Project No: 2020-058
Revision No: DA Issue 2
Date: 18 November 2020

FLOOD RISK MANAGEMENT REPORT

Alterations and Additions to the Existing Dwelling

at

Lot 3 DP 246147 – 24 John Street, Avalon Beach

for

Anthony & Shannon Ritchie

Report Prepared By:

WATERDESIGN CIVIL ENGINEERS
ABN 779 281 667 29

Phone: 0417 671646
Email: waterdesign@hotmail.com

Contents

1 Overview

1.1 Purpose

This report has been commissioned at the request of Anthony & Shannon Ritchie to assess the effects the proposed development will have on flood behaviour and potential impacts on adjoining properties and recommend measures to mitigate the impacts of flooding over the life of the development.

1.2 Proposed Development

The proposed development involves alterations and additions to the existing dwelling house comprising ground floor extension to the west of the existing dwelling and associated landscape works. Refer to Annexure C for the Architectural Drawings and Annexure D for the Landscape Plan.

1.3 Existing Site Conditions

The development site is affected by mainstream flooding from Careel Creek to the north east of the development site. The subject site is bounded by adjoining properties to the north-west and north-east.

2 Flood Information Data

2.1 Catchment / Floodplain Characteristics

Flood information contained in this report was obtained from Northern Beaches Flood Information Request which was derived from the Avalon to Palm Beach Floodplain Risk Management Study and Plan 2017. The Council Flood Information and Flood Risk Precinct Map can be found in Annexure B.

2.2 Flood Planning Area

The proposed development is located within the flood planning area affecting the subject site being the 1% AEP flood level plus 0.5 m freeboard.

2.3 1% AEP Flood

The maximum 1% AEP flood maximum flood level occurring at the development site is **RL 2.21 mAHD.** Therefore, a flood planning level of **FPL 2.71 mAHD** shall be adopted (includes 0.5m freeboard).

2.4 Probable Maximum Flood (PMF)

The maximum PMF flood maximum water level at the development site is **RL 3.10 mAHD**.

3 Council Flood Controls

3.1 Flood Risk Precinct

The proposed development has been identified as being located within a **Medium Risk** Flood Precinct.

3.2 Land Use Category

The development involves alterations and additions to the existing dwelling house and associated landscape works. The land use category is classified as being **Residential** Development.

3.3 Prescriptive Controls

A Flood effects caused by development – A1 & A3

A1 Development including (earthworks and subdivision) shall not be approved unless it can be demonstrated in a Flood Management Report that it complies with the Flood Prone Land Design Standard found on Council's Webpage.

The proposed development involves internal alterations and additions within the existing building footprint and ground floor additions to the western side of the existing dwelling. The proposed development has been designed so that in a 1% AEP Flood Event:

(a) There is no net loss in flood storage / floodway

(b) There are no adverse changes in flood levels and velocities caused by alterations to the flood conveyance

(c) There are no adverse effects on surrounding properties

(d) It is sited to minimise exposure to flood hazard

A3 The applicant shall include in their submission, calculations to illustrate that any fill or other structures that reduce the total flood storage are replaced by Compensatory Works

The proposed development involves the construction of a ground floor addition that is suspended above the 1% AEP flood level. The associated landscape works includes 300m high small mounding at the western corner of the site to screen the master bedroom.

No compensatory works are required as an existing outbuilding is being demolished as part of the development which has a larger footprint and therefore will not reduce the total flood storage area.

B Drainage Infrastructure and Creek Works – B1 & B2

B1 Flood mitigation works or stormwater devices that modify a major drainage system, stormwater system, natural water course, floodway or flood behaviour within or outside the development site may be permitted subject to demonstration through a Flood Management Report that they comply with the Flood Prone Land Design Standard found on Council's webpage.

The proposed development involves internal alterations and additions within the existing building footprint and ground floor additions to the western side of the existing dwelling. No stormwater devices or works are proposed within the existing floodway or natural watercourse that will affect the flood behaviour. The proposed development has been designed so that in a 1% AEP Flood Event:

(a) There is no loss in flood storage / floodway

(b) There are no adverse effects on surrounding properties

(c) The works do not have an adverse impact on the environment

B2 A section 88B notation under the Conveyancing Act 1919 may be required to be placed on the title describing the location and type of flood mitigation works with a requirement for their retention and maintenance.

The proposed development does not require flood mitigation compensatory works and therefore the creation of a notation on the property title is not necessary.

C Building Components and Structural – C1, C2 & C3

C1 All buildings shall be designed and constructed as flood compatible buildings.

The floor level of the existing building is below the Flood Planning Level FPL 2.71 mAHD and therefore is required to be constructed with flood compatible material. Refer to Council's Flood Compatible Building Guidelines in Annexure E.

C2 All structures must be designed and constructed to ensure the structural integrity up to the Flood Planning Level, taking into account the forces of floodwater, wave action, flowing water with debris, buoyancy and immersion. Structural certification shall be provided confirming the above. Where shelter in place refuge is to be provided the structural integrity of the shelter in place structure only is to be to the Probable Maximum Flood (PMF).

The ground floor additions to the north west comprising of kitchen and family room shall have the foundations designed and constructed to ensure its structural integrity up to FPL 2.71 mAHD can withstand all forces imposed on it from the flood.

The ground floor addition to the south west comprising of the master bedroom and ensuite is to be utilised as the shelter in place refuge for the PMF Floods and therefore shall have the foundations designed and constructed to ensure its structural integrity up to the PMF 3.10 mAHD.

The structural integrity of the additions shall be verified by a structural engineer for lateral flood flow, buoyancy, suction effects and debris load impact from flooding.

C3 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 Flood Planning Level. All existing electrical equipment and power points located below the Flood Planning Level must have residual current devices installed that turn off all electricity supply to the property when flood waters are detected.

All new electrical equipment, power points, wiring, fuel lines, sewerage systems must be waterproofed and/or located above the Flood Planning Level FPL 2.71 mAHD. The electrical equipment in the existing dwelling that is below the FPL 2.71 mAHD shall have residual current devices installed that turn off the electrical supply when flood waters are detected.

D <u>Storage of Goods</u> – D1 & D2

D1 Hazardous or potentially polluting materials shall not be stored below the Flood Planning Level unless adequately protected from floodwaters in accordance with industry standards

No hazardous or potentially polluting materials will be stored below the Flood Planning Level FPL 2.71 mAHD.

D2 Goods, materials or other products which may be highly susceptible to water damage are to be located / stored above the Flood Planning Level.

No valuable goods and materials susceptible to water damage will be stored below the Flood Planning Level FPL 2.71mAHD.

E Flood Emergency Response – E1 & E2

E1 Development shall comply with Council's Flood Emergency Response Planning Development in Pittwater Policy and the outcomes of any Flood Risk Emergency Assessment Report where it applies to the land.

Shelter in place refuge above the PMF Flood Level RL 3.10 mAHD is available within the proposed master bedroom additions to the west of the existing dwelling.

E2 New development must provide an appropriately sized area to safely shelter in place above the Probable Maximum Flood Level and appropriate access to this area should be available from all areas within the development

Shelter in place refuge within the master bedroom is readily accessible from all areas within the existing dwelling house and proposed additions.

F Floor Levels – F1, F2, F3, F4, F6, F8 & F9

F1 New floor levels within the development shall be at or above the Flood Planning Level. A reduced Flood Planning Level may be considered only where it is permitted in this Development Control Plan. The structure must be flood proofed (wet or dry) to the Flood Planning Level. This control cannot be applied to critical or vulnerable uses.

The proposed ground floor addition is designed with the floor levels at the Flood Planning Level FPL 2.71 mAHD

F2 All development structures must be designed and constructed so as not to impede the floodway or flood conveyance on the site, as well as ensuring no loss of flood storage in the 1% AEP Event.

The proposed ground floor additions shall be designed and constructed as a suspended structure above the Flood Planning Level FPL 2.71 mAHD and therefore will not impede the floodway or flood conveyance and no loss of flood storage in a 1% AEP Flood Event.

F3 Where the lowest floor has been elevated to allow the passage of flood waters, a restriction shall be imposed on the title of the land, pursuant to S88B of the Conveyancing Act confirming that the under-croft area is not to be enclosed.

A restriction on the use of land shall be created on the property title at completion of the development over the proposed ground floor additions confirming that the undercroft area shall not be enclosed to allow the passage of flood water.

F4 A one-off addition or alteration below the Flood Planning Level of less than 30 square metres or an increase of less than 10% of the ground floor area (whichever is the lesser) for residential development may be considered only where:

(a) It is an extension to an existing room

(b) The Flood Planning Level is incompatible with the floor levels of the existing room

The structure must be flood proofed to the Flood Planning Level.

All proposed additions have been designed with the floor levels above the Flood Planning Level FPL 2.71 mAHD.

F6 Any existing floor level may be retained below the Flood Planning Level when undertaking a first floor addition.

The floor level of the existing dwelling is to remain at FFL 2.24 mAHD which below the Flood Planning Level FPL 2.71 mAHD and above the 1% AEP Flood Level RL 2.21 mAHD.

F8 The minimum floor level of any first floor additions shall be at or above the Probable Maximum Flood Level.

Not Applicable. No first floor additions are proposed with this development.

F9 Foyers – consideration may be given to a minimum floor level of a foyer being set at the 5% AEP flood level, provided it can be demonstrated that it complies with the Flood Prone Land Design Standard.

The existing foyer is above the 1% AEP Flood Level.

G <u>Car Parking</u> – G1, G2, G3, G5, G6, G7 & G8

Not applicable

H <u>Fencing</u> – H1

Not applicable

I <u>Pools</u> – I1

Not applicable

4 Conclusions

The proposed development will satisfactorily comply with the requirements of Clause B3.11 Flood Prone Land development controls in Pittwater Council P21 Development Control Plan as demonstrated in this report.

- The proposed additions are designed above the Flood Planning Level.
- Shelter in Place is available within the proposed additions
- The flood mitigation measures outlined in this report shall be adopted.

Disclaimer: This flood risk management report is intended for the purposes of constructing a first floor addition as shown in the architectural drawings contained in this report ONLY and cannot be used for the purposes of planning other developments on the subject property or for proposed developments on neighbouring properties.

ANNEXURE A

Northern Beaches Council Certification Form A/A1

Attachment A

NORTHERN BEACHES COUNCIL
STANDARD HYDRAULIC CERTIFICATION FORM
FORM A/A1 – To be submitted with Development Application

Development Application for

Address of site: 24 John Street, Avalon Beach

Declaration made by hydraulic engineer or professional consultant specialising in flooding/flood risk management as part of undertaking the Flood Management Report:

I, Andrew Lam (Insert Name) on behalf of Waterdesign Civil Engineers (Trading or Business/ Company Name)

on this the 30/10/2020 (Date) certify that I am engineer or a professional consultant specialising in flooding and I am authorised by the above organisation/ company to issue this document and to certify that the organisation/ company has a current professional indemnity policy of at least $2 million.

***Flood Management Report* Details:**

Report Title:

Flood Risk Management Report

Report Date: 30/10/2020

Author: Andrew Lam

Author's Company/Organisation: Waterdesign Civil Engineers

I: Andrew Lam
(Insert Name)

Please tick all that are applicable (more than one box can be ticked)

☑ have obtained and included flood information from Council (must be less than 12 months old) (**This is mandatory**)

☑ have followed Council's Guidelines for Preparing a Flood Management Report

☐ have requested a variation to one or more of the flood related development controls. Details are provided in the *Flood Management Report*.

Signature 

Name Andrew Lam MIEAust BE Civil (Hons)

ANNEXURE B

Council Flood Information Request

RE: Proposed alterations and additions 24 John Street, Avalon Beach - Request for Flood and Estuarine Information

FP **Flood plain <floodplain@northernbeaches.nsw.gov.au>**
25/01/2018 2:10 PM

To: Kate Irwin Faulks

Hi Kate,

Apologies for the delay. Below is the latest flood information for the property identified as 24 John Street, Avalon Beach.

Flood Risk Precinct: Affected by the Medium Flood Risk Precinct. See the attached map
Highest 1% AEP (100 year) flood level: 2.21m AHD
Freeboard: 0.5m
Highest Flood Planning Level (FPL): 2.71m AHD
Probable Maximum Flood (PMF) level: 3.1 m AHD

The flood extents shown in the Flood Maps are indicative only. Flood levels should be compared to a survey plan of the property to identify flood extents.

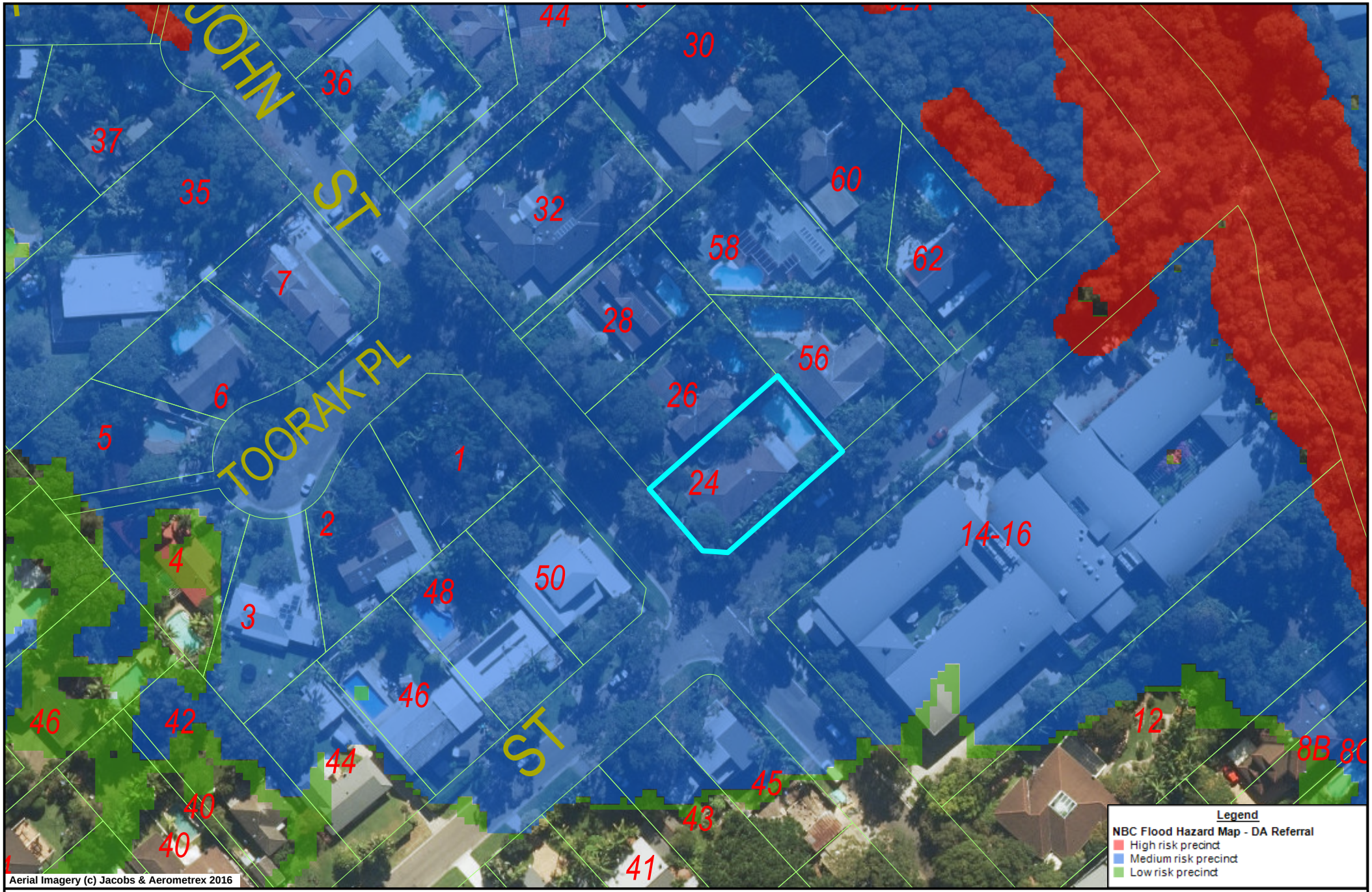
The above information is based off the Avalon to Palm Beach Floodplain Risk Management Study and Plan, 2017. This is currently the best available information on flooding in the area, but could be subject to change in the future.

Please don't hesitate to call or email floodplain@northernbeaches.nsw.gov.au if you have any questions.

Regards,

Duncan Howley
Senior Floodplain Management Officer

Stormwater Floodplain Engineering
t 02 9942 2381 **m** 0417 439 784
duncan.howley@northernbeaches.nsw.gov.au
northernbeaches.nsw.gov.au



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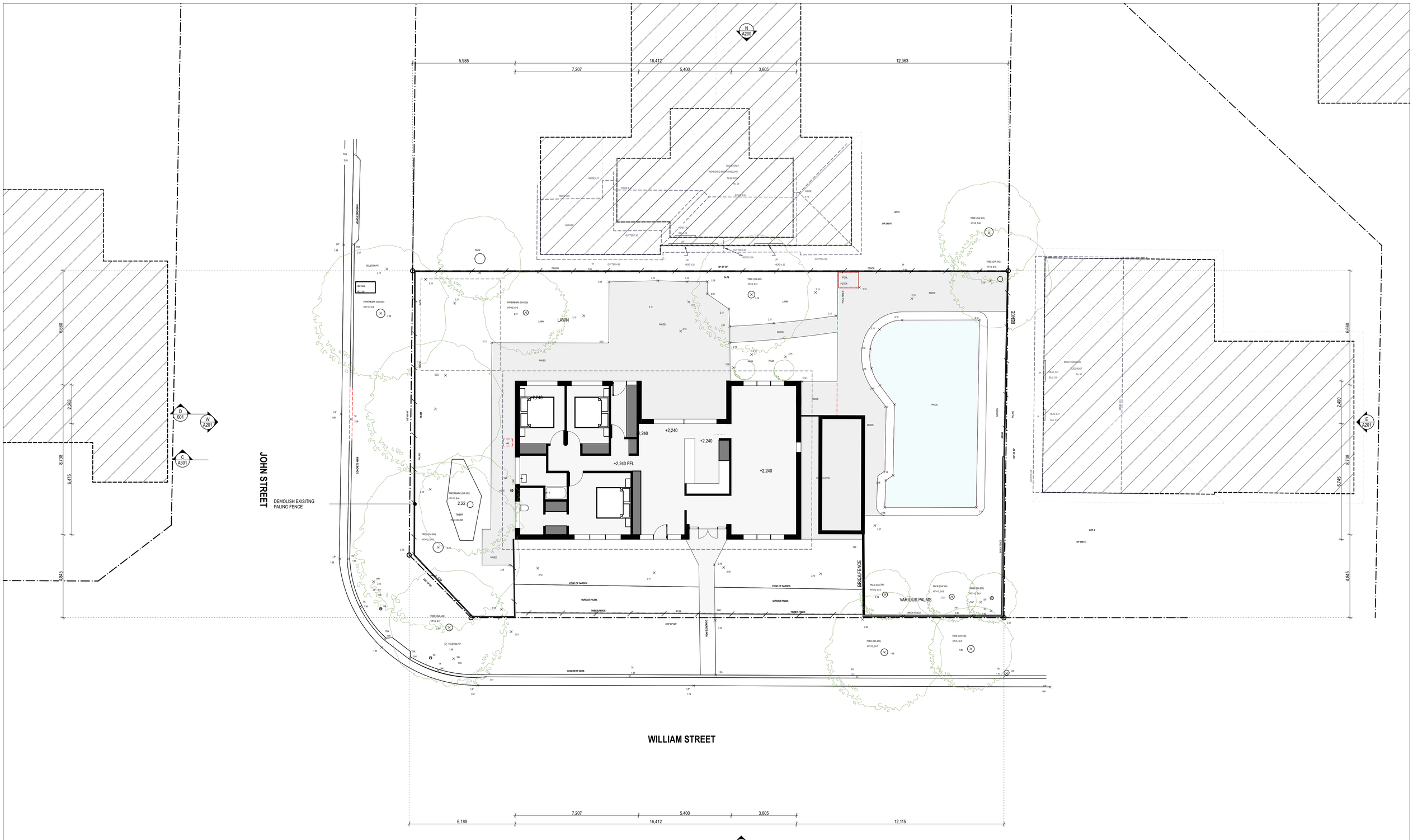
ANNEXURE C

Architectural Drawings



ABBREVIATIONS:

AC	AIR CONDITIONING	PCS	PRECAST CONCRETE STAIR
CON	CONCRETE	RCB	REINFORCED CONCRETE BLOCK
COS	CHECK ON SITE	RDB	RENDERED DOUBLE BRICK
CT	CERAMIC TILE	RSB	RENDERED BRICK
D	DOOR	RM	RENDERED MASONRY
DP	DOWNPIPE	RVBS	RETRACTABLE VERTICAL BATTEN
EXTG	EXISTING		SHUTTERS (40x40 ANODISED
EL	EXTERNAL LOUVRES		ALUMINIUM SHS)
FC	FIBRE CEMENT SHEET	RWO	RAIN WATER OUTLET
FFL	FINISHED FLOOR LEVEL	SB	SOLID BALUSTRADE
FG	FIXED GLAZING	SPEC	SPECIFIED
GB	GLASS BALUSTRADE	SL	SKYLIGHT
GL	GLASS LOUVRES	SD	SLIDING DOOR
GSD	GLASS SLIDING DOOR	SS	STAINLESS STEEL
GU	GUTTER	TBC	TO BE CONFIRMED
HR	HAND RAIL		TILE FINISH
	JOINERY UNIT	TDK	TIMBER DECK
LV	LOUVRE / ADJUSTABLE LOUVRES	TFW	TIMBER FLOORBOARDS
MB	METAL BALUSTRADE	TFG	TRANSLUCENT FIXED GLAZING
MDR	METAL DECK ROOF	TM	TIMBER, PAINT FINISH
MG	METAL GATE	VBS	VERTICAL BATTEN PRIVACY SCREEN
MS	MILD STEEL, PAINT FINISH		(40x40 ANODISED ALUMINIUM SHS)
PB	PLASTERBOARD, PAINT FINISH	ZN	ZINC CLADDING
PCF	POLISHED CONCRETE FLOOR		

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- STEEL/ALUMINIUM
- FIBRE CEMENT/CEMENT RENDER
- EARTH
- GLASS
- INTERNAL PLASTERED WALLS
- INTERNAL TILES

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ISSUE	Issue Name	DATE
A	Issue For Development Application	11/11/2020

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ARCHITECT'S REG. NO. 6123 (A. CHENCHOW)

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JOB TITLE:
ALTERATIONS AND ADDITIONS FOR ANTHONY & SHANNON RITCHIE
24 JOHN STREET AVALON BEACH NSW 2107

DRAWING TITLE:
EXISTING GROUND FLOOR PLAN

DRAWING NUMBER:
A100

DATE:	DRAWN BY:	CHECKED BY:
NOV 2020	AD	TCC

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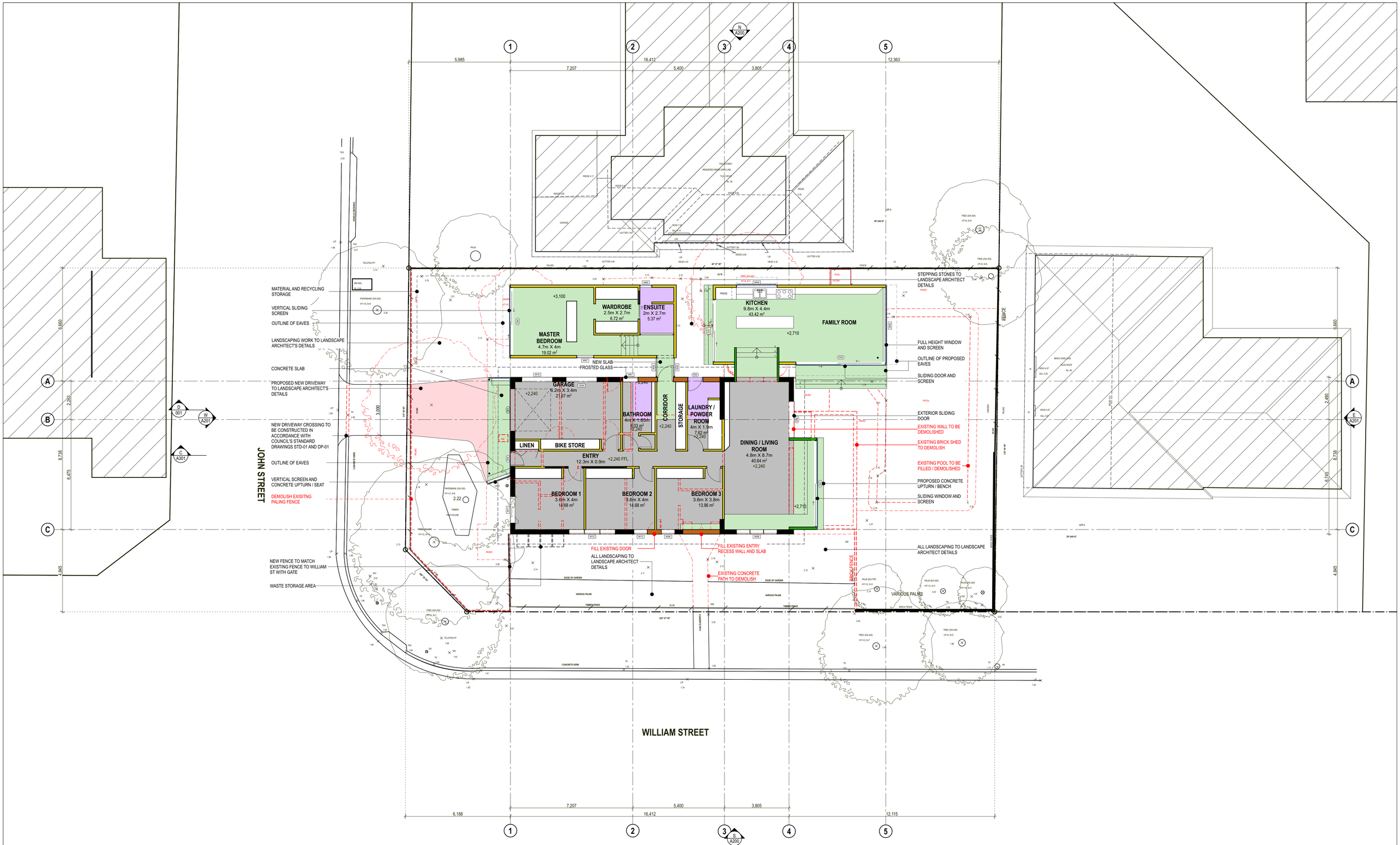

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A	Issue For Development Application	11/11/2020
05	Issue Preliminary DA	24/06/2020
04	Issue For Client Revision	4/05/2020
03	Issue For Client Revision	13/03/2020
02	Issue For Consultants Coordination	26/02/2020
01	Issue For Client	10/02/2020

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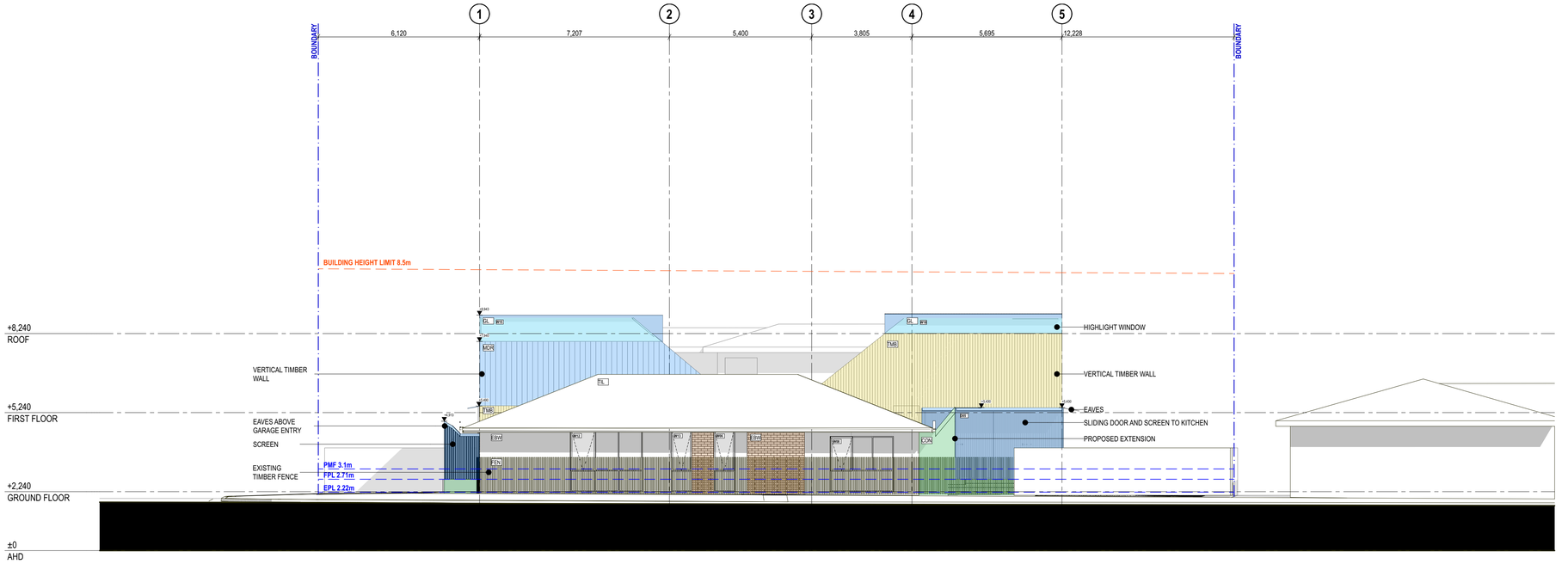

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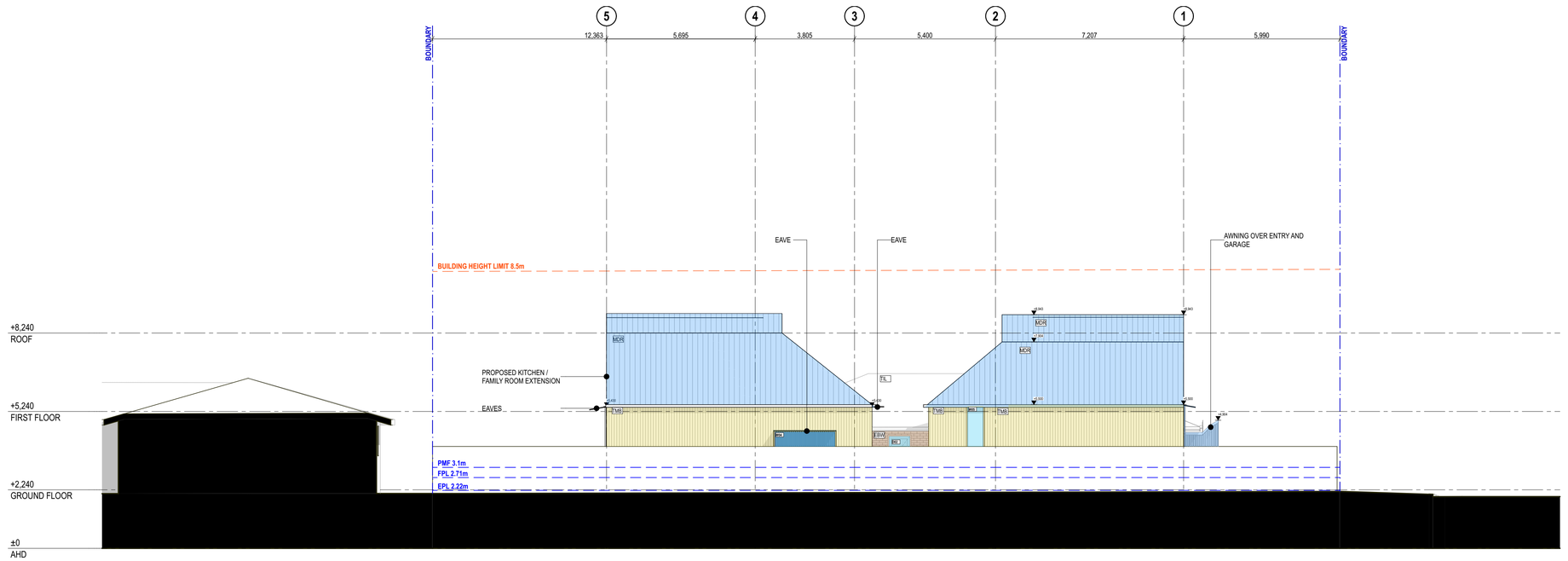

NORTH ELEVATION

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DP	DOWNPIPE	RVBS	RETRACTABLE VERTICAL BATTEN SHUTTERS (40x40 ANODISED ALUMINIUM SHS)
EXTG	EXISTING		
EL	EXTERNAL LOUVRES	RWO	RAIN WATER OUTLET
FC	FIBRE CEMENT SHEET	SB	SOLID BALUSTRADE
FFL	FINISHED FLOOR LEVEL	SPEC	SPECIFIED
FG	FIXED GLAZING	SR	SCREEN
GB	GLASS BALUSTRADE	SD	SLIDING DOOR
GL	GLASS LOUVRES	SS	STAINLESS STEEL
GSD	GLASS SLIDING DOOR	TBC	TO BE CONFIRMED
GU	GUTTER	T	TILE FINISH
HR	HAND RAIL	TDK	TIMBER DECK
J	JOINERY UNIT	TFW	TIMBER FLOORBOARDS
LV	FIXED ADJUSTABLE LOUVRES	TFG	TRANSLUCENT FIXED GLAZING
MB	METAL BALUSTRADE	TM	TIMBER, PAINT FINISH
MDR	METAL DECK ROOF	VBS	VERTICAL BATTEN PRIVACY SCREEN (40x40 ANODISED ALUMINIUM SHS)
MG	METAL GATE	ZN	ZINC CLADDING
MS	MILD STEEL, PAINT FINISH		
PB	PLASTERBOARD, PAINT FINISH		
PCF	POLISHED CONCRETE FLOOR		

LEGEND

- EXISTING ELEMENTS TO BE RETAINED
- EXISTING ELEMENTS TO BE DEMOLISHED
- PROPOSED
- BRICK
- CONCRETE
- TIMBER
- STEEL/ALUMINIUM
- FIBRE CEMENT/CEMENT RENDER
- EARTH
- GLASS
- INTERNAL PLASTERED WALLS
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ISSUE	Issue Name	DATE
A	Issue For Development Application	11/11/2020

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JOB TITLE:
ALTERATIONS AND ADDITIONS FOR ANTHONY & SHANNON RITCHIE
24 JOHN STREET AVALON BEACH NSW 2107

DRAWING TITLE:
SOUTH & NORTH ELEVATIONS

DRAWING NUMBER:
A200

DATE:	DRAWN BY:	CHECKED BY:	
NOV 2020	AD	TCC	
SCALE: 1:100	JOB NO: 1527	NO. IN SET: 6	AMENDMENT: A

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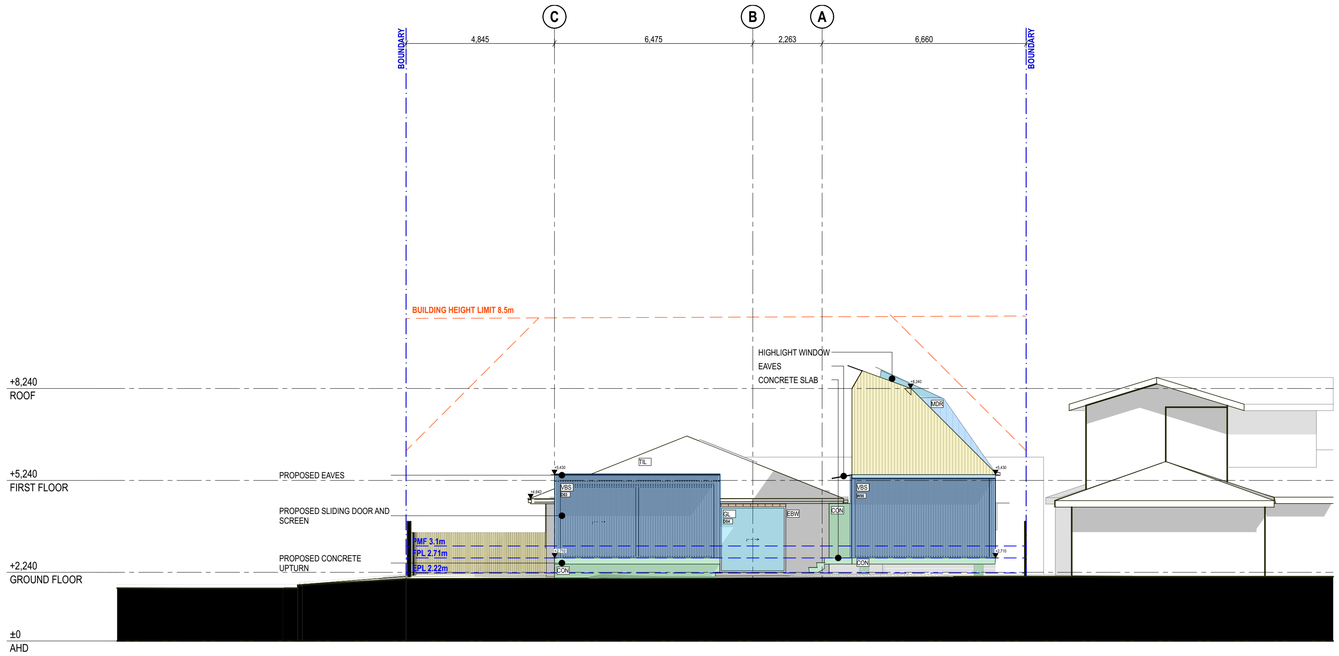
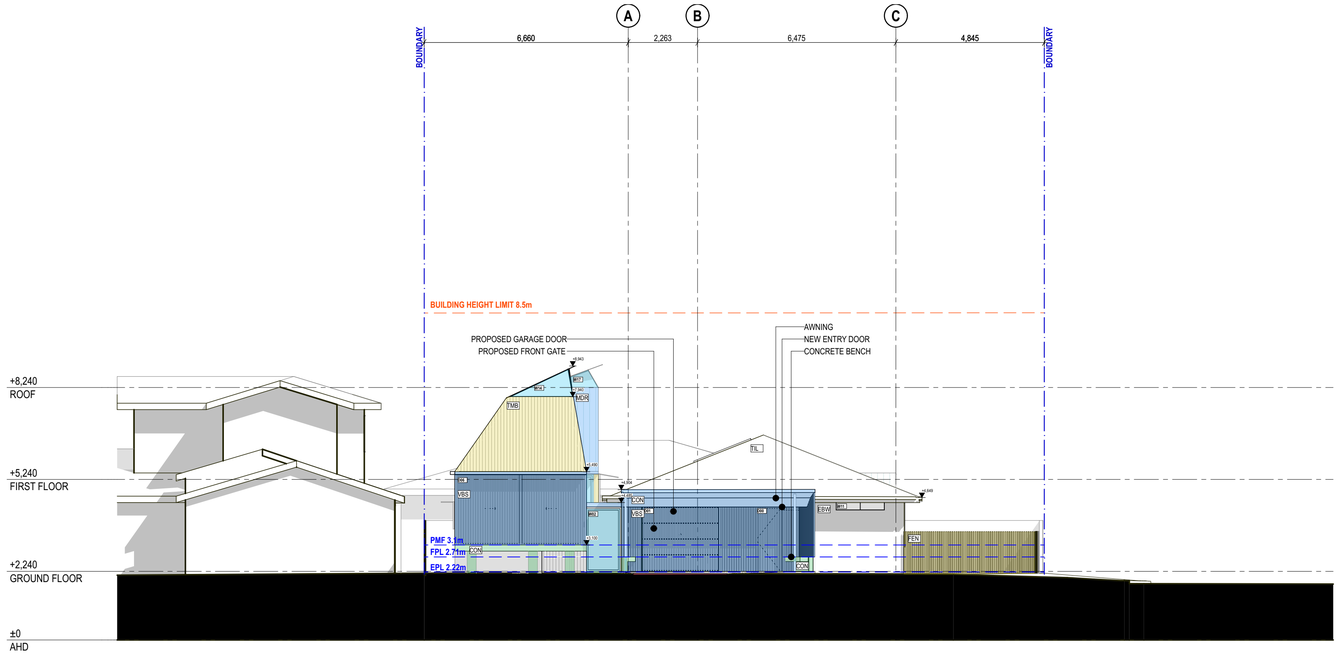


EAST ELEVATION



WEST ELEVATION

ABBREVIATIONS:

AC	AIR CONDITIONING	PCS	PRECAST CONCRETE STAIR
CON	CONCRETE	RCB	REINFORCED CONCRETE BLOCK
COS	CHECK ON SITE	RDB	RENDERED DOUBLE BRICK
CT	CERAMIC TILE	RL	RELATIVE LEVEL
D	DOOR	RM	RENDERED MASONRY
DP	DOWNPIPE	RVBS	RETRACTABLE VERTICAL BATTEN
EXTG	EXISTING		SHUTTERS (40x40 ANODISED
EL	EXTERNAL LOUVRES		ALUMINIUM SHS)
FC	FIBRE CEMENT SHEET	RWO	RAIN WATER OUTLET
FFL	FINISHED FLOOR LEVEL	SB	SOLID BALUSTRADE
FG	FIXED GLAZING	SPEC	SPECIFIED
GB	GLASS BALUSTRADE	ST	STAIRS
GL	GLASS LOUVRES	SD	SLIDING DOOR
GSD	GLASS SLIDING DOOR	SS	STAINLESS STEEL
GU	GUTTER	TBC	TO BE CONFIRMED
HR	HAND RAIL	T	TILE FINISH
J	JOINERY UNIT	TDK	TIMBER DECK
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MB	METAL BALUSTRADE	TFG	TRANSLUCENT FIXED GLAZING
MDR	METAL DECK ROOF	TM	TIMBER, PAINT FINISH
MG	METAL GATE	VBS	VERTICAL BATTEN PRIVACY SCREEN
MS	MILD STEEL, PAINT FINISH		(40x40 ANODISED ALUMINIUM SHS)
PB	PLASTERBOARD, PAINT FINISH	ZN	ZINC CLADDING
PCF	POLISHED CONCRETE FLOOR		

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ISSUE	Issue Name	DATE
A	Issue For Development Application	11/11/2020

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JOB TITLE:
ALTERATIONS AND ADDITIONS FOR ANTHONY & SHANNON RITCHIE
24 JOHN STREET AVALON BEACH NSW 2107

DRAWING TITLE:
EAST & WEST ELEVATIONS

DRAWING NUMBER:
A201

DATE:	DRAWN BY:	CHECKED BY:	
NOV 2020	AD	TCC	
SCALE:	JOB NO:	NO. IN SET:	AMENDMENT:
1:100	1527	7	A

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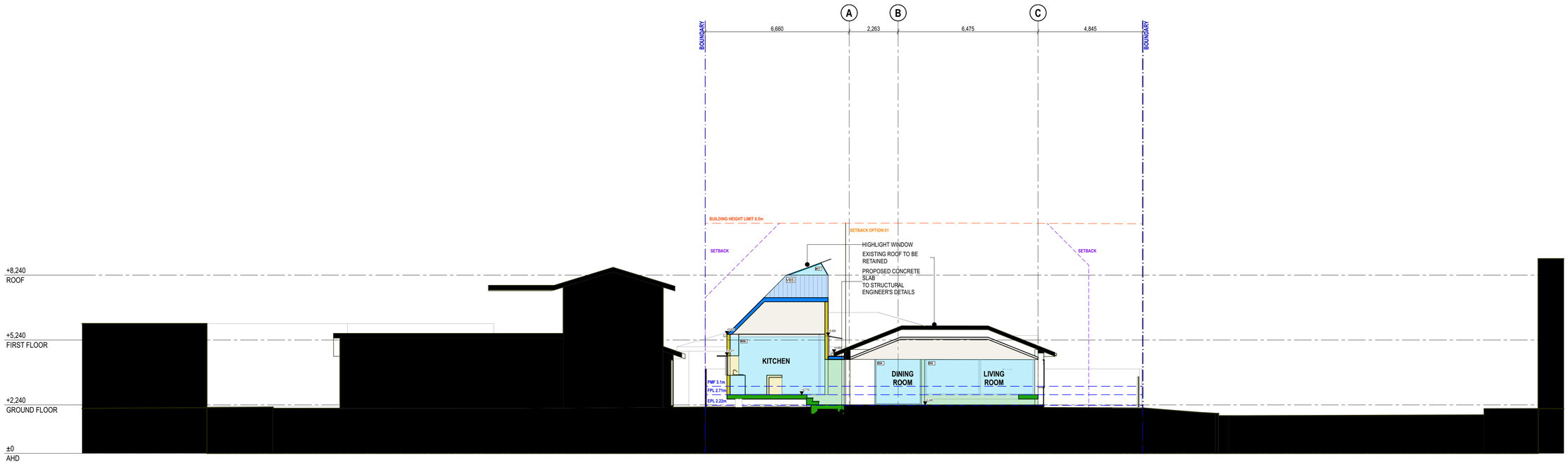
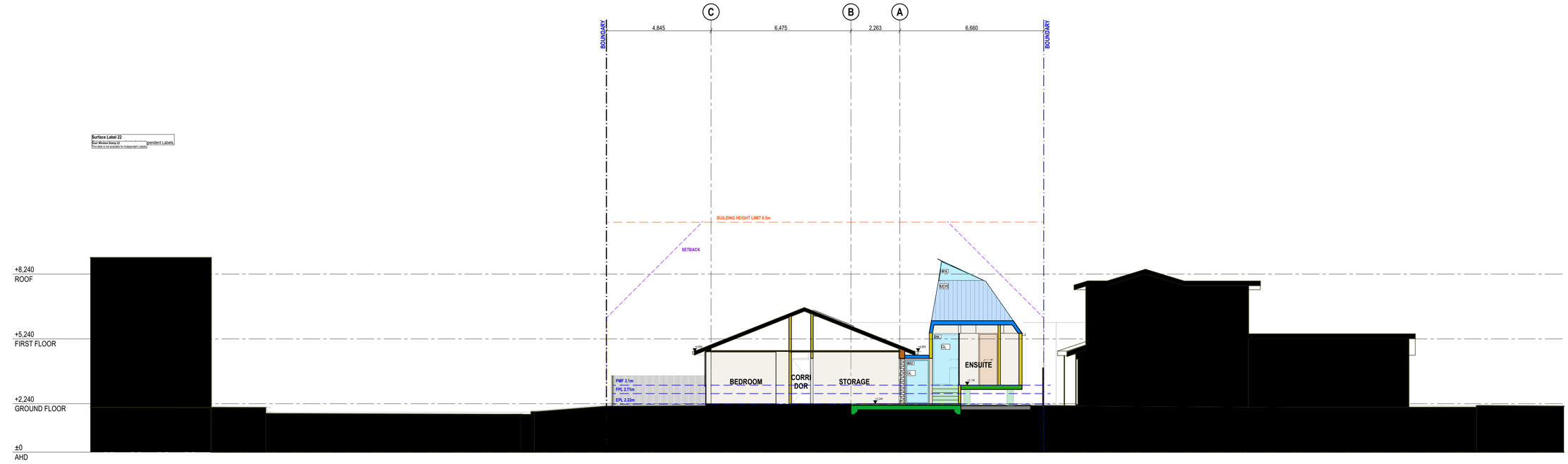


SECTION A-A



SECTION B-B

ABBREVIATIONS:

AC	AIR CONDITIONING	PCS	PRECAST CONCRETE STAIR
CON	CONCRETE	RCB	REINFORCED CONCRETE BLOCK
COS	CHECK ON SITE	RDB	RENDERED DOUBLE BRICK
CT	CERAMIC TILE	RL	RELATIVE LEVEL
D	DOOR	RM	RENDERED MASONRY
DP	DOWNPIPE	RVBS	RETRACTABLE VERTICAL BATTEN SHUTTERS (40x40 ANODISED ALUMINIUM SHS)
EXTG	EXISTING		
EL	EXTERNAL LOUVRES		
FC	FIBRE-CEMENT SHEET	RWO	RAIN WATER OUTLET
FFL	FINISHED FLOOR LEVEL	RB	RENDER BLUSTRADE
FG	FIXED GLAZING	SPEC	SPECIFIED
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GSD	GLASS SLIDING DOOR	SS	STAINLESS STEEL
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MS	MILD STEEL, PAINT FINISH		
PB	PLASTERBOARD, PAINT FINISH	ZN	ZINC CLADDING
PCF	POLISHED CONCRETE FLOOR		

LEGEND

- EXISTING ELEMENTS TO BE RETAINED
- EXISTING ELEMENTS TO BE DEMOLISHED
- PROPOSED
- BRICK
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ISSUE	Issue Name	DATE
A	Issue For Development Application	11/11/2020
01	Issue For Client Revision	4/05/2020

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JOB TITLE:
ALTERATIONS AND ADDITIONS FOR ANTHONY & SHANNON RITCHIE
24 JOHN STREET AVALON BEACH NSW 2107

DRAWING TITLE:
SECTIONS A-A & B-B

DRAWING NUMBER:
A300

DATE:	DRAWN BY:	CHECKED BY:	
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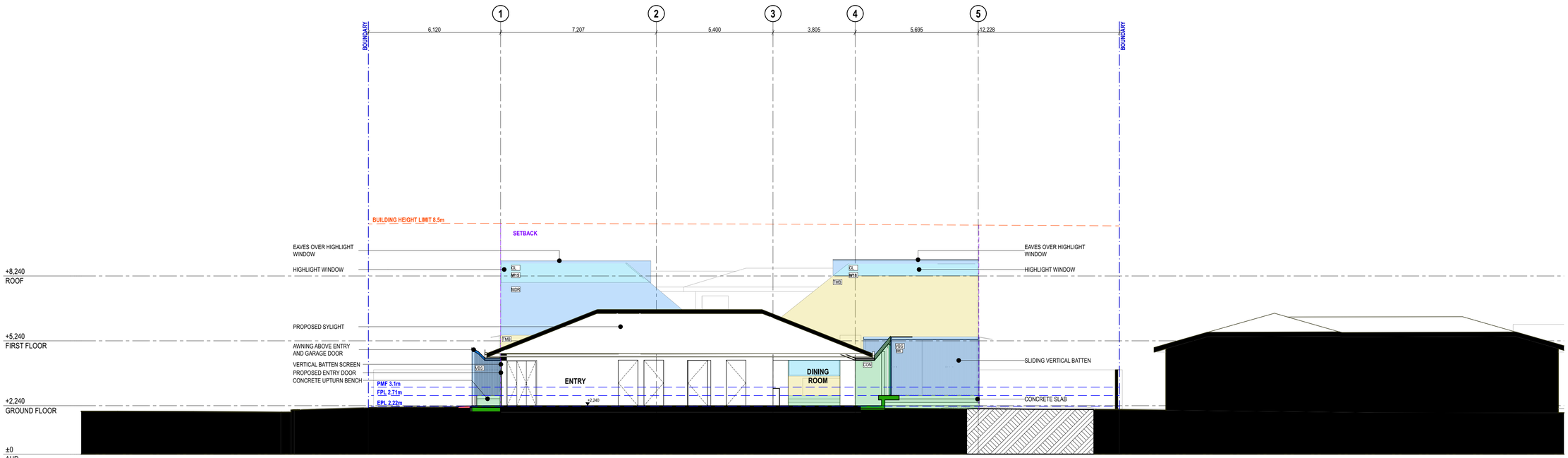

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JOB TITLE:
ALTERATIONS AND ADDITIONS FOR ANTHONY & SHANNON RITCHIE
24 JOHN STREET AVALON BEACH NSW 2107

DRAWING TITLE:
SECTION C-C

DRAWING NUMBER:
A301

DATE:	DRAWN BY:	CHECKED BY:	
NOV 2020	AD	TCC	
SCALE: 1:100	JOB NO: 1527	NO. IN SET: 9	AMENDMENT: A

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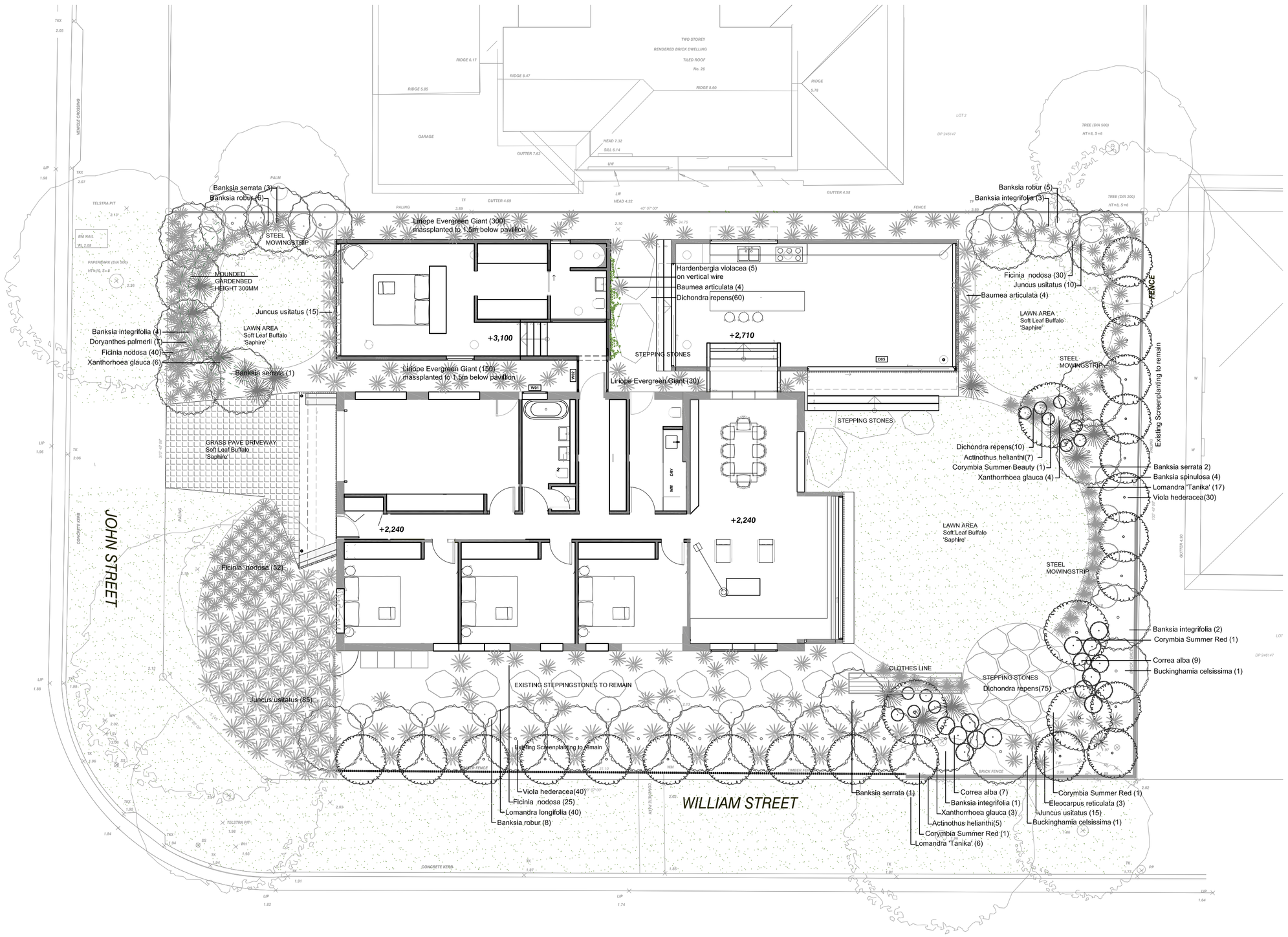
ANNEXURE D

Landscape Plan



PLANT LIST

botanical name	common name	quantity	pot size
TREES			
Banksia integrifolia	coast banksia	10	25l
Banksia serrata	old man banksia	7	25l
Buckinghamia celsissima	ivory curl tree	2	25l
Corymbia Summer Baeuty	dwarf flowering eucalypt	1	25l
Corymbia Summer Red	dwarf flowering eucalypt	3	25l
Elaeocarpus reticulatus	blueberry ash	3	25l
SHRUBS			
Correa alba	white correa	16	150mm
Banksia robur	swamp banksia	19	200mm
Banksia spinulosa	hairpin banksia	4	200mm
GRASSES			
Ficinia nodosa	knobby club-rush	158	150mm
Juncus usitatus	common rush	114	150mm
Lomandra 'Tanika'	mat rush	25	150mm
Lomandra longifolia	mat rush	48	150mm
Baumea juncea	baumea	8	150mm
PERENNIALS			
Actinotus helianthi	flannel flower	12	150mm
Doryanthes palmeri	giant spear lily	7	25l
Liriope 'Evergreen Giant'	giant lily-turf	480	150mm
Xanthorrhoea glauca	grass tree	13	200mm
GROUNDCOVERS			
Dichondra repens	native kidney weed	145	150mm
Viola hederacea	australian native violet	70	150mm
CLIMBERS			
Hardenbergia violacea	happy wanderer	5	150mm

NOTES:
95% OF PLANT SPECIES ARE LOCAL NATIVE SPECIES

Notes:
This Drawing is for design guidance only. Final details must meet site conditions, relevant authorities and applicable building standards. Verify all dimensions on site and with detailed site survey prior to off site fabrication

VOLKER KLEMM LANDSCAPE DESIGN

PO BOX 760 AVALON NSW 2107 TEL/FAX 02 9973 3797 MOBILE 0403 193 337

project
RITCHIE RESIDENCE
24 JOHN STREET
AVALON

drawn	Scale	date	Drawing No	Revision
VK	1 : 100	10/20	DA 01	C

Scale
DA LANDSCAPE PLAN

ANNEXURE E

Reducing Vulnerability of Buildings to Flood Damage:
Guidance on Building in Flood Prone Areas

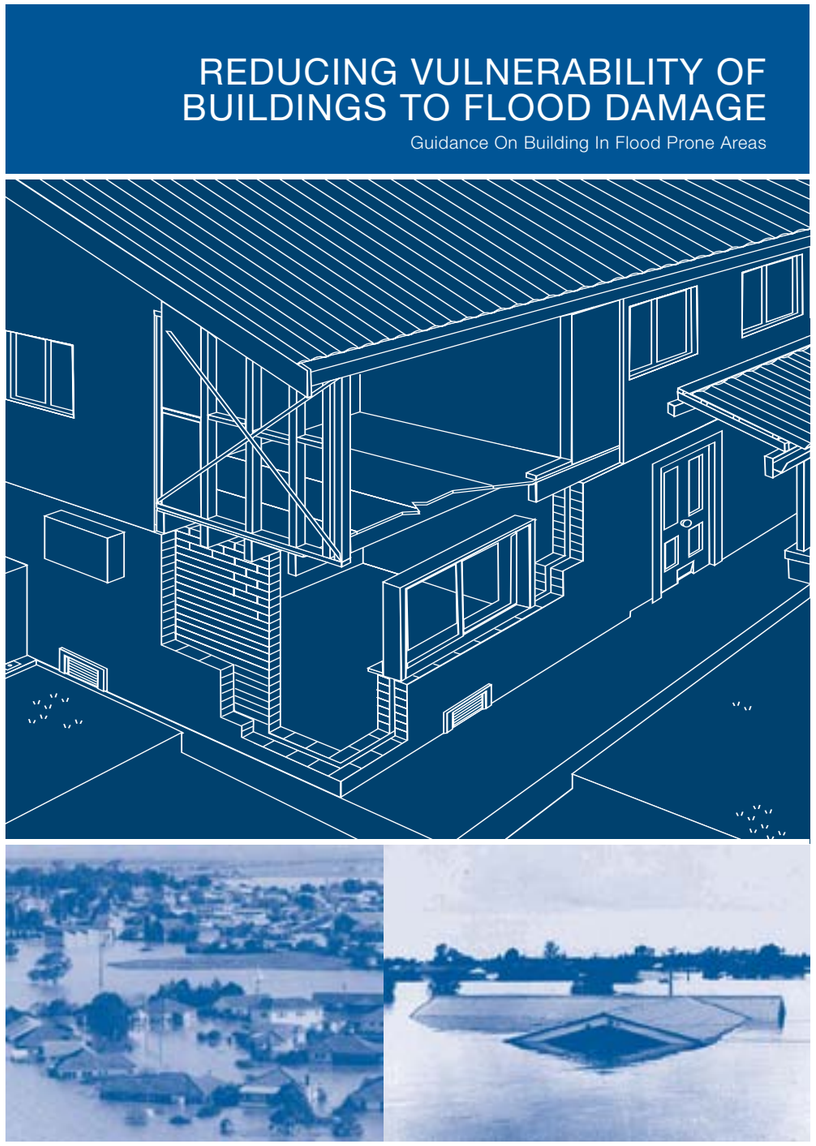
Flood Compatible Building Guidelines

June 2014

PITTWATER COUNCIL

Maximising flood aware design and location of your home in a flood-prone area can be the difference between having a home to return to or not.

ACKNOWLEDGEMENT



This document is a summary of the document Reducing Vulnerability of Buildings to Flood Damage: Guidance on Building in Flood Prone Areas, prepared for the Hawkesbury Nepean Floodplain Management Steering Committee in June 2006 (HNFMSC, 2006). A full copy of the HNFMSC 2006 be found at:

www.floodsafe.com.au

The wealth of information provided in HNFMSC 2006 is gratefully recognised.

Maximising flood aware design and location of your home in a flood-prone area can be the difference between having a home to return to or not.

Where to go for more information

Please note that the following links may change.

- Reducing Vulnerability of Building to Flood Damage - Guidance in flood prone areas
  www.floodsafe.com.au
- Building Code of Australia
  www.abcb.gov.au
- Pittwater Sustainability Principles and Checklist
  www.pittwater.nsw.gov.au
- NSW Floodplain Development Manual
  www.environment.nsw.gov.au/floodplains/manual.htm
- NSW Government Flood Policy
  www.environment.nsw.gov.au/floodplains/index.htm

For more information on flooding in the Pittwater Local Government Area visit:

www.pittwater.nsw.gov.au

Table of Contents

To find out more about Building and Development in Pittwater:

http://www.pittwater.nsw.gov.au/building__and__development

How to read this document

Some key information is provided in coloured boxes. These boxes provide the reader with quick easy access to building recommendations, further advice, related information and weblinks.

An index to the boxes is as follows:

Handy tips

Website Links

Reference to relevant section of Reducing Vulnerability of Buildings to Flood Damage: Guidance on Building in Flood

What are the guidelines about?

This document is a summary of the recommendations from the report entitled Guidance on Building in Flood Prone Areas, Reducing Vulnerability of Buildings to Flood Damage, prepared for the Hawkesbury-Nepean Floodplain Management Steering Committee in 2006.

The recommendations provided in this summary document are not mandatory building requirements but suggested ways to achieve a reasonable level of protection against flood damage to a house or building. By applying the principles outlined in this document you will be able to achieve a higher degree of protection against structural flood damage than exists with a traditional house.

Why are the guidelines useful?

Modern housing construction often results in houses that are ill equipped to withstand flooding. Given the limited availability of comprehensive domestic flood insurance, most homeowners of flood prone property are potentially vulnerable to major structural damage and resulting repair costs.

These guidelines provide detailed information on general building positioning, materials (internal and external), building style and design. This approach can reduce structural damage

Who are the guidelines for?

The principles provided in this document can be used by anyone (commercial or residential) when designing or renovating a home or building located in flood prone areas. This can include alterations, additions and a higher level of development.

To determine if your property is affected by flood risk visit Pittwater Council's website:

http://www.pittwater.nsw.gov.au/building__and__development

1 FLOODING IN THE PITTWATER AREA

Flooding is a natural hazard that can result in significant financial, environmental and social costs when major flooding occurs.

A major flood in Pittwater can place lives at risk, destroy buildings and cars and pollute the natural environment. Minor flood events are a nuisance, blocking drains, transporting litter, saturating parks and fields and making some footpaths and roads impassable.

Flooding in Pittwater is caused by estuarine, ocean and rainfall impacts. Properties close to the ocean or estuaries can be flooded from a rise in water level and wave impacts during a storm event.

Pittwater Council

The vulnerability of a property to flooding in Pittwater results from its proximity to the estuary, coast, creeks, major stormwater drains and overland flow paths.
If a property is not designed to withstand a flood, damage can occur. The following are some examples:

- water pressure acting on the walls of the house can force collapse;
- buoyancy forces can cause the building to float off its piers when the water channels under the floor of the building rise to the base of the floor;
- saturated materials can weaken, distort and fail.

1.1 Development Approvals

If you intend to make any changes to an existing building including renovations or extensions or you intend to construct a new building then the first step is to determine whether a Development Application is required.

Property owners extending or designing a new house or business should consider the impacts of flooding. This includes the impact flooding may have on adjoining land and properties downstream. The Building Code of Australia has information on the construction of buildings in flood hazard areas. Local councils are also responsible for ensuring buildings comply with policies and controls for flood prone areas.

The purpose of these Flood Aware Building Guidelines is to provide guidance on measures to improve the performance of buildings both during and after a flood. The guidelines provide information about:

- design of buildings
- structural elements of dwellings
- non structural components

Pittwater Council's Development Controls

http://www.pittwater.nsw.gov.au/building__and__development

Being flood aware will ensure your property can better withstand flooding and ultimately reduce the cost of flood damage.

It is more cost effective to use flood aware building techniques for your building at the design stage so that you can reduce the costs of repair, replacement and cleaning after flooding.

2 DESIGNING FLOOD COMPATIBLE BUILDINGS

When renovating or designing a new home, commercial or industrial building you should consider the following:

- Build on the highest area of the land.
- Don't build on a water course or overland flow path.
- Avoid long and narrow designs. Maintain a ratio of the side lengths of the building to less than 1:2 - square footprint which is ideal.
- Ensure long walls are parallel to the direction of flow.
- Remove obstructions that prevent water draining from under the house.
- Ensure surrounding garden beds do not restrict drainage.
- Maximise flow across your property using flood compatible fences, etc.
- Consider forces created by floodwater on components of the building.
- Deterioration of building materials in contact with water.
- Ensure the foundations won't move due to geotechnical (soil) failure.
- Use materials that are can resist water damage.
- Avoid areas that can trap moisture in a building.
- Seal porous materials against water entry.
- Don't be afraid to use new and alternative materials

2.1 Site factors

Section 4.1

The location and placement of a building in a floodplain can influence its exposure to flood damage. Ground conditions and topography should be considered when deciding on location and placement.

You can protect your building from flood waters by:

- elevating the floor above the surrounding ground level;
- orientating the building to minimise bockage;
- landscaping the site to ensure the water moves off your property quickly and doesn't pond on the ground.

2.2 Housing types

Section 4.2

Housing Type	Flood related problems	Benefits and Recommendations
Single storey	• There is no option for moving assets/contents to a higher level during a flood. • If flood waters reach halfway up the walls it will result in loss of virtually all contents and structural damage. • The structural damage will mean the house cannot be occupied safely while reinstatement is in progress.	• Utilise the roof space or attic to store valuable contents during a flood. • If there is no roof space investigate options for adding an attic for storage. • Where practical, raise all electrical components including powerpoints above the flood planning level.
Elevated	• There is often the temptation to enclose areas under elevated houses to use for storage or even habitable areas.	• Ensure the substructure is built to withstand floodwater and debris forces. • Install two sets of stairs and a veranda to provide opportunities for evacuation if required. • Reduces the footprint and impact of the building on the natural flow of water over the ground.
Two storey	• Can cost more to build compared with a single storey house of equivalent floor space. • Can be mistaken as a safe place during a flood.	• Provides a flood free storage area for valuables. • Use lower floors for basic or cheap contents. • Use flood resistant construction materials for the lower storey. • Reduces the footprint and impact of the building on the natural flow of water over the ground.
Multi storey	• Multi story development in flood plains should consider the danger of placing large numbers of people in flood prone areas where they may stranded during a flood.	• Some units could be located above floor levels. • Provide a last resort refuge if evacuation is not possible.

2.3 Foundations

Section 5.1

Foundations are generally the first part of a building to be affected by flooding. Failure of foundations can result in total loss of a building. Some examples include a slab floating, poor settlement and erosion.

Ensure your foundation design considers the behaviour of the ground when affected by flooding. Look at factors such as adequate drainage, water pressure and the impact of flow velocities eroding the ground.

HNFMSC, 2006

Ground Condition	Characteristic	Considerations
Gravels	• erode with fast flowing water (3m/sec) • able to absorb water • low shrink/swell • maintain strength when saturated	Be aware of buoyancy forces for slab on ground designs.
Sand & Silt	• erode with flowing water (0.2m/sec) • absorbable • low shrink/swell • lose strength when saturated	Stabilise all ground slopes and banks that are exposed to high flows using vegetation, grassing and rocks.
Clays	• erodible with flowing water (1.5m/sec) • low absorption • high shrink/swell • lose strength when saturated	Ensure the ground is well compacted. Minimise slopes to 2:1 horizontal to vertical or less to reduce slope failure.

You should engage a geotechnical engineer to assess your site before building.

2.4 Floor levels

To prevent flood damage in your property a simple solution is to raise the floor level. In NSW, Councils determine the floor levels in flood prone areas. The floor level is referred to as the Flood Planning Level (FPL) for mainstream flooding and minimum floor level requirement for overland flow. Each property has a specific freeboard and this value can vary from one property to another.

Setting the floor level doesn't mean a house is "flood free". The minimum floor level / FPL for residential development is calculated for inundation in a 1% Annual Exceedence Probability (AEP) flood event. These values are usually provided in mAHD (metres Australian Height Datum, which is relative to sea level). In Pittwater, the minimum floor level comprises:

- Mainstream Flooding = 1% AEP + 0.5m freeboard
- Overland Flow Path - Major = 1% AEP + 5m (horizontal buffer) + 0.5m (freeboard)
- Overland Flow Path - Minor = 1% AEP + 0.3m (freeboard).

Note: freeboard is used to provide a factor of safety to account for local flood impacts and any inconsistencies with the modelling used to derive the flood levels.

Where building footprints could obstruct the water flow, floor levels should be raised using piers to reduce the impact of a new building. Slab on ground buildings in a floodplain reduce the available space for water to flow. Consequently the water that would flow over that section of land is redirected around the building which can potentially increases water flow on neighbouring or downstream properties.

Flood levels used to determine FPL / Minimum Floor Levels can be obtained from Council.

Please check the most recent version of the Building Code of Australia (BCA) and Pittwater Councils website for development controls at the time of your development application.

2.5 Construction Materials - Inside and Out

Section 4.3

Be aware when selecting structural and non structural materials for a building:

- Material properties can change when they become wet, some materials can become weak when wet, shrink, swell and distort.
- Materials damaged by water can be costly and difficult to replac or repair.

Damages	High to Moderate Absorbency	Low Absorbency	Nil Absorbency
Minimal damage under most circumstances	• masonry • concrete	• solvent-based neoprene adhesives • two-part epoxy adhesives • rubber based and silicone based sealants	• copper • brass • glass • glass bricks • nylon fittings • plastics
Susceptible to damage when wet, no long term damage	• plasterboard • plywood • hardwood		
Damaged after prolonged immersion but will recover when dry	• low durability timbers • good quality adhesives • low quality tiles • water-based paints	• high durability timbers • good quality tiles • rubber-based adhesives • epoxy putty sealants • stone epoxy formed in place	• galvanised steel • aluminium
Permanent damage if subjected to relatively short periods of wetness	• insulation • wall paper • ceiling plasterboard • normal articleboard • hardboard • dry area adhesives • water based acrylic & urethane adhesives • water-based acrylic sealants • PVA emulsion cements • lino, carpets, cork	• oil-based paints	• bright steel

See Table 4.3.1.3 Materials for 96-hour immersion for more detailed information

When selecting materials consider the absorbency and the sort of damage that can occur immersed in water for a period of time.

Ask the manufacturer or supplier questions about a material's suitability for use in flood prone areas.

Advantages and disadvantages of common construction materials

House Construction Materials	Benefits/Advantages	Problems/Disadvantages
Brick veneer	• brick wall outside a framed structure • often the most cost effective form of construction	• brick ties, embedded in mortar, higher corrosion rate than those in air spaces, particularly if the mortar beds have been immersed in salty brakish water
Light-clad frame	• a frame structure directly covered with materials such as timber, aluminium, vinyl or fibre cement sheets)	• not as strong as brick or concrete walls
Full/double/cavity brick	• two brick walls separated by a cavity	• silt deposits and moisture get trapped in the cavity
Block-work	• concrete blocks not damaged by floodwaters and easily cleaned • concrete blocks can be reinforced to increase their strength	• concrete blocks are very porous and require impervious sealant Waterproof coatings only suitable for light wetting rather than immersion
Concrete panel housing	• external and often internal walls made of vertically positioned concrete panels • precast • excellent flood performance – strong, impervious, durable • minimal cleaning and maintenance • cost competitive with double brick	• rely on connections to be protected and stay in place otherwise failure and/or corrosion occurs • often built with slab on ground which may require significant raising in a flood prone area with compacted fill

Maximising flood aware design and location of your home in a flood-prone area can be the difference between having a home to return to or not.

HNFMSC, 2006

Warringah Council, 2009

Recommendations for the use of common adhesives and fasteners in flood prone areas

Fastener/Adhesive	Recommendation in flood affected areas
Adhesives and Sealants	• Solvent based neoprene adhesive • Rubber based adhesive • Two-part epoxies and polysylphide epoxy resins
Wood Glues	• Resorcinol based glues perform better than melamine urea formaldehyde • Avoid PVA glues as they absorb water and lose strength
Sealants	Sealants in order of greatest water resistance to least: • Polysulphide sealants • Silicone sealants • Rubber-based sealants • Epoxy putty • Polyurethane joint filler (bitumen impregnated) • Water-based acrylic
Bolts, Hinges, Nails and Fittings	• Use brass, nylon, stainless steel, removable pin hinges, galvanised steel, aluminium • AS 1684.2 requires all nails used in joints that are continuously damp or exposed to the weather to be hot dip galvanised, stainless steel or monel metal • Generally replacing conventional nailing with a sheet metal connector results in much stronger connections

2.6 Flooring Materials

Type	General Tips
Strip floor	• Recovers to its full strength after immersion • May buckle or cup at the edges, swell and lose nails by “pop-ping” while wet • Requires good ventilation to dry out
Plywood	• Good alternative to particle board particularly exterior grade plywood • Loses considerable strength (approximately 50%) when wet However its initial strength is better than particle board
Steel beams	• Relatively light and strong so recovers quickly after immersion • Maintain their strength and dimensions when wet • Open section steel members are preferred over closed hollow sections • Consider whether it is adequately protected against corrosion and any associated welds • AS 4680-2006 Hot-dip galvanized (zinc) coatings on fabricated ferrous articles
Particle board	• Not recommended in flood prone areas • May have to be completely replaced after flooding • Suffers swelling and loses strength after being immersed for more than 2 days • More vulnerable to failure from loads such as furniture and appliances

Place insulation made of polystyrene boards held by wire mesh between floor joists. Wire and nails should be corrosion resistant.

Clearance between the underside of joists and the ground should be a minimum of 450mm in flood affected areas and ensure this area is kept clear.

If there are ventilation problems after a flood, consider temporarily removing the insultation until the floor is thoroughly dried to avoid rotting.

2.7 External walls and cladding

Section 4.3

External walls support loads from the upper structure and roof, reduce movement, floating debris and water pressure.

Brick walls can fail in a number of ways including cracking, bowing of the wall, collapse of the external brick wall or cladding, internal timber frame snapping or the steel frame bending, and inner brick wall collapse upon failure of the external wall.

Recommendations to reduce risks to brick walls and cladding:

- Un-rendered walls dry out faster than rendered brick walls.
- Use fibre cement, plastic or aluminium for wall cladding as these materials are less likely to be structurally affected.
- Consider timber cladding such as hardwood, western red cedar and cypress pine that are naturally durable and dry relatively quickly.
- Try not to use hardboard as it buckles and loses strength after immersion
- Water based paint systems perform best with a premium quality acrylic primer under an acrylic top coat.
- Use weatherboard or fibre cement cladding (rather than bricks) to resist floodwater.

2.8 Internal walls

Section 5.4
Section 5.6

Internal wall problems:

- walls falling sideways
- timber frames twisting
- internal frame wall linings collapsing
- frame deterioration
- delayed drying
- deposits in the frame
- deposits in insulation
- poor support for external brick layers

Warringah Council, 2009

Recommendations to address some of these issues:

- Use weatherboard cladding for ease of access.
- Use good brick tie design.
- Use galvanized steel bracing.
- Reduce the distance between nails.
- Keep weepholes unblocked.
- Drill holes in the side of the bottom plate and matching plasterboard to allow water to drain.
- Use polystyrene insulation boards as they don't absorb water.
- Use metal nail plate connectors with timber frame construction.
- Keep the base of the cavity clean from building waste.
- Increase the rebate in the slab to provide more "storage" and blocking.
- Use fibre cement screwed in place for internal linings for its durability.
- Allow a 20-30 mm gap between the bottom wall plate and plasterboard for access to the cavity.

Avoid particleboard, fibreboard, strawboard, wallpaper, standard plywood and gypsum plaster where flood waters can reach.

2.9 Insulation

Section 5.5

Insulation can trap and retain moisture, delay drying, reduce ventilation and obstruct access to silt deposits in cavities.

Some tips to consider when selecting insulation materials for your property:

- Select materials that drain and dry quickly, maintain their shape and are resistant to retaining silt;
- Avoid materials that store water and delay drying - use waterproof and non absorbent materials.
- Avoid open cell insulation like batts.
- Always consult the insulation manufacturer or supplier for correct installation details.
- Always try to minimise the number of cavities and joints
- Always try to maximise ventilation of any cavities
- Batt insulation should run vertically so water can drain.

Examples of insulation that performs well in flood affected areas:

- plastic boards;
- polystyrene boards;
- closed cell solid insulation;
- reflective foil perforated with holes to drain water if used under timber floors.

2.10 Joinery and fittings

Section 5.5

The sort of problems encountered with joinery and fittings can be due to pre-fabricated units being installed in such a way that moisture traps are created under or behind them. Adhesives and materials can be susceptible to warping and other damages when immersed in water.

Component	Recommendation
Stairs	• Adopt straight and wide stairs with treads and risers of comfortable proportions to help relocation of contents from ground to upper floors • Traditional timber stairs can include enclosed areas which are difficult to clean and dry - have an open-tread solid timber stair • Stairs should be wide and easily negotiated. Recommended 1 metre clear between balustrades, or wall and balustrade and to have treads at least 280mm wide and risers no more than 180mm high
Cupboards	• Supported on short metal or plastic legs • Selecting particle board cupboards may be appropriate and cost effective because its replacement can be the cheapest. • Avoid false floors in cupboards and wardrobes
Skirting boards	• Use exposed head screws rather than nails • Use water resistant adhesives • Avoid MDF; solid timber skirting boards are generally less affected by water damage • Use removable metal or solid timber skirting boards; the skirting should be removable or have perforations in water resistant material • Keep in mind skirting boards are relatively low cost and easy to replace • If a building is built from solid walls, skirting boards can be omitted
Architraves	• Use solid timber as it can be reused if removal is required to repair plasterboard linings, doors and windows
Doors	• Hollow core doors damage easily but are cheap to replace; • Solid core or solid construction doors perform better after flooding if glues and plywood used are suited to periods of immersion in water
Windows	• Aluminium frames are suitable for immersion; • Timber frames not well suited as they absorb water resulting in difficulty opening, and surface friction that can remove the sealant
Materials	• From most to least appropriate: solid timber, marine grade plywood, exterior grade plywood, hardboard and MDF, particleboard; • Products built from well-sealed solid timber with water resistant adhesives perform the best in flood conditions

2.11 Floor Coverings

Section 6.2

Floor coverings can prevent the floor drying and the saturated coverings can subject additional loads on possibly already weakened timber floors. The following provides some advice on materials and their suitability in flood prone buildings.

- Avoid woollen carpet, grass matting, linoleum and cork flooring, on ground floors, that may shrink, swell or decay unless dried quickly.
- Avoid hardboard underlay as it swells, retains water and may decay.
- Use removable floor coverings e.g. carpet tiles and rugs on lower storey's.
- Use tiled concrete or polished hardwood timber floors.
- Use tiles with limited moisture expansion characteristics (less than 3%)
- Use tile adhesives that are water resistant.
- Use cementitious, epoxy, vinyl, rubber floorings.
- Do not reinstall any flooring until everything is thoroughly dried!

2.12 Electrical Services

Section 6.3

Water and Electricity do not mix!! Electricians can check for electrical hazards.

Flooding of meters, fuses, switches, power points and wiring can cause short-circuits, damage to components, corrosion and possibly electric shocks or fires. Here are some things you can do to reduce the damage to electrical services:

- Put the power for each level on separate circuits for two storey houses.
- Mount expensive fixed electrical equipment as high as possible.
- Raise power points on the wall to above the flood planning level.
- Elevate electrical components to the highest practical and regulatory level.
- Ensure access to the meter box for inspection and reading.
- Locate house wiring in the roof space and extend down the wall.
- Avoid placing house wiring in the slab or under suspended floors
- Ensure installation of conduits allows water to drain freely
- Check all your fittings. Replace fittings after flooding if required

Maximising flood aware design and location of your home in a flood-prone area can be the difference between having a home to return to or not.

2.13 Sewerage Systems

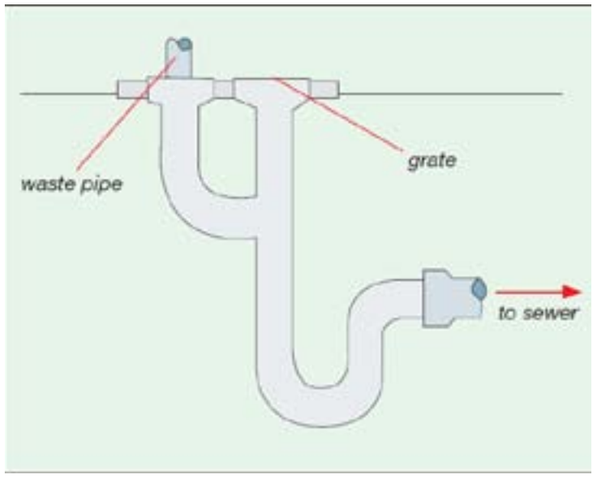
Section 6.4

Buoyancy, velocity, debris impact and scouring can cause damage to sewerage systems.

In a flood, sewage can back up into buildings. There may be damage pipes, pumps and electrical systems. Here are some ways to reduce the damage to sewerage systems:

- Install external components that can resist flow and buoyancy forces.
- Provide a gully trap outside the building and low to the ground.
- Cover exposed pipes and access covers to tanks and pits.
- Install a non-return or gate valve in the service connection pipe.
- Locate valves in a small pit outside the house between the mains sewer.
- Ensure the gully trap is well elevated.
- Place distribution pipes in areas of low flow velocity where possible.
- Ensure quick drainage of a trench system during high water levels.
- Ensure correct operation and maintenance of the valves.
- Remove any obstructions that may block a valve.

Warringah Council, 2009



HNFMSC, 2006

Maximising flood aware design and location of your home in a flood-prone area can be the difference between having a home to return to or not.

2.14 Water storage tanks

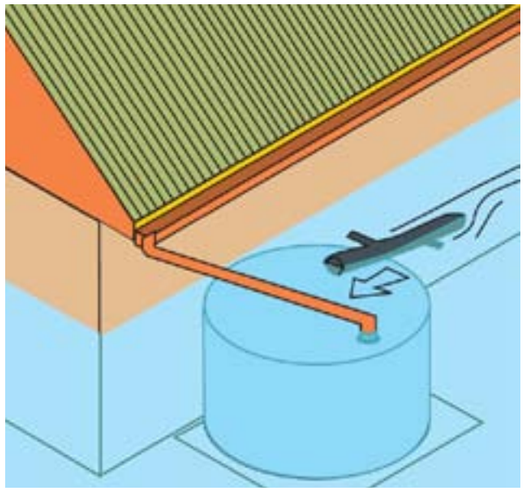
Section 6.5 & 6.6

Water tanks can be contaminated by flood water resulting in unsafe water supplies and damage to water supply systems.

Storage tanks, water heaters, air ducts etc. have the ability to float, pop out of soil, break away or be damaged. Any associated pipes or system components can also be damaged. Here are some ways to reduce damage:

- Locate the inlet to the tank as high as possible.
- Elevate above ground tanks and hot water heaters and ensure the supporting structures are flood resistant.
- Use corrosion resistant materials
- All designs should account for a loss of strength under flood conditions.
- Secure and fasten exposed components and pipes.
- Ensure tanks are securely fastened to prevent floatation.

Both above and below ground tanks need to be designed for buoyancy forces. Soil conditions can dramatically affect this and residents should always consult with a geotechnical engineer or other experienced professional before installing.



HNFMSC, 2006

Summary

- Build on the highest area of the property.
- Don't build on a water channel or overland flow path.
- Avoid long and narrow designs by maintaining a ratio of the side lengths of the building to less than 1:2 - square footprint is ideal.
- Ensure long walls are parallel to the direction of flow and do not block flows.
- Remove obstructions that prevent water draining from under the house.
- Ensure surrounding garden beds do not restrict drainage.
- Maximise flow across your property using flood compatible fences, etc.

Reducing Vulnerability of Buildings to Flood Damage: Guidance on Building in Flood Prone Areas, is a comprehensive document that anyone building or renovating a property in a flood affected area should consult. The following link will take you directly to the document:

http://www.floodsafe.com.au/uploads/83/building_guidelines.pdf

Please visit Pittwater Council's website for the most up-to-date flood related information and contact details

http://www.pittwater.nsw.gov.au