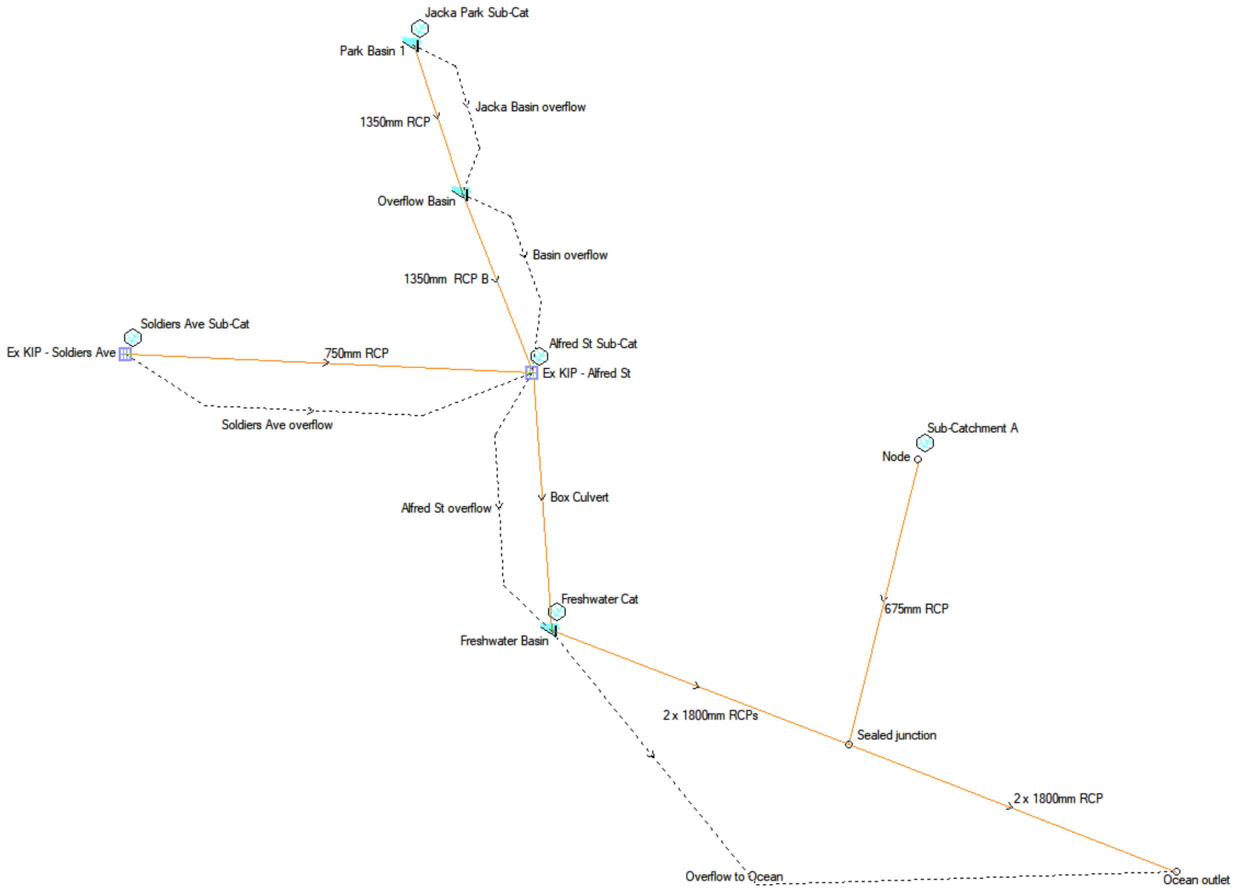


Figure 7 - DRAINS model: Catchment configuration

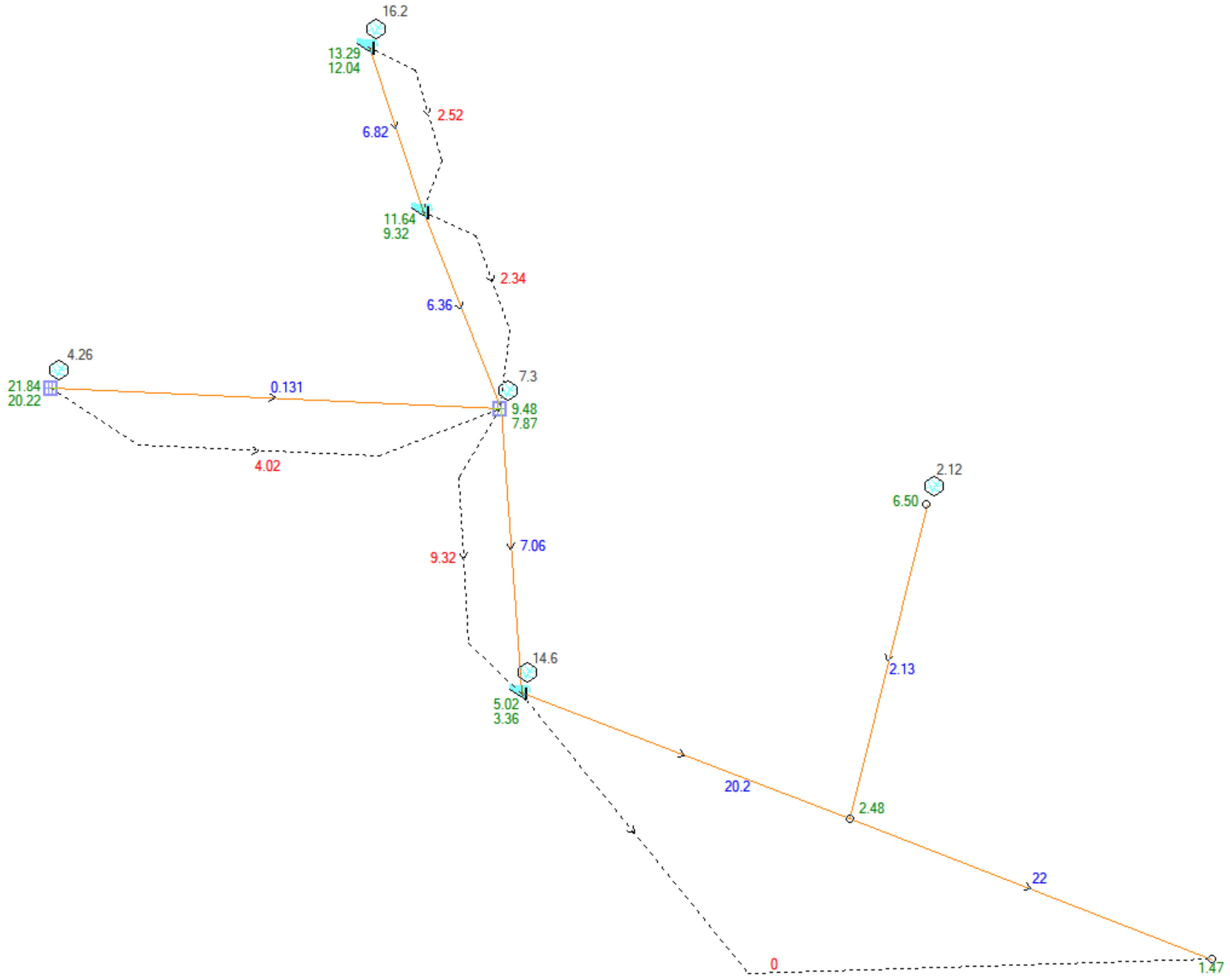
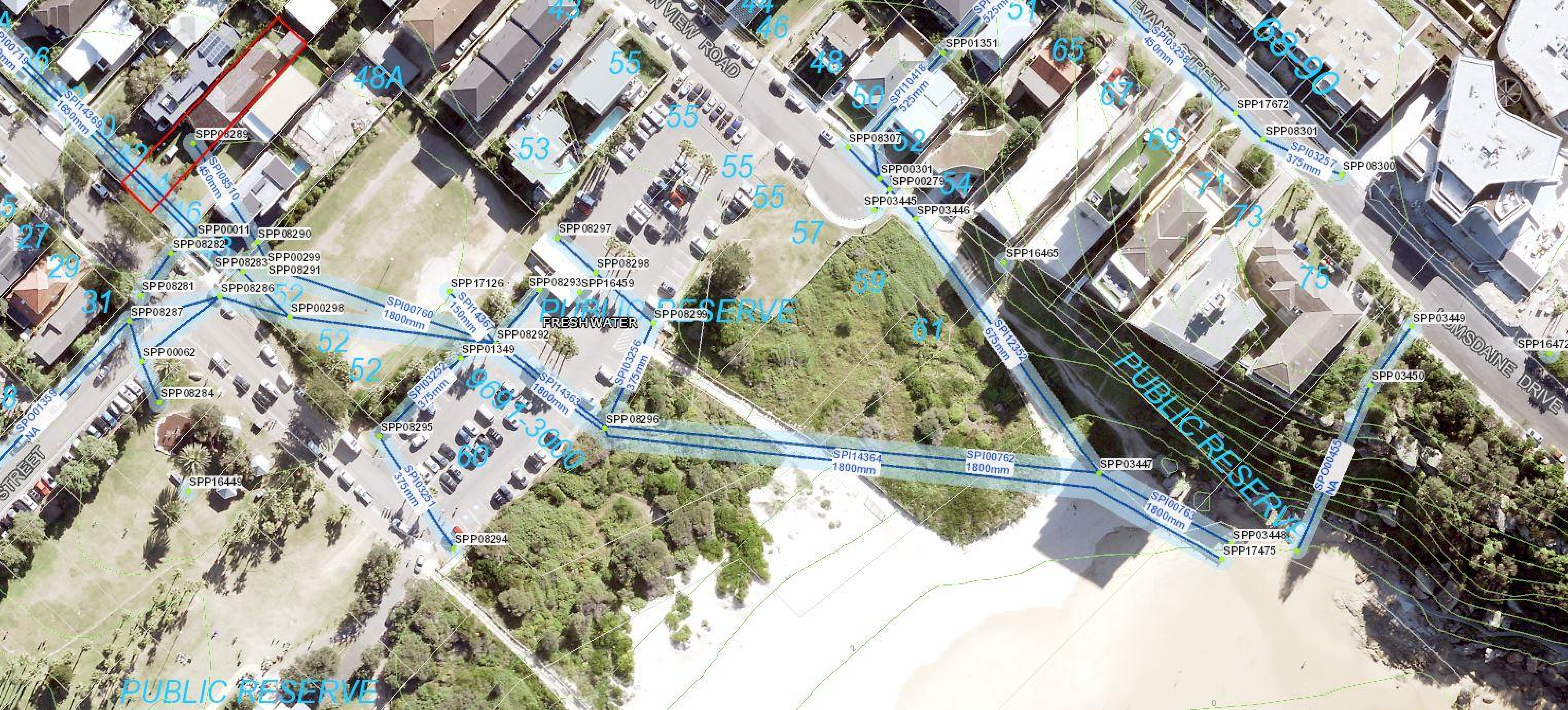


Figure 8 - DRAINS model: Catchment Flows for 1% AEP Storm Event. Source: DRAINS

APPENDIX B

Council Mapping Information



PUBLIC RESERVE
FRESHWATER
PUBLIC RESERVE
PUBLIC RESERVE
EVANS STREET
LUMSDAINE DRIVE
VIEW ROAD
STREET
9691-3000
68-90
SPP08289
SPI08510 450mm
SPP00011
SPP08290
SPP08282
SPP08283
SPP00299
SPP08291
SPP08281
SPP08286
SPP00298
SPP08287
SPP00062
SPP08284
SPI14369 1650mm
SPO01359 NA
SPI00760 1800mm
SPP17126
SPI14367 150mm
SPP08293
SPP16459
SPP08297
SPP08298
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SPP08292
SPP01349
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SPP03446
SPP00301
SPP00279
SPP08307
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SPP01351
SPI03258 450mm
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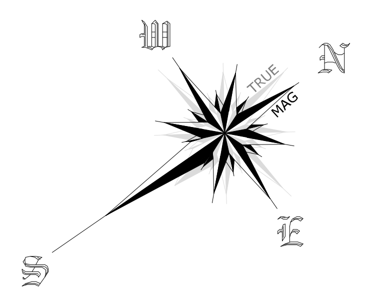
SPP08301
SPI03257 375mm
SPP08300

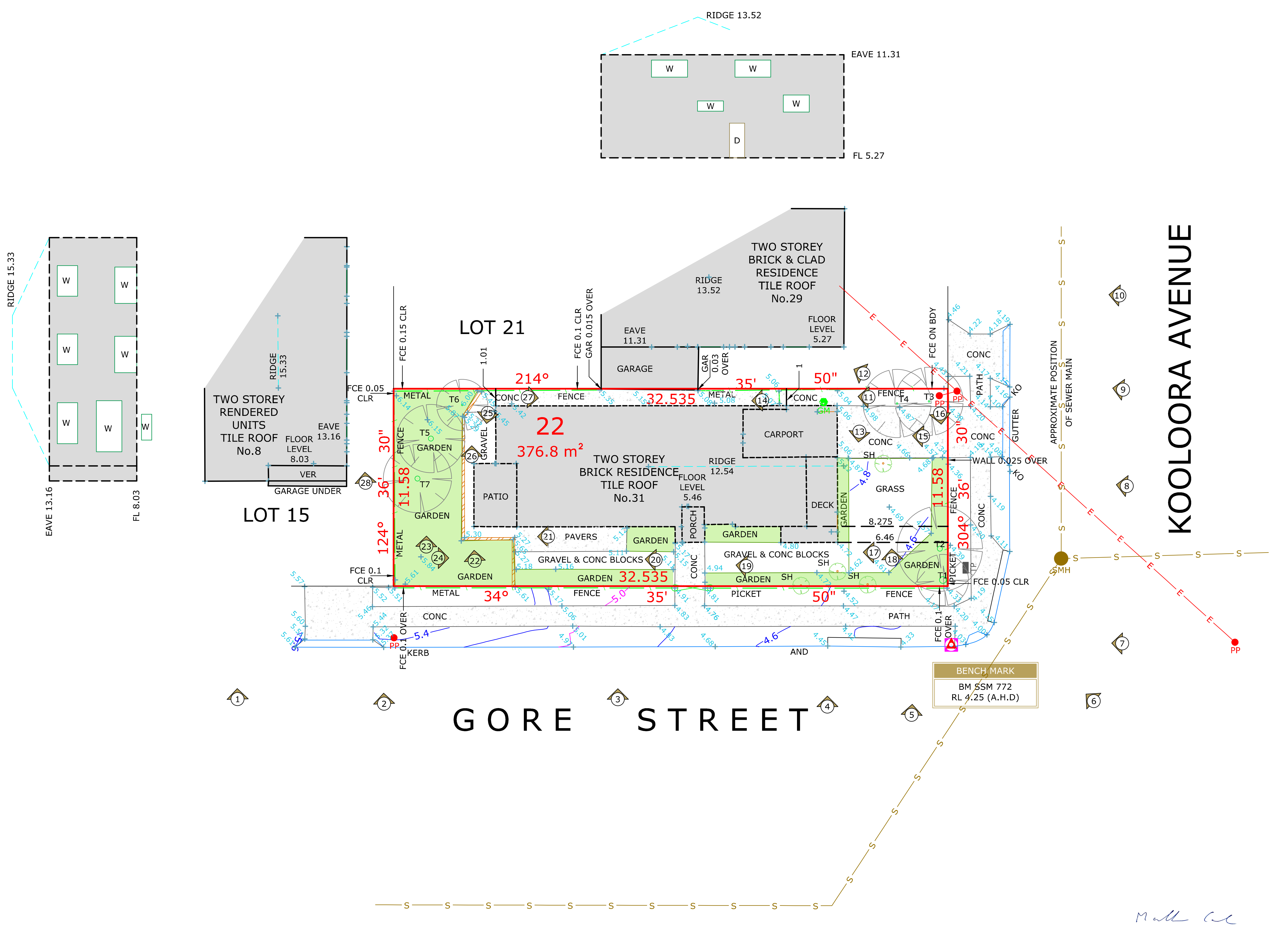
APPENDIX C

Site survey plan & Architectural plans



NORTH NOTE

BEARINGS SHOWN HAVE BEEN DETERMINED FROM NSW LAND REGISTRY SERVICES PLANS AND ARE RELATED TO MAGNETIC NORTH. TRUE NORTH IS APPROXIMATE ONLY AND FURTHER INVESTIGATION WOULD BE REQUIRED TO DETERMINE ACCURATE TRUE NORTH.



BENCH MARK

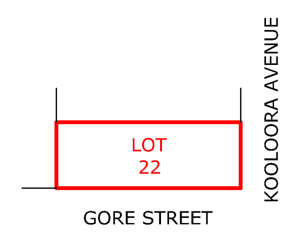
BM SSM 772
RL 4.25 (A.H.D)

M.J. CORK
REGISTERED LAND SURVEYOR

DIAL BEFORE YOU DIG
www.1100.com.au

LOCATION PLAN

LAT: -33.7799
LONG: 151.2892



SCHEDULE OF TREES

	DIAMETER	HEIGHT	TYPE
T1	0.40	9m	PALM
T2	0.30	7m	-
T3	0.10	6m	-
T4	0.10	6m	-
T5	0.30	6m	-
T6	0.10	4m	-
T7	0.30	7m	-

LEGEND

- BENCH MARK
- PHOTO POINT
- GULLY PIT
- VEHICULAR/PRAM CROSSING
- TOP OF BANK
- BOTTOM OF BANK

ABBREVIATIONS

EB - ELECTRICAL BOX
EM - ELECTRICAL METER
GM - GAS METER
H - HYDRANT
KO - KERB OUTLET
LH - LAMP HOLE
LP - LIGHT POLE
MH - MAN HOLE
MS - MAINTENANCE SHAFT
PP - POWER POLE
R - HYDRANT RECYCLED
SH - SHRUB
SIO - SEWER INSPECTION OPENING
SMH - SEWER MAN HOLE
SR - STOP VALVE RECYCLED
SV - STOP VALVE
SVP - SEWER VENT PIPE
SWP - STORM WATER PIT
T - TREE
TP - TELECOMMUNICATIONS PIT
VER - VERANDAH
WT - WATER TAG
WM - WATER METER
WMR - WATER METER RECYCLED
WC, GC, EC, TC - SERVICE CONDUIT
W/C - WATER CLOSET

SOURCE OF LEVELS

SSM 772 RL 4.25
S.C.I.M.S

DRAWING NOTES

1. CONTOURS SHOWN HAVE BEEN INTERPOLATED FROM SPOT LEVELS TAKEN ON-SITE AND ARE A REPRESENTATION OF THE TOPOGRAPHY ONLY.
2. BOUNDARIES HAVE BEEN SURVEYED.
3. SERVICES SHOWN HAVE BEEN LOCATED WHERE POSSIBLE BY FIELD SURVEY. PRIOR TO ANY SITE WORKS, THE RELEVANT AUTHORITY SHOULD BE CONTACTED TO DETERMINE EXACT POSITION OF ANY UNDERGROUND PIPES, CABLES ETC.
4. DIMENSIONS OF ANY TREES SHOWN ON THE PLAN ARE APPROXIMATE.

PLAN BY: DONOVAN ASSOCIATES — REGISTERED SURVEYORS AND CIVIL/STRUCTURAL ENGINEERS

CLIENT: ICON HOMES

CLIENT REFERENCE:

REVISION	DESCRIPTION	DATE

PROJECT LOCATION

LOT 22 SEC 2 DP 7022
31 KOOLOORA AVENUE
FRESHWATER

PLAN TYPE	LEVEL DATUM	
CONTOUR PLAN	AUSTRALIAN HEIGHT DATUM	
	DRAWN	CHECKED
	R.MCINTYRE	M.CORK
JOB REFERENCE	SURVEY DATE	DGN/DWG No.
1929/330489	20.03.2023	330489
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	A2	1:200

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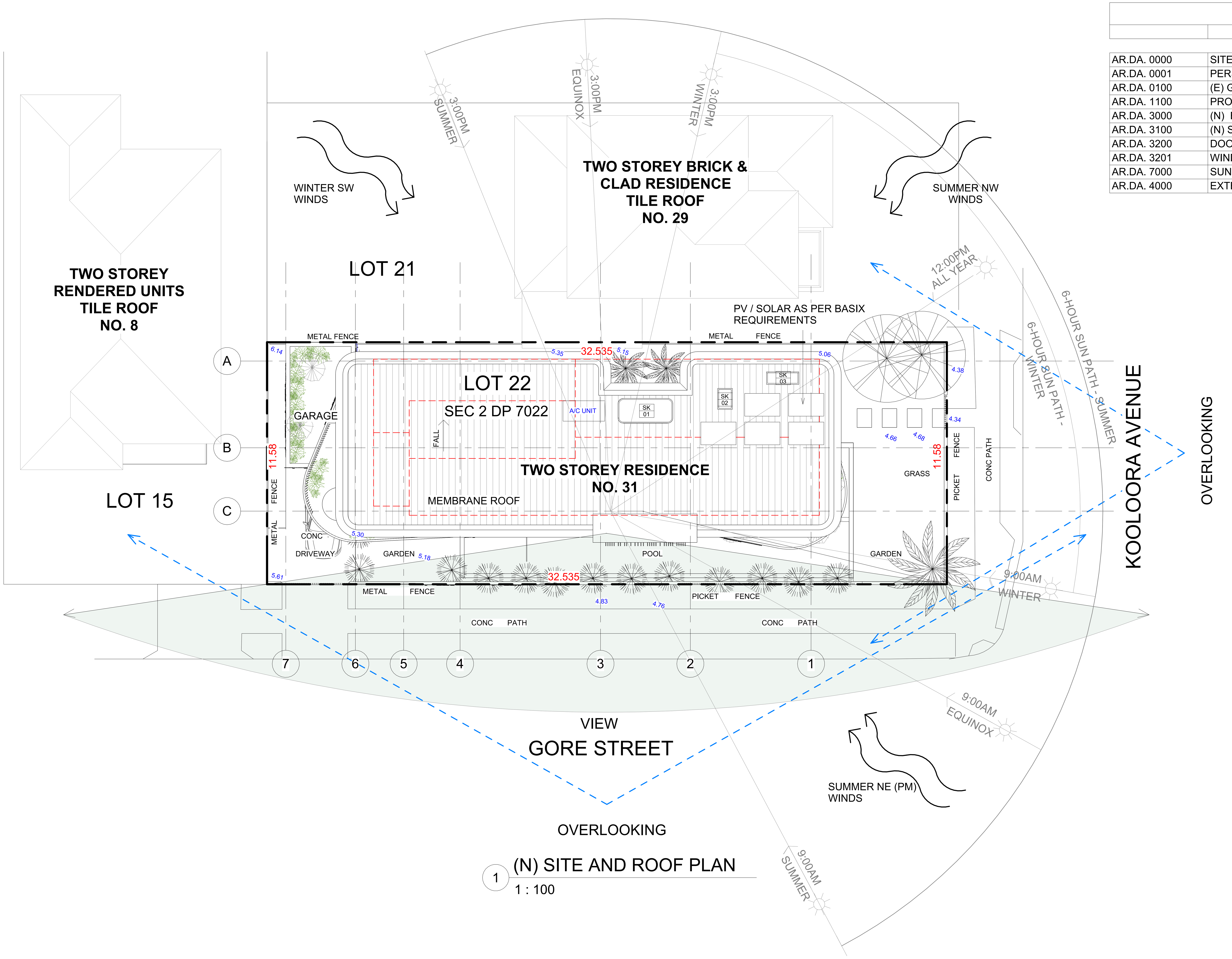

1 (N) SITE AND ROOF PLAN
1 : 100

DRAWING LIST

	Sheet Name
AR.DA. 0000	SITE AND ROOF PLAN
AR.DA. 0001	PERSPECTIVE VIEWS
AR.DA. 0100	(E) GROUND AND FIRST FLOOR
AR.DA. 1100	PROPOSED GROUND AND FIRST FLOOR PLAN
AR.DA. 3000	(N) ELEVATIONS
AR.DA. 3100	(N) SECTIONS
AR.DA. 3200	DOOR SCHEDULE
AR.DA. 3201	WINDOW SCHEDULE
AR.DA. 7000	SUN SHADOWS STUDIES
AR.DA. 4000	EXTERNAL FINISHES

Certificate No. 0009167644-02
Scan QR code or follow website link for rating details.
Assessor name Danielle Grumont
Accreditation No. HERA10134
Property Address 31 Kooloora Avenue,FRESHWATER NSW,2096
hstar.com.au/QR/Generate?p=KsaEMySxs

CLIENT
JUDY HSU & CHRIS HUDSON

DESIGN ARCHITECT
R SQUARED STUDIOS

PLANNER
VMDC PLANNING

LANDSCAPE CONSULTANT
TCGD

SURVEYOR
DONOVAN ASSOCIATES

STRUCTURAL & HYDRAULIC ENGINEER
BMY BUILDING CONSULTANTS

ENERGY CONSULTANT
GREEN FUTURE GROUP

Rev	Date	Description	Drawn	Auth.
P1	9.11.2023	ISSUE FOR COORDINATION	TI	RR
P2	28.11.2023	ISSUE FOR COORDINATION	TI	RR
P3	1.12.2023	ISSUE FOR COORDINATION	TI	RR
A	20.12.2023	ISSUE FOR DA	TI	RR
B	25.03.2024	ISSUE FOR DA	TI	RR
C	17.05.2024	ISSUE FOR DA	TI	RR

LEGEND

Proj. Arch RR
Drawn TI
Date MAY 2024
Scale 1 : 100

Do not scale drawings. Verify All dimensions on site. Notify architect of all discrepancies.

Project
FRESHWATER HOUSE
31 Kooloora Avenue, Freshwater

Drawing Title
SITE AND ROOF PLAN

Drawing No.
AR.DA. 0000

Revision
C

Project Architect
R Squared Studios Pty Ltd
contact@r2studios.com.au
www.r2studios.com.au

R² STUDIOS

1 3D View 1

3 3D View 3

Job No.	Revision	Notes	Date
Hsu & Hudson	A	NatHERS & BASIX Assessment	22/12/2023

Thermal Comfort Specifications	
Glazing: Doors/windows	'Default' codes modelled which are not brand specific. You can use any brand/manufacturer and type of glass and frame; these are maximum U-values, and there is a flexibility of +/- 10% (as stated below) with the SHGC value. Group A – bifold and casement doors: PVC-005-01: U-Value: 2.60 (equal to or lower than) SHGC: 0.50 (±10%) Group B – sliding doors/windows + fixed glazing: PVC-006-01: U-Value: 2.60 (equal to or lower than) SHGC: 0.53 (±10%) Given values are AFRC, total window system values (glass and frame)
Skylights	Double glazed with timber or aluminium frame
Roof	Concrete roof with waterproof membrane Colour: Light (0.475>SA)
Ceiling	Plasterboard ceiling with R4.0 insulation (insulation only value) where roof above No insulation required to Garage ceiling Ground Floor ceiling is concrete between levels
Ceiling penetrations	Sealed LED downlights to Ground Floor, modelled; One per $3m^2$
External Walls	Concrete with R2.7 insulation (insulation only value) No insulation required to Garage walls Default Medium colour modelled (0.475<SA<0.7)
Internal walls	Plasterboard on studs *Note: tested also with single skin masonry which performs 0.1 Stars better. Have applied worst case scenario with plasterboard on studs. Single skin masonry can be installed as an alternative.*
Floors	Concrete slab on ground with R1.8 underslab insulation (insulation only value Concrete to First Floor (between levels) with R2.0 insulation (insulation only value) to any suspended floor with open subfloor Floor coverings: Tiles to Ground Floor and the wet areas of First Floor, carpet to upstairs bedrooms, timber elsewhere upstairs
Ceiling fans	Three Ceiling Fans: one to Upper Sitting Room, one to Dining Room, and one to either the GF Sitting Room or Living Room
External Shading	Covered Alfresco and Balconies. Shading screens to Ensuite 1 and Study windows. Eaves as shown on drawings
BASIX Water Commitments	
Fixtures	Install showerheads minimum rating of 4 stars (>6.0 and <= 7.5 Litres/min) Install toilet flushing system with a minimum rating of 4 stars in each toilet Install tap with minimum rating of 4 stars in the kitchen Install taps with minimum rating of 4 stars in each bathroom
Alternative Water	Install rainwater tank with minimum 10,000L capacity, connected to – At least one outdoor tap and toilets, and used to top up spa and pool Rainwater harvest collected from a min. $215m^2$ roof area
Pool and Spa	Volume of Pool: 74kL, Volume of Spa: 6kL. Both Pool and Spa are to have a cover.
BASIX Energy Commitments	
Hot water System	Gas Instantaneous with minimum performance of 6 Stars
Cooling system	3 phase air conditioning to living areas and bedrooms: EER 3.0-3.5
Heating system	3 phase air conditioning to living areas and bedrooms: EER 3.0-3.5
Ventilation	Kitchen - Individual fan, externally ducted to roof or façade, manual on/off switch Bathrooms - Individual fan, externally ducted to roof or façade, manual on/off switch Laundry - Individual fan, externally ducted to roof or façade, manual on/off switch
Pool and Spa	Pool Heating System: solar (electric boosted), controlled by timer, dual speed pool pump with minimum performance of 6 Stars. Spa Heating System: solar (electric boosted), controlled by timer
Alternative Energy	Minimum 5.5kW of solar/PV, with panels sloped between $>0^{o}$ to $<=10^{o}$, and facing North West
Other	Gas cooktop & electric oven Outdoor clothes drying line

2 3D View 2

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CHRIS HUDSON

DESIGN ARCHITECT
R SQUARED STUDIOS

PLANNER
VMDC PLANNING

LANDSCAPE CONSULTANT
TCGD

SURVEYOR
DONOVAN ASSOCIATES

STRUCTURAL & HYDRAULIC ENGINEER
BMY BUILDING CONSULTANTS

ENERGY CONSULTANT
GREEN FUTURE GROUP

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B	25.03.2024	ISSUE FOR DA	TI	RR
C	17.05.2024	ISSUE FOR DA	TI	RR

LEGEND

Proj. Arch RR
Drawn TI
Date MAY 2024
Scale

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Project
FRESHWATER HOUSE
31 Kooloora Avenue, Freshwater

Drawing Title
PERSPECTIVE VIEWS

Drawing No.
AR.DA. 0001

Revision
C

Project Architect

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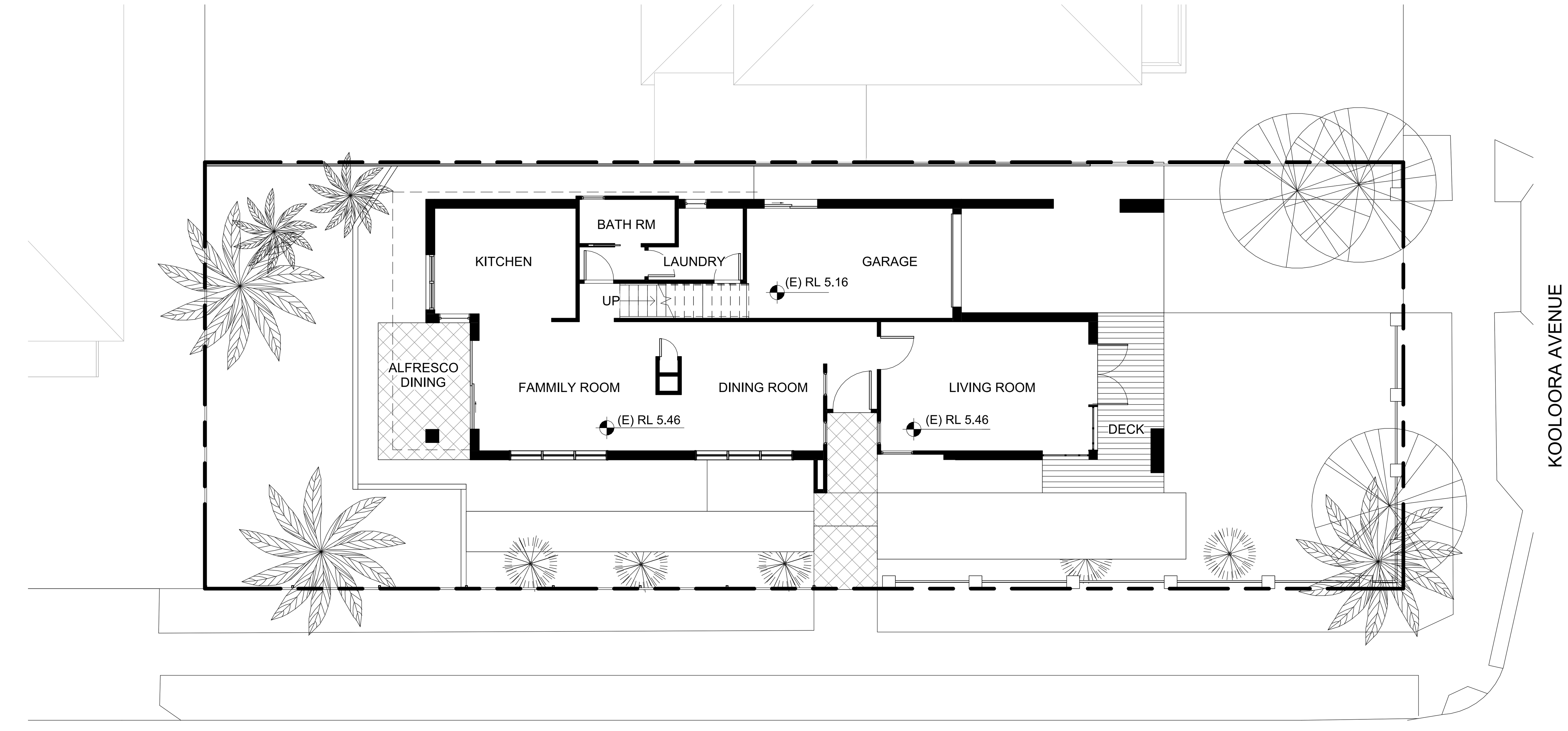
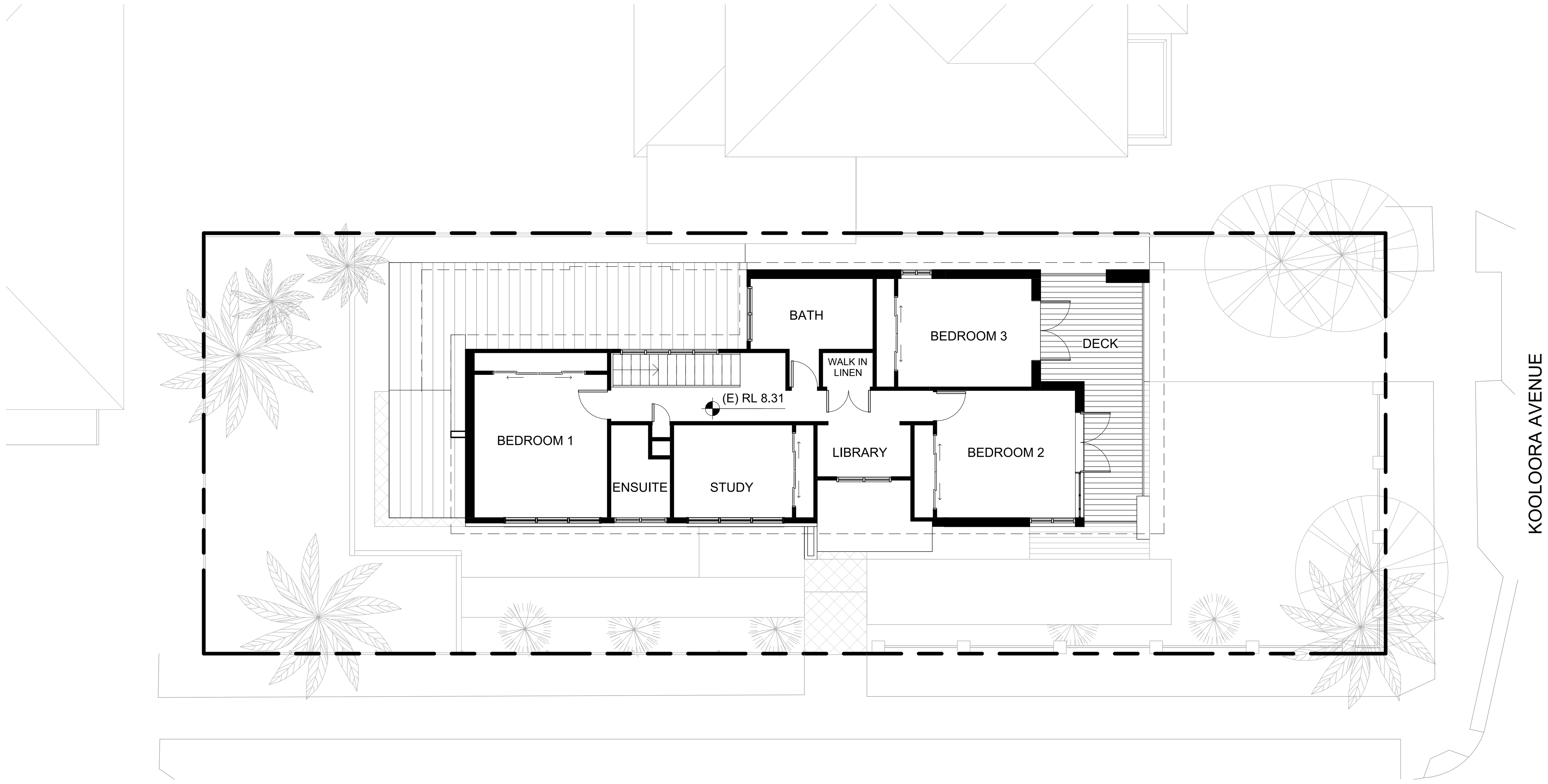
www.r2studios.com.au

R² STUDIOS



(E) GROUND FLOOR
1
1 : 100



(E) FIRST FLOOR
2
1 : 100

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Accreditation No. HERA10134
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CHRIS HUDSON

DESIGN ARCHITECT
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PLANNER
VMDC PLANNING

LANDSCAPE CONSULTANT
TCGD

SURVEYOR
DONOVAN ASSOCIATES

STRUCTURAL & HYDRAULIC ENGINEER
BMY BUILDING CONSULTANTS

ENERGY CONSULTANT
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C	17.05.2024	ISSUE FOR DA	TI	RR

LEGEND

Proj. Arch: RR
Drawn: TI
Date: MAY 2024
Scale: 1 : 100

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Project
FRESHWATER HOUSE
31 Kooloora Avenue, Freshwater

Drawing Title
(E) GROUND AND FIRST FLOOR

Drawing No.
AR.DA. 0100

Revision
C

Project Architect

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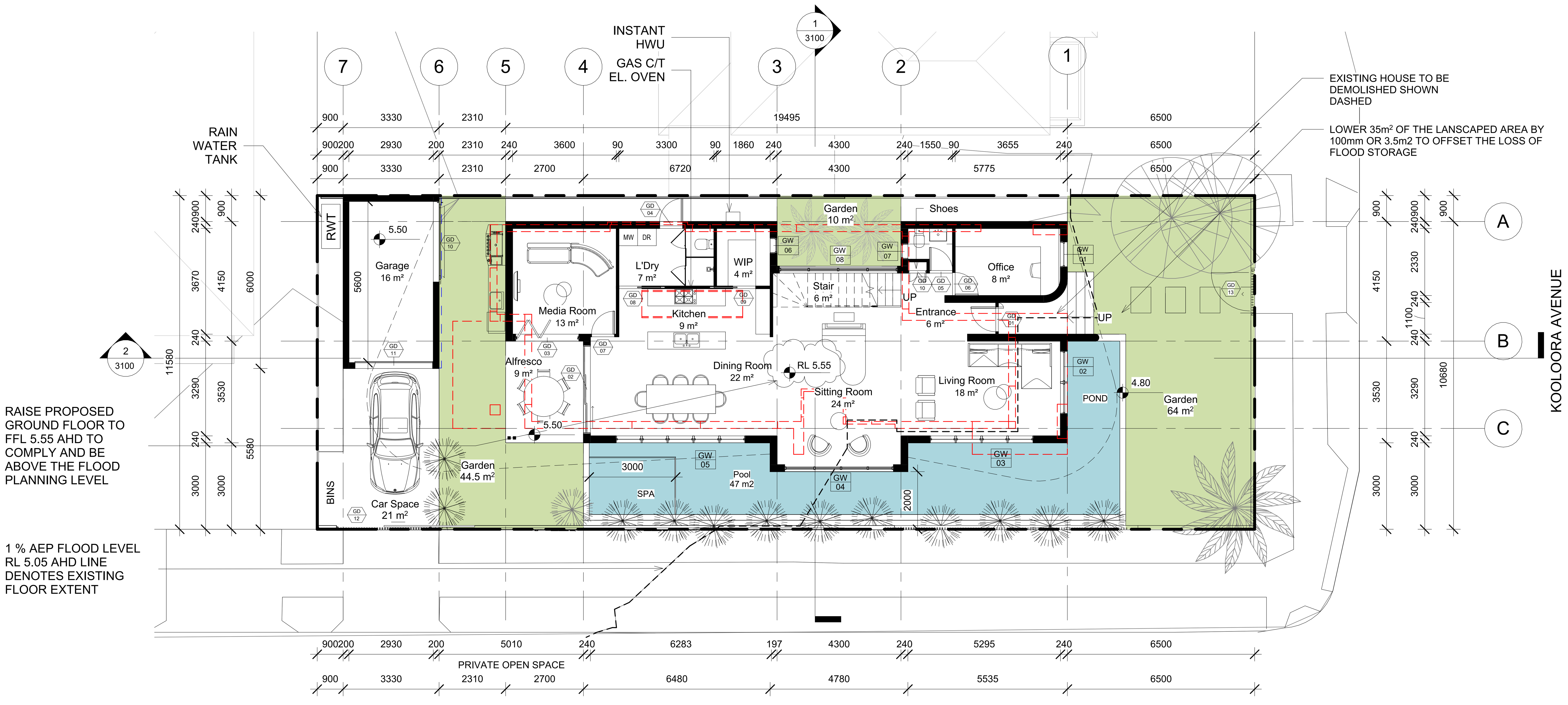
R² STUDIOS

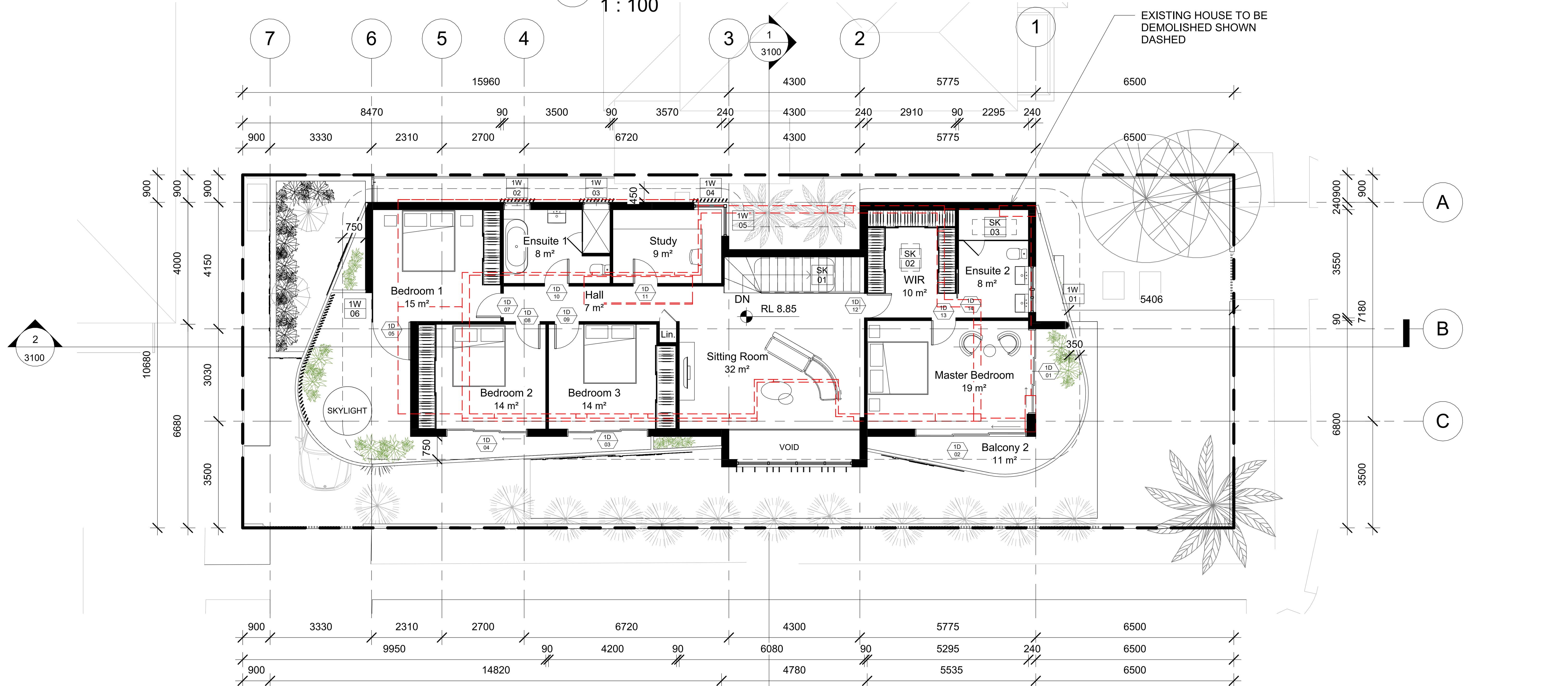


PROPOSED GROUND FLOOR

1 : 100

Ground Floor Room Schedule	
Name	Area
Media Room	13 m²
Kitchen	9 m²
L'Dry	7 m²
WIP	4 m²
Sitting Room	24 m²
Entrance	6 m²
Office	8 m²
Powder Room	2 m²
Living Room	18 m²
Dining Room	22 m²
Stair	6 m²
	119 m²
Garage	16 m²
Alfresco	9 m²
Car Space	21 m²
	46 m²

Landscape Area Schedule	
Name	Area
Garden	34 m²
Garden	57 m²
Pool	48 m²
Garden	10 m²
	149 m²



PROPOSED FIRST FLOOR

1 : 100

First Floor Room Schedule	
Name	Area
Balcony 1	21 m²
Bedroom 1	15 m²
Ensuite 1	8 m²
Study	9 m²
Bedroom 2	14 m²
Bedroom 3	14 m²
Hall	7 m²
WIR	10 m²
Ensuite 2	8 m²
Master Bedroom	19 m²
Balcony 2	11 m²
Sitting Room	32 m²
	170 m²

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JUDY HSU & CHRIS HUDSON

DESIGN ARCHITECT: **R SQUARED STUDIOS**
SURVEYOR: **DONOVAN ASSOCIATES**
PLANNER: **VMDC PLANNING**
STRUCTURAL & HYDRAULIC ENGINEER: **BMY BUILDING CONSULTANTS**
LANDSCAPE CONSULTANT: **TCGD**
ENERGY CONSULTANT: **GREEN FUTURE GROUP**

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LEGEND

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Project: FRESHWATER HOUSE
31 Kooloora Avenue, Freshwater
Drawing Title: PROPOSED GROUND AND FIRST FLOOR PLAN
Drawing No.: AR.DA. 1100
Revision: C

Project Architect
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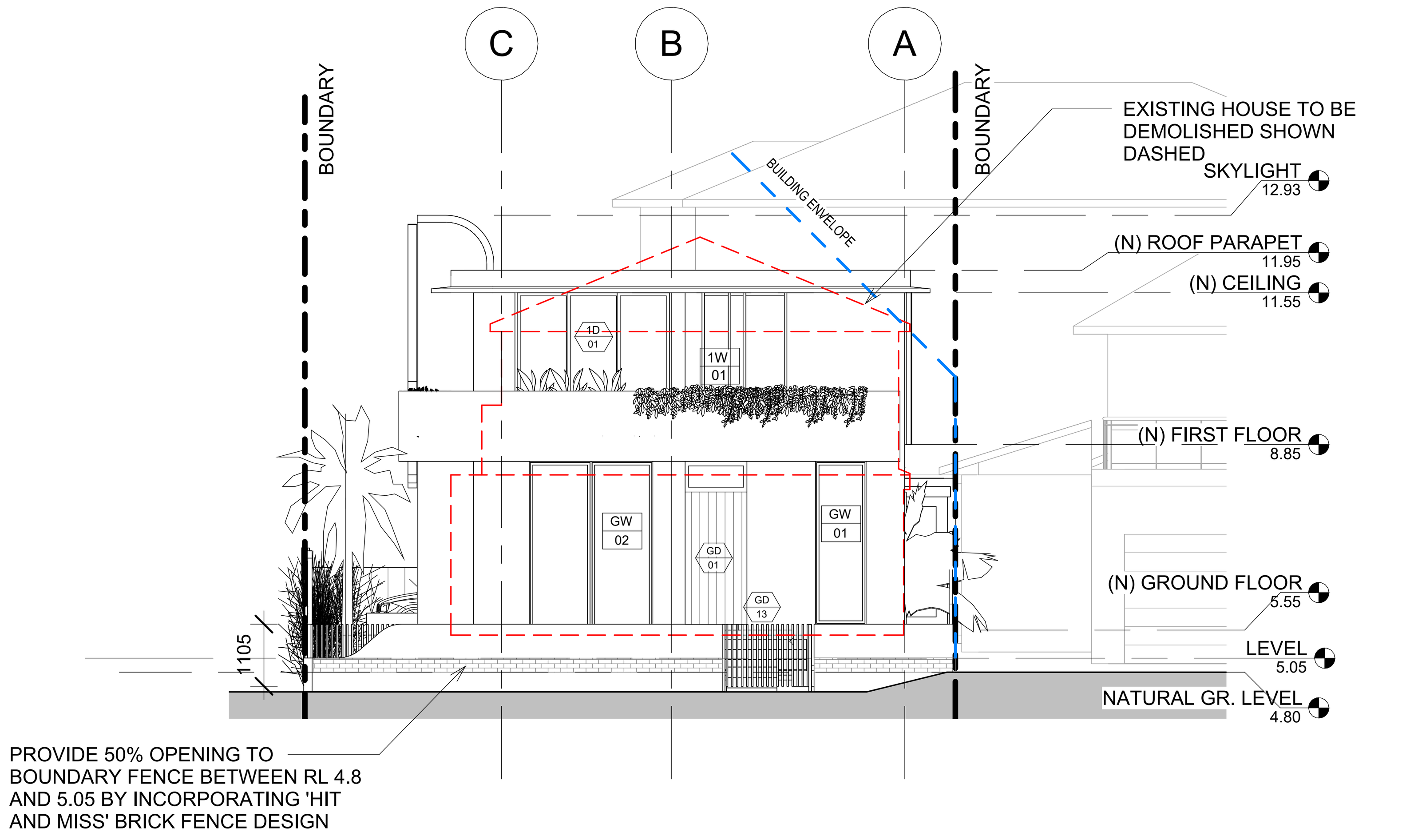
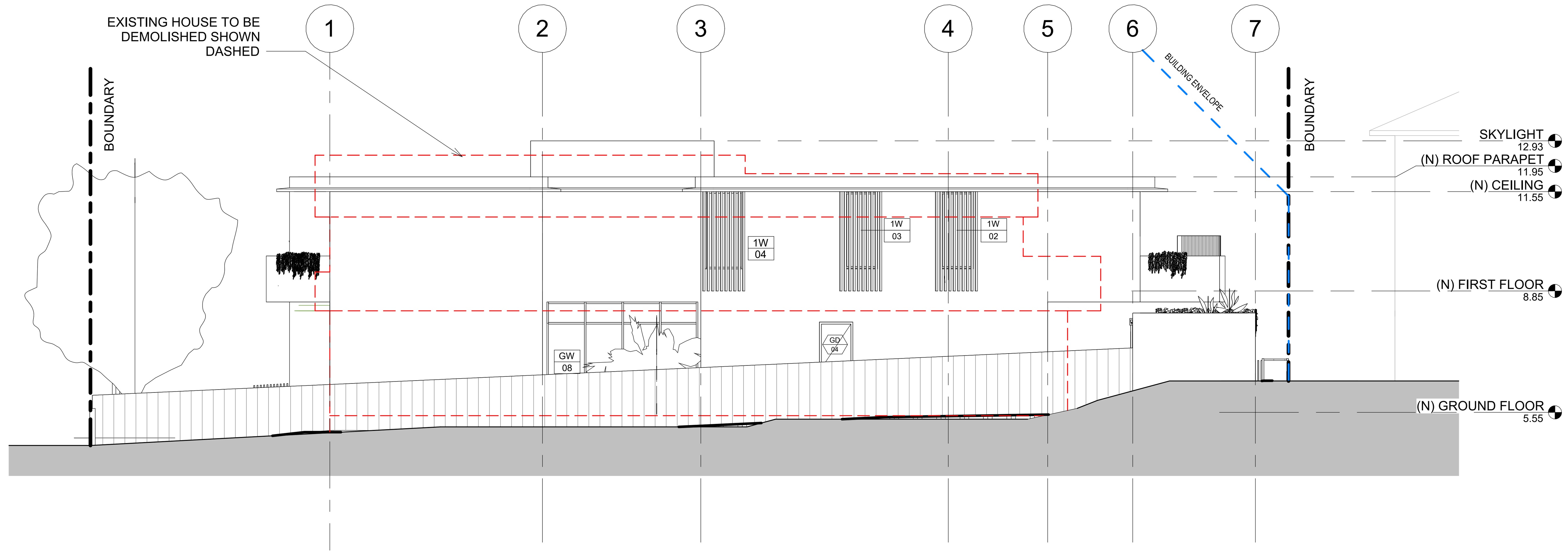
www.r2studios.com.au
R² STUDIOS



1 North Elevation

1 : 100



2 West Elevation

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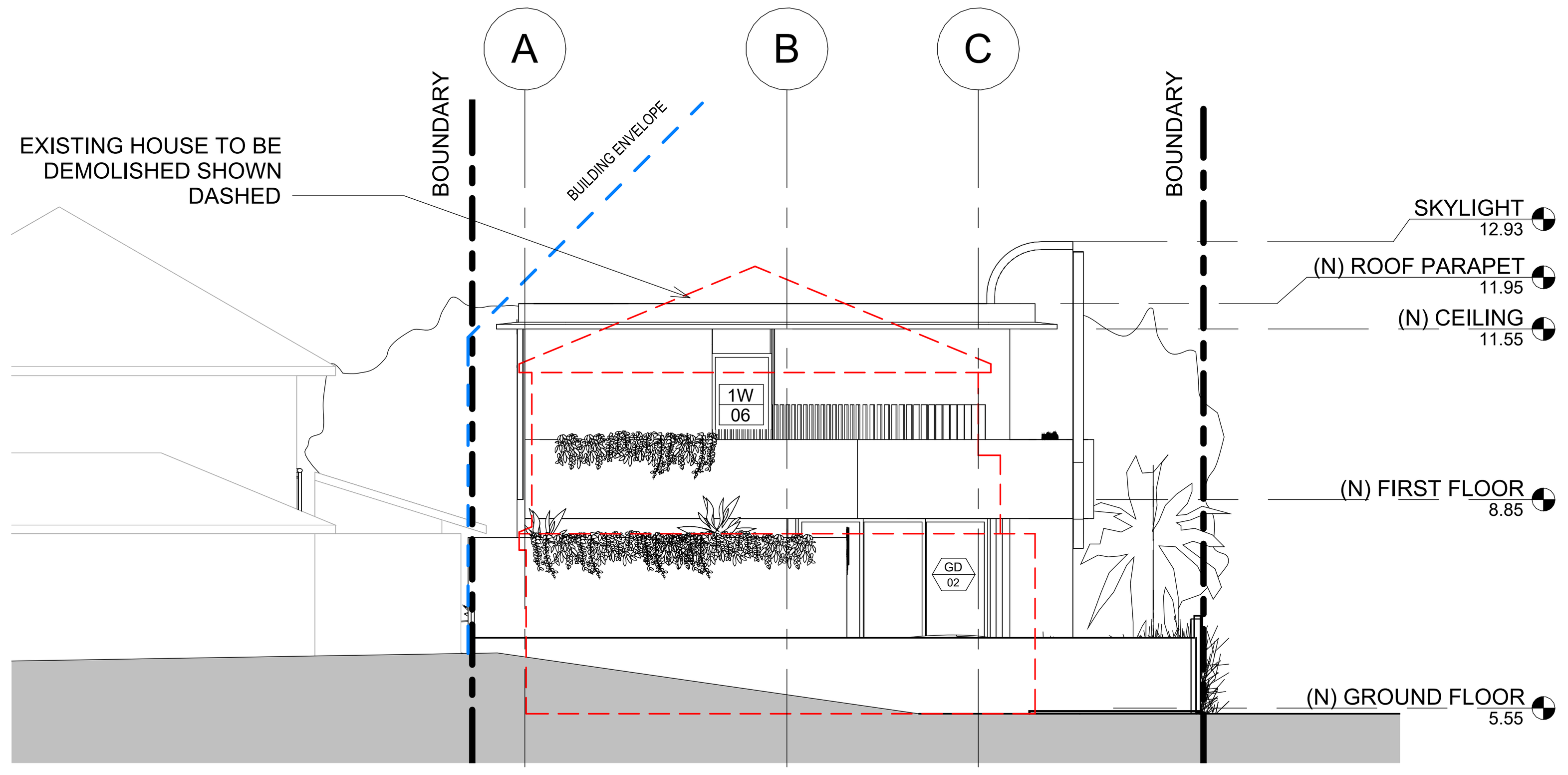
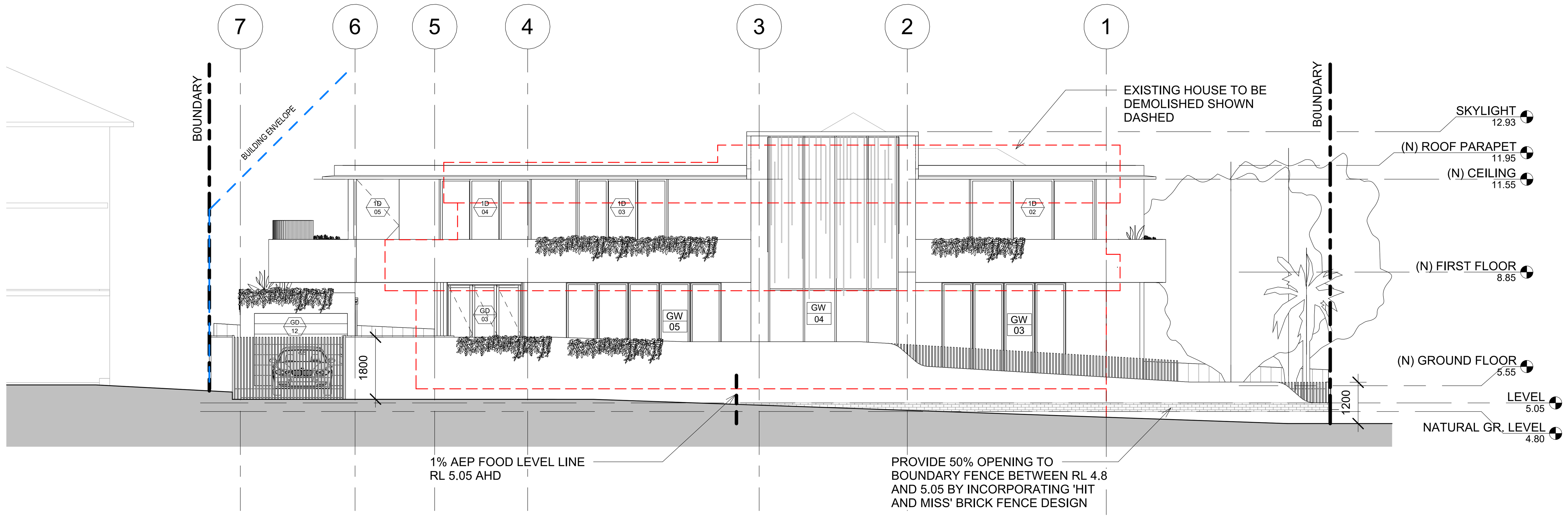


4 South Elevation

1 : 100



3 East Elevation

1 : 100

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DONOVAN ASSOCIATES

STRUCTURAL & HYDRAULIC ENGINEER
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LEGEND

Proj. Arch RR
Drawn TI
Date MAY 2024
Scale 1 : 100

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Project
FRESHWATER HOUSE
31 Kooloora Avenue, Freshwater

Drawing Title
(N) ELEVATIONS

Drawing No. AR.DA. 3000
Revision C

Project Architect

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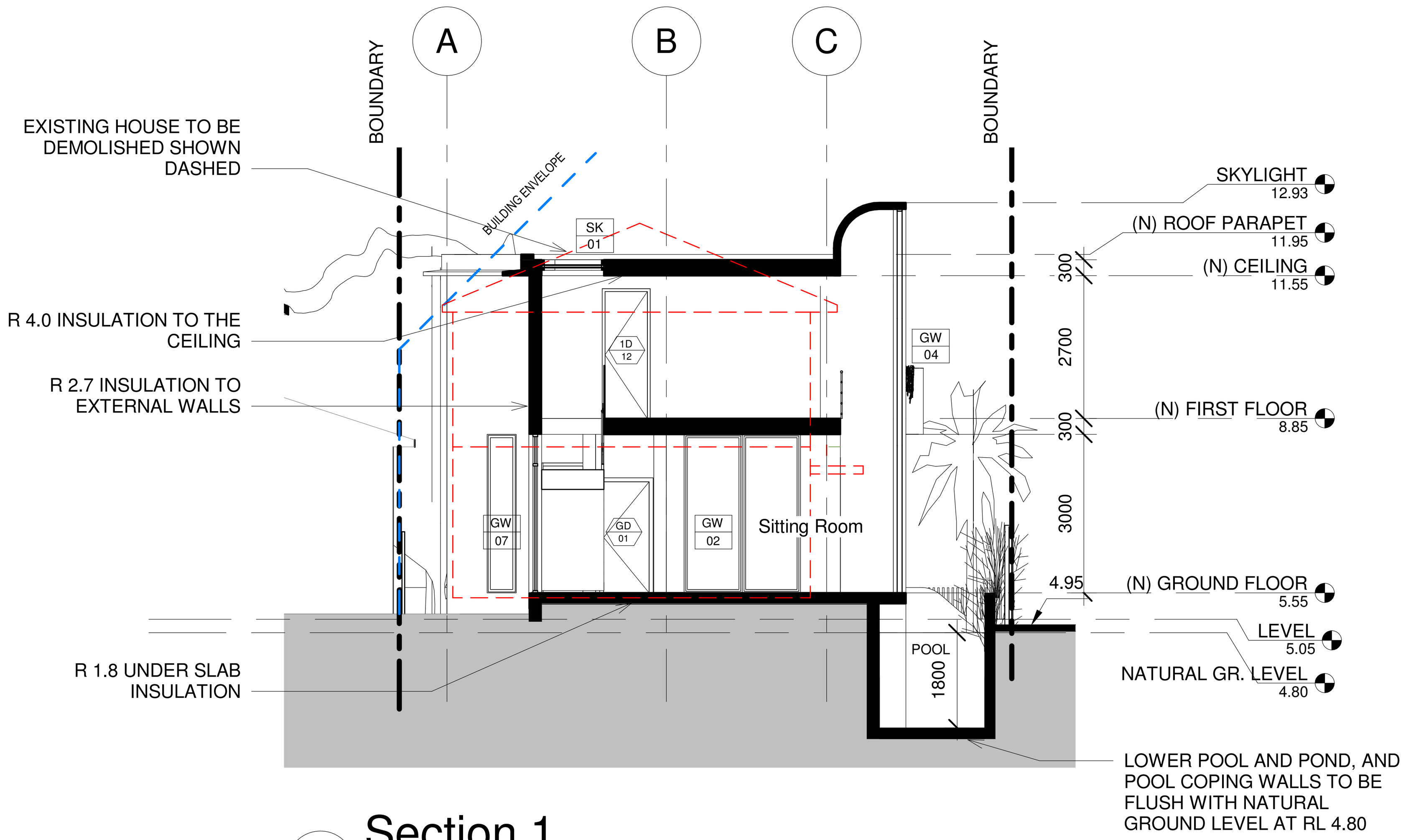
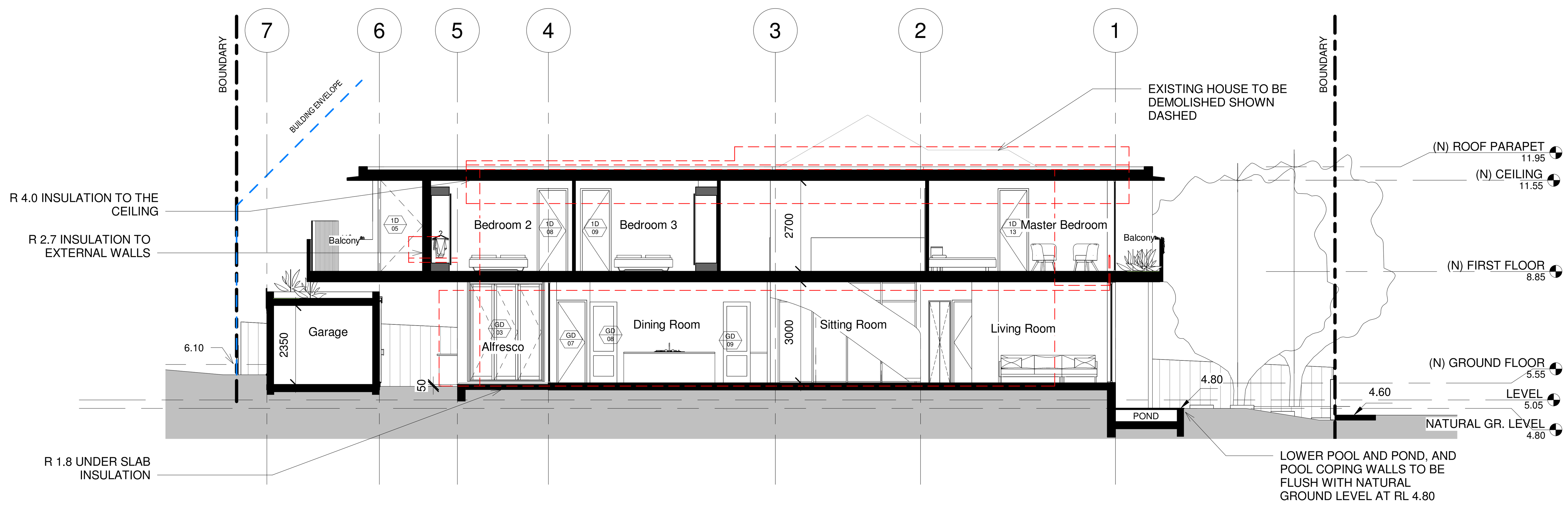
R² STUDIOS



1 Section 1

1 : 100



2 Section 2

1 : 100

Job No.	Revision	Notes	Date
Hsu & Hudson	A	NatHERS & BASIX Assessment	22/12/2023

Thermal Comfort Specifications	
Glazing: Doors/windows	'Default' codes modelled which are not brand specific. You can use any brand/manufacturer and type of glass and frame; these are maximum U-values, and there is a flexibility of +/- 10% (as stated below) with the SHGC value. Group A – bifold and casement doors: PVC-005-01: U-Value: 2.60 (equal to or lower than) SHGC: 0.50 (±10%) Group B – sliding doors/windows + fixed glazing: PVC-006-01: U-Value: 2.60 (equal to or lower than) SHGC: 0.53 (±10%) Given values are AFRC, total window system values (glass and frame)
Skylights	Double glazed with timber or aluminium frame
Roof	Concrete roof with waterproof membrane Colour: Light (0.475>SA)
Ceiling	Plasterboard ceiling with R4.0 insulation (insulation only value) where roof above No insulation required to Garage ceiling Ground Floor ceiling is concrete between levels
Ceiling penetrations	Sealed LED downlights to Ground Floor, modelled; One per 3m²
External Walls	Concrete with R2.7 insulation (insulation only value) No insulation required to Garage walls Default Medium colour modelled (0.475<SA<0.7)
Internal walls	Plasterboard on studs *Note: tested also with single skin masonry which performs 0.1 Stars better. Have applied worst case scenario with plasterboard on studs. Single skin masonry can be installed as an alternative.*
Floors	Concrete slab on ground with R1.8 underslab insulation (insulation only value Concrete to First Floor (between levels) with R2.0 insulation (insulation only value) to any suspended floor with open subfloor Floor coverings: Tiles to Ground Floor and the wet areas of First Floor, carpet to upstairs bedrooms, timber elsewhere upstairs
Ceiling fans	Three Ceiling Fans: one to Upper Sitting Room, one to Dining Room, and one to either the GF Sitting Room or Living Room
External Shading	Covered Alfresco and Balconies. Shading screens to Ensuite 1 and Study windows. Eaves as shown on drawings
BASIX Water Commitments	
Fixtures	Install showerheads minimum rating of 4 stars (>6.0 and <= 7.5 Litres/min) Install toilet flushing system with a minimum rating of 4 stars in each toilet Install tap with minimum rating of 4 stars in the kitchen Install taps with minimum rating of 4 stars in each bathroom
Alternative Water	Install rainwater tank with minimum 10,000L capacity, connected to – At least one outdoor tap and toilets, and used to top up spa and pool Rainwater harvest collected from a min. 215m² roof area
Pool and Spa	Volume of Pool: 74kL, Volume of Spa: 6kL. Both Pool and Spa are to have a cover.
BASIX Energy Commitments	
Hot water System	Gas Instantaneous with minimum performance of 6 Stars
Cooling system	3 phase air conditioning to living areas and bedrooms: EER 3.0-3.5
Heating system	3 phase air conditioning to living areas and bedrooms: EER 3.0-3.5
Ventilation	Kitchen - Individual fan, externally ducted to roof or façade, manual on/off switch Bathrooms - Individual fan, externally ducted to roof or façade, manual on/off switch Laundry - Individual fan, externally ducted to roof or façade, manual on/off switch
Pool and Spa	Pool Heating System: solar (electric boosted), controlled by timer, dual speed pool pump with minimum performance of 6 Stars. Spa Heating System: solar (electric boosted), controlled by timer
Alternative Energy	Minimum 5.5kW of solar/PV, with panels sloped between >0° to <=10°, and facing North West
Other	Gas cooktop & electric oven Outdoor clothes drying line

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LEGEND

Proj. Arch: RR
Drawn: TI
Date: MAY 2024
Scale: 1 : 100

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Project
FRESHWATER HOUSE
31 Kooloora Avenue, Freshwater

Drawing Title
(N) SECTIONS

Drawing No.
AR.DA. 3100

Revision
C

Project Architect

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R² STUDIOS

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LEGEND

Proj. Arch	Drawn
RR	TI
Date	**Scale**
MAY 2024	1 : 50

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Project
FRESHWATER HOUSE
31 Kooloora Avenue, Freshwater

Drawing Title
DOOR SCHEDULE

Drawing No. AR.DA. 3200
Revision C

Project Architect

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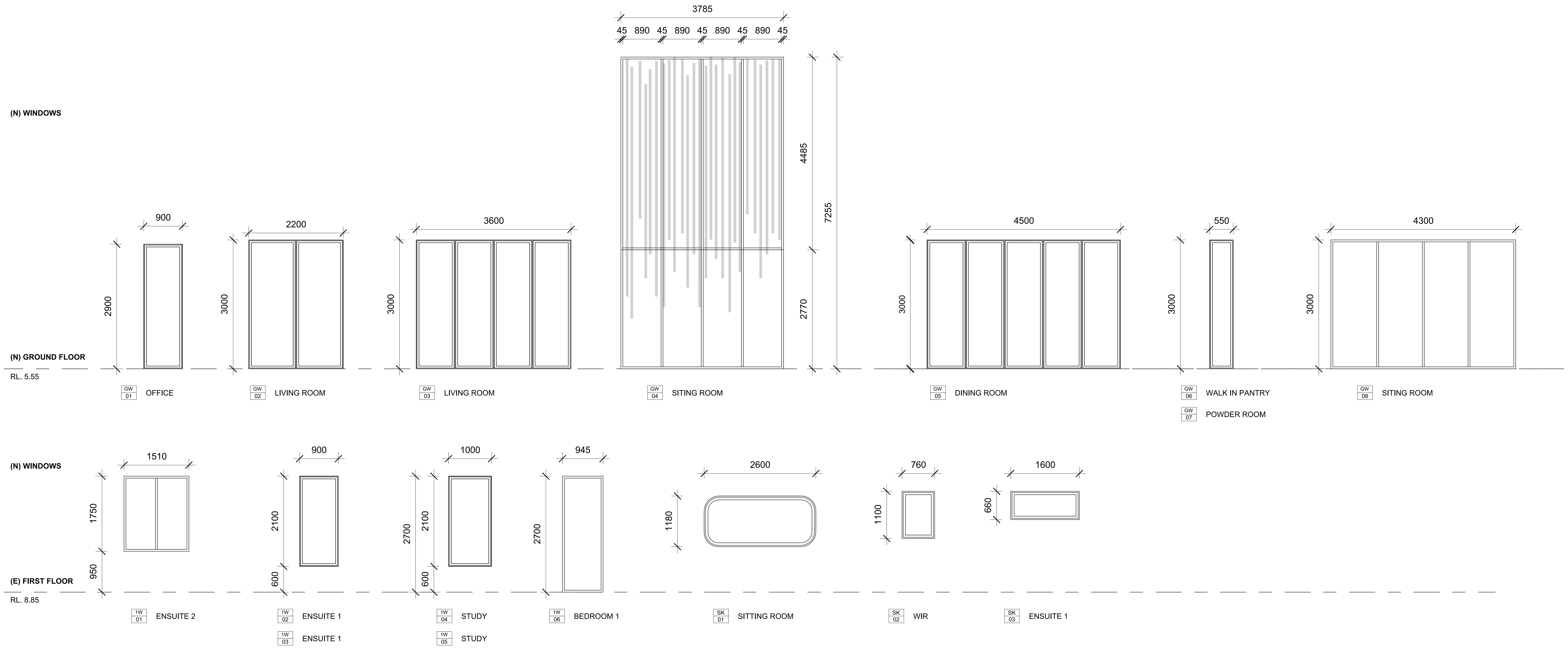

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Drawn TI
Date MAY 2024
Scale 1 : 50

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Project
FRESHWATER HOUSE
31 Kooloora Avenue, Freshwater

Drawing Title
WINDOW SCHEDULE

Drawing No.
AR.DA. 3201

Revision
C

Project Architect

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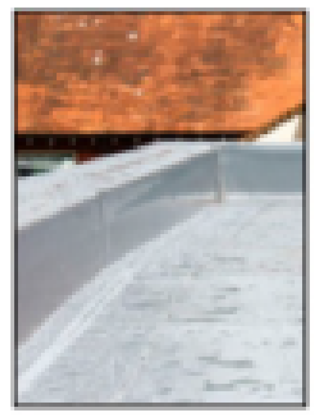
R² STUDIOS



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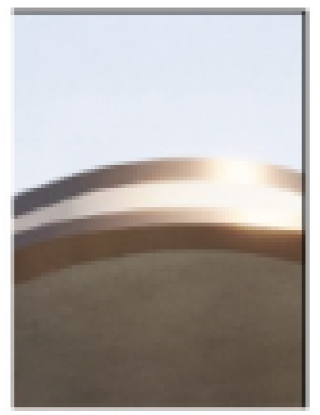
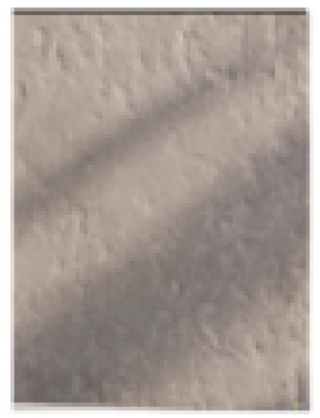
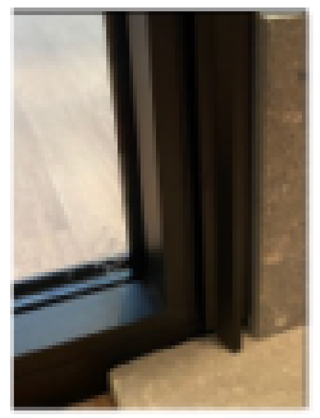


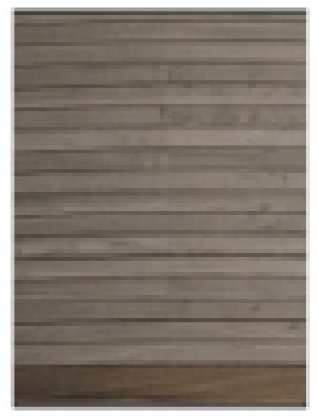
2. ROOF TRIM



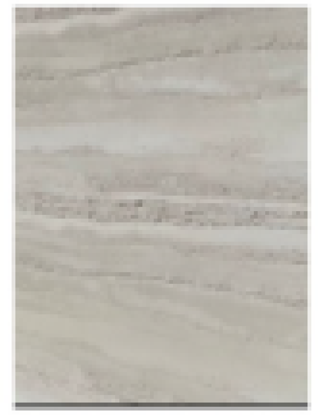
3. WALLS



4. WINDOWS

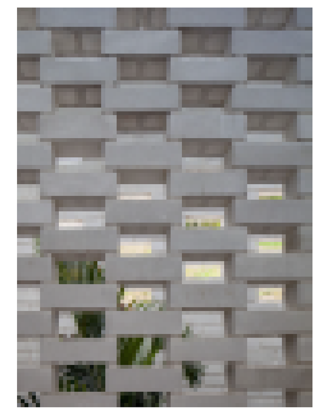


5. BALCONY



6. BLADE WALL

7. FENCE



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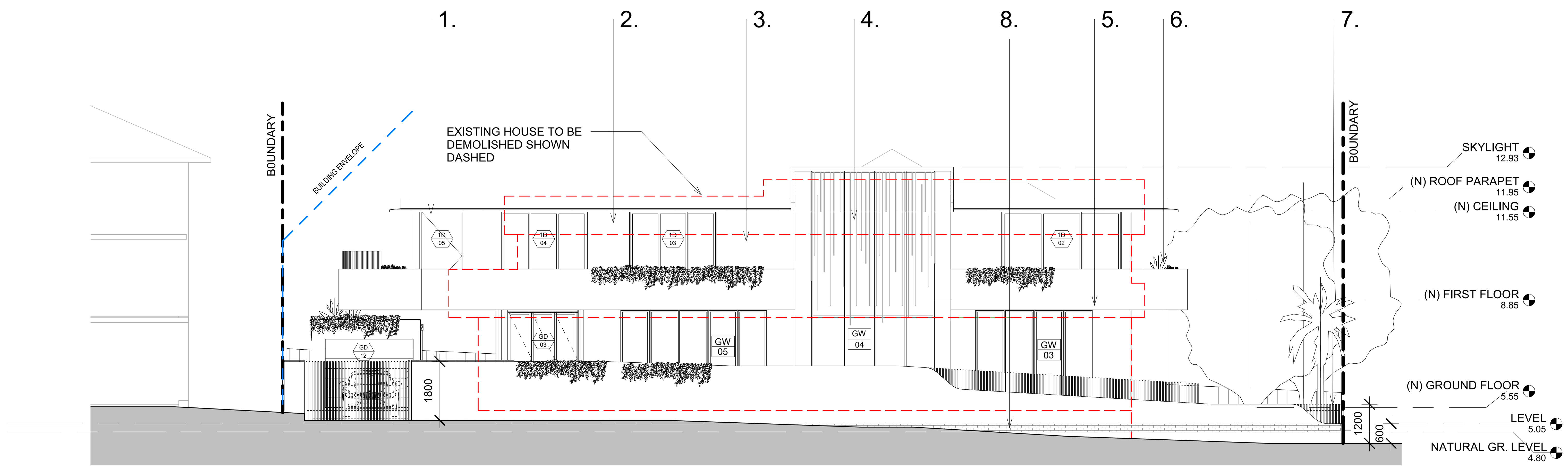

1 External Finishes

1 : 100

CLIENT

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CHRIS HUDSON

DESIGN ARCHITECT
R SQUARED STUDIOS

PLANNER
VMDC PLANNING

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STRUCTURAL & HYDRAULIC ENGINEER
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LEGEND

Proj. Arch: RR
Drawn: TI
Date: MAY 2024
Scale: As indicated

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Project
FRESHWATER HOUSE
31 Kooloora Avenue, Freshwater

Drawing Title
EXTERNAL FINISHES

Drawing No.
AR.DA. 4000

Revision
C

Project Architect

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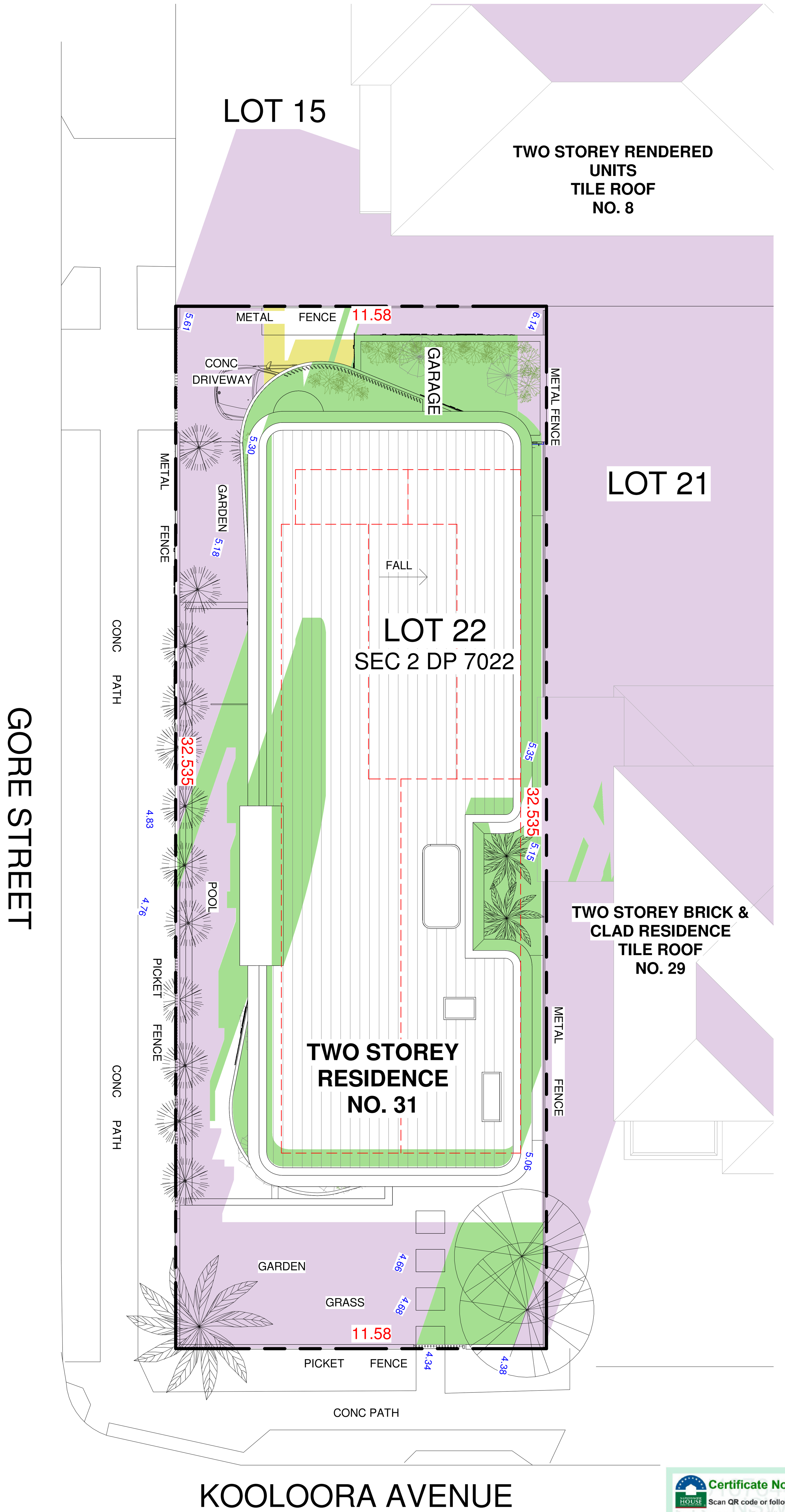
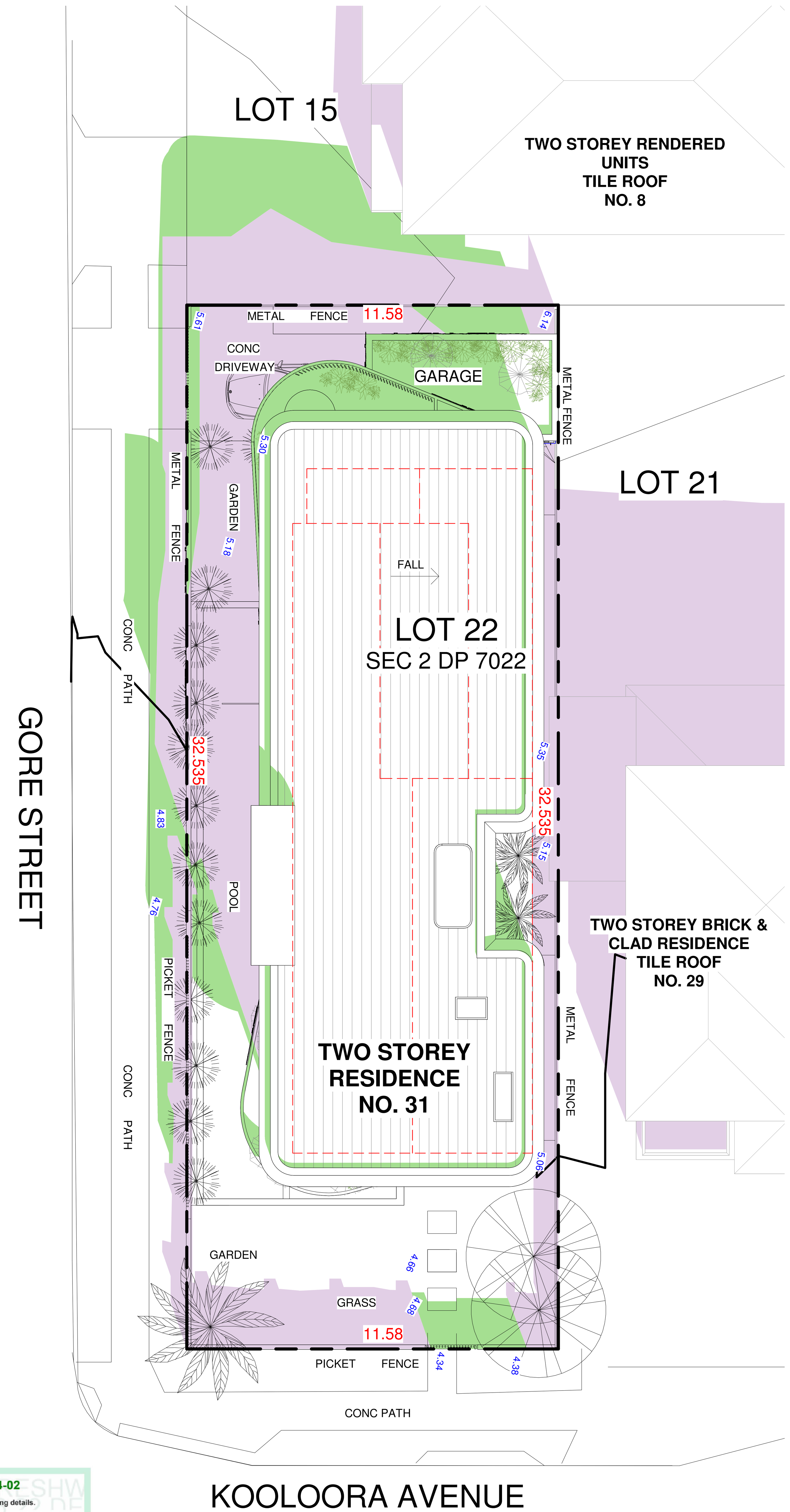
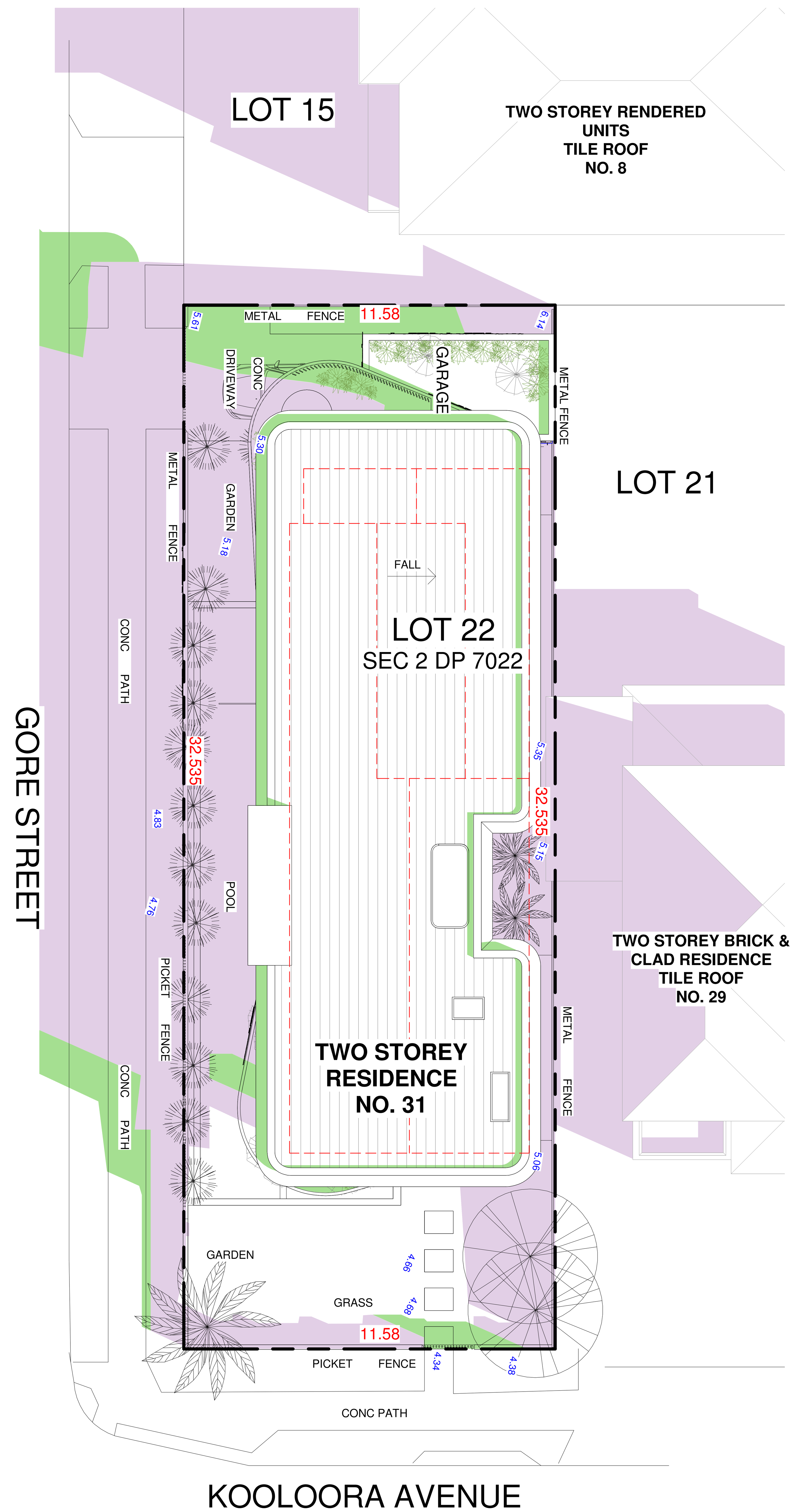
R² STUDIOS



BUILDING SHADOW - 21.06 - 9.00AM



BUILDING SHADOW - 21.06 - 12.00PM



BUILDING SHADOW - 21.06 - 3.00PM

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Accreditation No.: HERA10134
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PLANNER: **VMDC PLANNING**
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LANDSCAPE CONSULTANT: **TCGD**
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P1	9.11.2023	ISSUE FOR COORDINATION	TI	RR
P2	28.11.2023	ISSUE FOR COORDINATION	TI	RR
P3	1.12.2023	ISSUE FOR COORDINATION	TI	RR
A	20.12.2023	ISSUE FOR DA	TI	RR
B	25.03.2024	ISSUE FOR DA	TI	RR
C	17.05.2024	ISSUE FOR DA	TI	RR

LEGEND
- EXISTING SHADOWS
- INCREASE SHADOWS
- DECREASE SHADOWS

Proj. Arch: RR
Drawn: TI
Date: MAY 2024
Scale: As indicated
Do not scale drawings. Verify All dimensions on site. Notify architect of all discrepancies.

Project: FRESHWATER HOUSE
31 Kooloora Avenue, Freshwater
Drawing Title: SUN SHADOWS STUDIES
Drawing No.: AR.DA. 7000
Revision: C

Project Architect
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R² STUDIOS

APPENDIX D

Pipeline Velocity Self-Cleaning Information

Pg 1: Brisbane City Council, “Stormwater Outlets in Parks and Waterways [Guidelines]”, Version 2, 2003, Chapter 3, pg 5

Pg 2: Concrete Pipe Association of Australasia , “Hydraulics of Precast Concrete Conduits”, Reprinted 2012, Pg 42

PERFORMANCE CRITERIA	ACCEPTABLE SOLUTIONS

- Consequences of adverse flooding impacts are investigated for full grate blockage.

A4.6 Detention Storage

Where the public space is also used for stormwater detention storage, the design intents and safety aspects satisfy the requirements of Council's Subdivision and Development Guidelines.

A4.7 Pipe Velocity

The velocity of stormwater flows in pipes or box sections is adequate to maintain self-cleaning, and the velocity prevents scouring and erosion of the conduit especially the invert.

- The desirable minimum design velocities are limited to 1.2 m/s for partial flow and 1.0 m/s for full flow conditions.
- The desirable maximum design velocities are limited to 4.7 m/s for partial flow and 4.0 m/s for full flow conditions (energy dissipation may be required).

A4.8 Outlet Velocity

The average outlet velocity (V_o) for the nominated design discharge (Q_o) is determined. Typically Q_o also corresponds to the design storm event for the pipe. However, for reasons of cost or practicality, it may be necessary to design scour protection for a lower discharge event. The permissible maximum flow velocities (m/s) for the different types of exposed soil immediately downstream of the outlet are given below. These figures assume slope gradient <10%, peak velocities maintained for period less than 6 hours, and good (ie 80%) ground cover. Soil erodibility factor, $K \leq 0.019$ corresponds to low erodibility. $0.020 \leq K \leq 0.045$ and $K>0.045$ correspond to moderate and high erodibilities respectively.

	Permissible maximum flow velocity (m/s)		
	Soil erodibility (K) - Low	Moderate	High
Bare soil	0.7	0.5	0.3
Tussock grasses	1.3	0.9	0.5
Other improved perennials	1.6	1.3	0.9
Couch, carpet & other sward-forming grass	2.0	1.8	1.4
Kikuyu grass	2.5	2.2	1.9

Visual intrusion of this stormwater outlet is minimised

4. STORMWATER DRAINAGE

4.1 INTRODUCTION

4.1.1 HEAD LOSSES

The design flow is established as outlined in Section 2, and it is customary in the hydraulic design to assume the pipes flowing full.

The design must take into consideration:

(i) resistance to flow in conduits

(ii) losses at inlets and junction pits, bends and other deviations from straight lines of uniform cross section and flow.

Investigations have shown that the latter source of losses can be of greater significance than the energy losses on uniform straight runs, particularly on short lengths of pipeline [4.1, 4.2].

4.1.2 MINIMUM AND MAXIMUM VELOCITIES

Much of the debris entering stormwater drains is heavier than water, and to ensure some measure of self cleansing a minimum velocity of about 0.5 to 1 m/s at full and half full flow or a boundary shear of 1.5 N/m^2 is recommended [4.1, 4.3]. (Refer also to Section 1.4 and 3.4.4.)

Maximum velocities are discussed in Section 3.4.3. Generally velocities should be kept below 8 m/s if possible.

4.1.3 TOPOGRAPHY

Topographic conditions are significant for the design. In very flat country of minimal fall, layout and details minimising head losses are important in order to avoid excessively deep drains.

In hilly country with steep grades design must consider the possibility of erosion.

4.2 RESISTANCE TO FLOW IN CONDUITS

4.2.1 STRAIGHT DRAINS

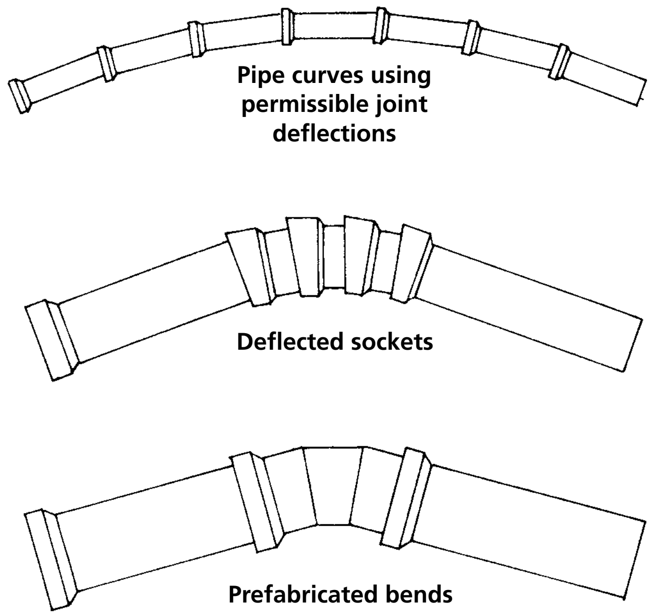
For straight, precast concrete pipes or box culverts flowing full with clean water a k value of 0.15 would be appropriate when using the Colebrook-White equation. Having regard to the effect of the debris a value of 0.6 seems reasonable (Figure 1.10) but it must be realised that no tests under these conditions are known to exist.

Figures 1.8 – 1.11 can be used for box culverts (full or part-full flowing) by substituting 4R for diameter D, where R is the hydraulic radius for the cross section.

4.2.2 CURVED DRAINS

4.2.2.1 PIPES

It is common for drainage pipelines to be laid straight, but there are circumstances when curves or bends are desirable. Concrete pipes can be laid satisfactorily with deflections at the joints to construct curved pipelines with curve radii of 100–300 pipe diameters. Joint deflections range from 0.6 to 3.0˚ dependent on diameter. (See Figure 4.1.)



PIPE CURVES AND BENDS
Figure 4.1

Splayed pipes and bends can be produced to provide curve radii down to about 5 pipe diameters.

Energy losses in curves formed by joint deflections are only slightly higher than those in straight lines and can be treated as such or an extra allowance of

$$0.1 \frac{v^2}{2g}$$

can be added for curve deflections over 20˚.

Lobster-back bends show losses with k_b –values ranging up to 1.3 for 90˚ single splay bends. This and other examples are shown in Table 1.2.

4.2.2.2 BOX CULVERTS

Most box culverts are made with simple butt joints without any claims to watertightness. The joint itself, consequently, offers little scope for joint deflection.