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15 PARKES ST PARRAMATTA NSW 2150
INCORPORATED ENGSURVEY PTY LTD ABN: 84 134 616 078

No.21-25 Woodriff Street, Penrith

Our Ref: E286341

OVERLAND FLOW ASSESSMENT

PREPARED BY: YOUSSEF RIAD
CHECKED BY: SCOTT SHARMA

DATE: 12th OCTOBER 2016

ISSUE A

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INTRODUCTION

Donovan Associates have been engaged to prepare this Overland Flow Assessment at the request of Penrith City Council to accompany the Development Application (DA) of the proposed residential flat development at the subject site No.21-25 Woodriff Street, Penrith.

The Scope of works involves the construction of an eight storey mixed use commercial and residential development (not including two basement levels).

SITE INFORMATION

The proposed development area encompasses the entirety of the site of No. 21-25 Woodriff Street (Lot 101 of DP 1031340 - 2005m^2), as well as the 10m wide nature strip between the eastern boundary of the site and Woodriff Street. The existing state of the site is an open gravel car park. The proposed development area (approximately 2732m^2 total) generally falls towards the northern boundary towards Union Lane and the western boundary towards the driveway entrance from Woodriff Street, with a localised 'high point' in the centre of the site. The site is traversed by driveway connecting Woodriff Street to a multistorey parking complex within a 'Right of Carriageway and Easement for Services' at the southern end of the site (refer to Appendix A for site survey). The general nature of the surrounding developments is generally commercial and industrial. Figure 1 below depicts the location of the subject site and an indication of the nature of the developments surrounding the site.

Figure 1: Subject Site and Surrounding Area Developments

FLOOD INFORMATION BACKGROUND

The property has been identified by Penrith City Council as being affected by overland flows during the 1% Annual Exceedence Probability (AEP) storm event. Penrith City Council have adopted flood information from the Penrith Central Business District (CBD) Detailed Overland Flow Flood Study (Cardno 2015). As part of the Flood Level Enquiry letter dated 10 March, 2016, Penrith City Council have provided flood levels for the 1% AEP storm event at the proposed development site. The Top Water Level (TWL) of floodwater has been identified by Council as RL 28.70m at the eastern boundary of the site and 28.50m at the western boundary of the site, to Australian Height Datum (AHD).

Figure 2: Flood Map Image - Penrith City Council

Figure 2 above is an image taken from Penrith City Council's Flood Level Enquiry letter outlining the extent of flooding through No.21-25 Woodriff Street, Penrith. This figure identifies the extents of overland flow (shown blue) on the subject site. See Appendix B for council flood information letter.

The following Assessment is based upon the following documentation and information:

a. Architectural drawings by Morson Group, 'Consultant Issue', sheets DA01 - DA19, dated 11/07/2016

b. Survey by Richard Hogan & Co. PTY LTD, dated 05/02/2015

c. Letter from Penrith City Council dated 10 March, 2016 entailing flood levels at the subject site

d. Penrith Central Business District (CBD) Detailed Overland Flow Flood Study (Cardno 2015)

e. Penrith City Council Development Control Plan - C3.5 Flood Planning 'Stormwater Drainage for Building Developments' Council document

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DISCUSSION

According to the figures shown in the Penrith CBD Detailed Overland Flow Flood Study, the proposed development appears to be located within the vicinity of an existing overland flow path traversing west through Tindale Street (upstream of the subject site). Figure 2 identifies the behaviour of the overland flow, which appears to be flowing towards the eastern boundary of the site where it is separated by a natural 'high point' in the site under existing conditions.

In the pre-development state, flood waters may enter the subject site but are directed away from the centre of the subject site by the natural ground "high spot" at the centre of the site, subsequently directing any potential floodwater towards the site boundaries. The pre-development flow behaviour is mimicked in the post development scenario with a "high spot" at the centre of the site. The proposed development structure is situated such that it is occupying the centre of the site (to be above the applicable flood planning level) and paved areas to be sloped towards the road reserve of Woodriff Street and Union Lane. **Thus the overland flows directed towards the site will not be significantly altered in the post development scenario**.

The location of the existing driveway (pre-development) at the southern boundary of the site will remain the 'low point' of the development in the post-development state. An *existing* raised pedestrian crossing with crest height 28.46m AHD inhibits (but does not block) flows entering the site at the southern boundary of the site in the pre-development state. Flows entering the site through the existing driveway flow through the site towards the multistorey parking development adjacent the subject site. This is to be reflected in the post-development scenario, with the proposed raised pedestrian crossing platform to be similar in height and location to the existing crossing. In order to prevent indefinite ponding of water on the subject site, adequate drainage is to be provided within the southern driveway area, which is to accommodate flows in minor storm events. The ground floor of the proposed development has been designed to directed flows towards the Woodriff Street road reserve. Appropriate drainage is to be provided in the driveway area, however in the case that the drainage is unable to accommodate the flows entering in a major storm event, It is likely that the water will flow through the driveway area and towards at the entry point into the multi-story car park as currently in the pre-development state. See Figure 3.

The Penrith CBD Detailed Overland Flow Flood Study provides figures indicating the approximate depth of flows throughout the flood affected areas, as well as velocities and hazard categories. Flood velocity at the subject site appears to be predominantly below 0.25m/s but varies up to 0.5m/s during the 1% AEP storm event. With a maximum flow depth of 200mm, the theoretical maximum *velocity x depth* product of the overland flows would be $0.1m^2/s$ in a 1% AEP storm event. This value falls within the 'low hazard' as it is well below the adopted maximum value of $0.4m^2/s$ as noted in the New South Wales Floodplain Development Manual.

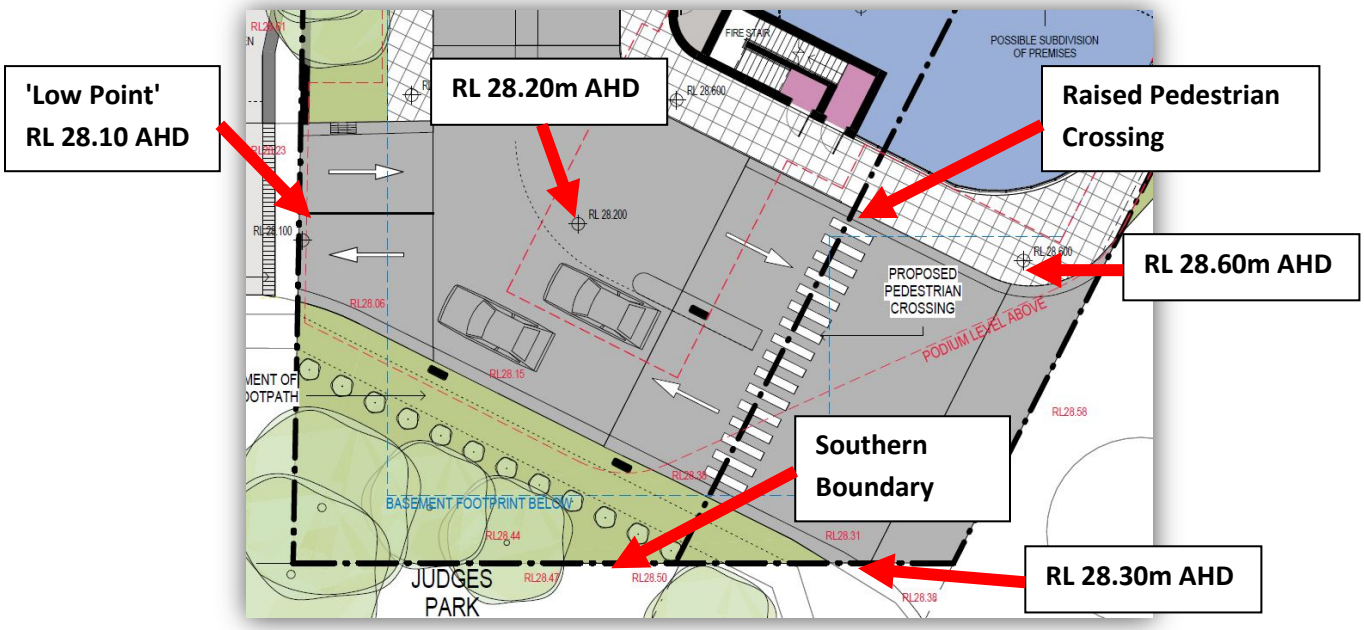

Figure 3: No.21-25 Woodriff Street, Penrith: DA Architectural Extract

Figure 3 is an extract taken from the DA Architectural Plans for the proposed development. Figure 3 depicts the proposed raised pedestrian crossing, reflecting the existing site conditions at the low point of the site. **It is thus deemed that overland flows in the post development scenario will behave in a similar manner to the pre-development state**.

In order to alleviate the issue of minor overland flows generated from the site during a severe storm event, the majority of the surface area of the site is to be directed via a "pit and pipe" system to an appropriate water quality treatment train, which is to discharge directly to the Woodriff Street road reserve. **Details are shown on Stormwater Management Plans prepared by Donovan Associates**.

FLOOD PLANNING CONTROLS

Penrith City Council's Development Control Plan (DCP) requires development proposals to have regard for a number of flood planning controls and objectives.

This Assessment has been prepared with the intention of demonstrating how the proposed residential development will meet the planning controls and objectives set by council.

Accordingly, the planning controls outlined in Penrith City Council DCP C3.5 - 'Flood Planning' are as follows;

Control: **The development will not increase the flood hazard or risk to other properties.**

Assessment: In reference to the flood information and flood mapping provided by council, it appears that the floodwaters will not alter significantly from pre development to post development state. 1% AEP flows in the vicinity of the proposed site may flow over the raised pedestrian crossing and into the site. However the behaviour of water will not be greatly affected by the increased plan area of the development as there is an existing 'high point' within the site. Furthermore the overland regime will be directed towards the road reserves of Woodriff Street and Union Lane, reflecting the pre-development scenario.

It has been deemed that the proposed development will have minimal adverse impact on surrounding properties through the diversion, concentration or ponding of overland flows.

Control: **The structure of the proposed building works shall be adequate to deal with flooding situations.**

Assessment: An appropriately qualified structural engineer is to certify that the proposed development in waterproofed and can structurally withstand forces due to buoyancy, scour and debris up to the 1% AEP flood level plus 500mm freeboard - RL 29.20m AHD.

Control: **The proposed building materials are suitable.**

Assessment: All components of the proposed structure below RL 29.20m AHD are to be constructed of flood compatible materials. This particular control should be addressed by the architect and suitably qualified structural engineer. See Appendix C for table of flood compatible building materials.

Control: **The buildings are sited in the optimum position to avoid flood waters and allow safe flood access for evacuation.**

Assessment: In reference to the flood information and flood mapping provided by council, it appears that the floodwaters flow in a westerly direction. This is consistent with the positioning of the proposed structure, allowing the flows to traverse in a way that mimics the pre development state.

Crests have been provided in the driveways leading to basement parking at RL 28.80. In addition to this, appropriate drainage has been provided to prevent overland flows causing indefinite ponding of water on the developed site. In the event of a major storm event, the proposed paved and driveway areas of the ground floor of the developed site are to grade towards the road reserve.

Control: **The proposed development will not expose any resident to unacceptable levels of risk or any property to unreasonable damage.**

Assessment: In reference to the Penrith (CBD) Detailed Overland Flow Flood Study, the *depth x velocity* of overland flow in the vicinity of the proposed development is considered to be 'low hazard' as defined by the New South Wales Floodplain Development Manual. It is deemed that the proposed development will not expose any resident/customer of the development to unacceptable levels of risk or any property to unreasonable damage.

Control: **Compliance of any existing buildings with the Standard - Construction of Buildings in Flood Hazard Area and the accompanying handbook developed by the Australian Building Codes Board (2012).**

Assessment: All components of the proposed structure are to be constructed in compliance with all relevant building codes and Construction of Buildings in Flood Hazard Area documents.

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Furthermore, in accordance with Council's Document's 'Stormwater Drainage For Building Developments' and 'C3 Water Management' DCP, the following Freeboard requirements are applicable to the proposed development;

- Habitable Finished Floor level to be 500mm above 1% AEP top water level - no lower than RL29.20m AHD
- Non Habitable Floor level to be 100mm above 1% AEP top water level - no lower than RL28.80m AHD
- Crest in driveway to basement car park to be 300mm above 1% AEP top water level - no lower than RL28.80m AHD (as basement crest adjacent to western boundary where maximum flow level is 28.50m AHD)
- **Industrial/Commercial Finished Floor Level to be 300mm above 1% AEP top water level - no lower than RL29.00m AHD**

As the entire ground floor of the development is to be commercial, the proposed 300mm freeboard applies to the entire ground floor level. This proposed freeboard requirement is based on the following considerations having been addressed as per council's DCP - Part C3 *Water Management*;

i) The nature of the business carried out

As the commercial (ground) floor area of the proposed development is relatively small in area with 310m2 of potential retail area, cafe seating area, lobby area and loading bays and amenities, no critical business will be affected in such a way that will cause significant impact to the development or its residents.

ii) The frequency and depth of flooding

During any storm events the frequency of flooding will be relatively low. From all entry points into the building of the ground floor, a fall has been provided to either a drainage system or the road reserve. In addition the proposed development is to provide a minimum of 300mm freeboard to commercial/industrial areas in the 1% AEP. As such, the proposed commercial/industrial areas may only be affected in storm events greater than the 1% AEP storm event.

iii) The potential for personal and property loss

The proposed reduced freeboard to the commercial/industrial area is likely to have negligible impact on personal and property loss as the proposed FFL is to be a minimum 300mm above the overland flow level.

iv) The utility of the building for its proposed use

The proposed development incorporating the FFL 300mm above the overland flooding level maintains freeboard from the top water level as well as proving seamless transitioning into the streetscape in order to provide amenity for its residence, users and general public.

v) Whether the filling of the site or raising of the floor levels would render the development of the property unworkable or uneconomical

Further raising of the proposed finish floor level may impact the floodwaters flow regime as more extensive ramps would have to be provided from the boundaries to a higher floor level. As such, providing greater than 300mm freeboard may prove counterproductive in achieving Council's objective of not affecting the overland flow path.

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vi) Whether the raising of the floor levels would be out of character with the adjacent buildings

As aforementioned, further raising of the proposed finish floor level may impact the floodwaters flow regime as more extensive ramps would have to be provided from the boundaries to a higher floor level. This may be visually unsightly, however this consideration is not of critical concern.

vii) Any risk of pollution of water from storage or use of chemicals within the building

As the proposed FFL maintains a minimum of 300mm freeboard to the top water level of the 1% AEP overland flow, it is unlikely that there will be any risk of pollution stored on the proposed development ground floor.

CONCLUSION AND RECOMMENDATIONS

It is concluded that the proposed development at No.21-25 Woodriff Street, Penrith, generally meets planning controls and objectives as outlined in Penrith City Council's DCP and Stormwater 'Drainage for Building Developments (relating to Section 1.4 - Flooding)' guidelines. The above statement has been determined based on the following:

- The assessment of the aforementioned controls carried out in this report
- The flood levels provided by Council for the subject property in Council's Flood Level Enquiry
- The Penrith (CBD) Detailed Overland Flow Flood Study

1. **Habitable finished floor levels are to be no lower than RL 29.20m AHD**
2. **Commercial floor levels are to be no lower than RL 29.00m AHD**
3. **Non habitable floor levels are to be no lower than RL 28.80m AHD**
4. **Driveway crest leading to basement parking is to be no lower than RL 28.80m AHD**
5. **This report is to be read in conjunction with Stormwater Management Plans prepared by Donovan Associates**

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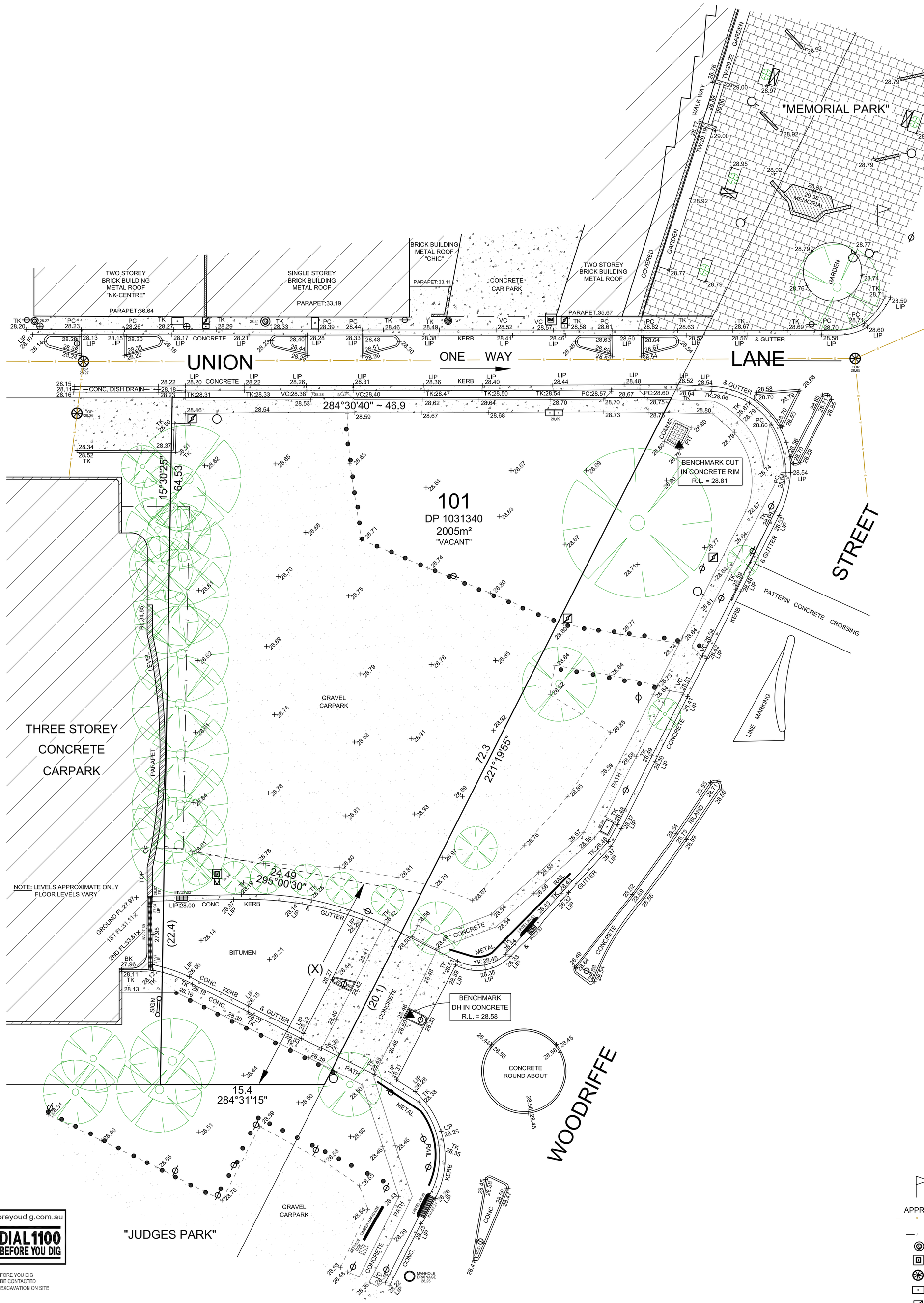
APPENDIX A

DETAILED SITE SURVEY

A1

CAD FILENAME: X:\2015-RHCO\15044 - 21-25 Woodriffe St, Penrith\ACAD\15044 - Woodriffe St, Penrith - detail survey.dwg



www.dialbeforeyoudig.com.au
DIAL 1100 BEFORE YOU DIG
TM
DIAL BEFORE YOU DIG SHOULD BE CONTACTED PRIOR TO ANY EXCAVATION ON SITE

NOTES :

1. THIS DETAIL SURVEY IS NOT A 'SURVEY' AS DEFINED BY THE SURVEYING & SPATIAL INFORMATION ACT, 2002.
2. DATUM OF LEVELS : AUSTRALIAN HEIGHT DATUM
3. ALL AREAS AND DIMENSIONS HAVE BEEN COMPILED FROM PLANS MADE AVAILABLE BY THE OFFICE OF LAND & PROPERTY INFORMATION (NSW) AND ARE SUBJECT TO FINAL SURVEY.
4. NO SEARCH MADE OF LOCATION AND NATURE OF TELEPHONE, ELECTRICITY, SEWER, WATER, GAS AND DRAINAGE RECORDS AT THE RELEVANT AUTHORITY. PRIOR TO ANY CONSTRUCTION THE RELEVANT AUTHORITY SHOULD BE CONTACTED FOR LOCATION OF SERVICES.
5. THE POSITION OF IMPROVEMENTS IN RELATION TO BOUNDARIES IS DIAGRAMMATIC ONLY.
6. VISIBLE, ACCESSIBLE SERVICES LOCATED ONLY
7. SIGNIFICANT TREES LOCATED ONLY.
8. NEIGHBOURING HOUSES, RIDGE AND ROOF POSITIONS ARE APPROXIMATE ONLY.
9. THIS TITLE BLOCK AND NOTES IS AN INTEGRAL PART OF THIS DRAWING WHICH IS NOT TO BE REMOVED.
10. CONTOURS ARE INDICATIVE ONLY. SPOT LEVELS SHOULD BE USED FOR CALCULATIONS OF QUANTITIES WITH CAUTION.

(X) - RIGHT OF CARRIAGEWAY AND EASEMENT FOR SERVICES VARIABLE WIDTH LIMITED IN HEIGHT TO 31.0m AHD.

1:200

5 0 5 10 15 20 25

METRES

- FLAG POLE
- APPROX. SEWER LINE
- FENCE LINE
- GAS
- FIRE HYDRANT
- SEWER MANHOLE
- COMMS. PIT
- ELEC. BOX
- LIGHT POLE
- SIGN POST
- POWER POLE
- SEWER INSPECTION POINT
- BOLLARD
- PARK BENCH

VC	DENOTES VEHICULAR CROSSING
TK	DENOTES LEVEL AT TOP OF KERB
LIP	DENOTES LEVEL AT LIP OF KERB
PC	DENOTES PRAM CROSSING
LIN	DENOTES LEVEL AT TOP OF LINTEL

RICHARD HOGAN & CO. PTY LTD
SURVEYING & DEVELOPMENT CONSULTANTS
A.B.N. 59 082 453 165
P.O. BOX 4365, PENRITH PLAZA, NSW 2750.
PHONE: (02) 4732 6599 FAX: (02) 4732 6699 MOB.: 0416 - 021 222
EMAIL: admin@hoganco.com.au

SURVEYOR: TZ
DRAWN: TZ
REDUCTION RATIO: 1:200
CONTOUR INTERVAL: N/A
SHEET 1 OF 1

ORIGIN OF LEVELS:
PM 12636
RL = 28.472 (DP 1031340)
DATUM: AUSTRALIAN HEIGHT DATUM
DATE: 05/02/2015
VERSION No.: A

PLAN OF DETAIL AND LEVELS OVER
LOT 101 IN DP 1031340
WOODRIFFE STREET, PENRITH

CLIENT: SHRUMPF
L.G.A.: PENRITH
JOB REF: 15044

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APPENDIX B

FLOOD LEVEL ENQUIRY

PENRITH

Our reference: ECM 7060489
Contact: Ratnam Thilliyar
Telephone: 4732 7988

10 March 2016

Mr Ivica Djuric
PO BOX 170
POTTS POINT NSW 1335

Dear Mr Djuric

Flood Level Enquiry
Lot 101 DP 1031340 No. 21-25 Woodriff Street Penrith

Please find enclosed Flood Level information for the above property.

Should you require any further information please do not hesitate to contact me on 4732 7988.

Yours sincerely

Ratnam Thilliyar
Engineering Stormwater Supervisor

Penrith City Council
PO Box 60, Penrith
NSW 2751 Australia
T 4732 7777
F 4732 7958
penrithcity.nsw.gov.au

PENRITH
CITY COUNCIL

Flood Information
Lot 101 DP 1031340 No. 21-25 Woodriff Street Penrith

Date of issue: 10 March 2016

The 1% AEP local overland flow flood levels affecting the above property are estimated to be RL28.7m AHD at eastern boundary and RL28.5m AHD at western boundary. These flood levels are based on Penrith Central Business District (CBD) Detailed Overland Flow Flood Study (Cardno 2015).

Property less than 0.5m above the 1% AEP flood level is subject to Penrith Development Control Plan 2014 Section C3.5 Flood Planning. The Penrith Development Control Plan 2014 is available from Council's website www.penrithcity.nsw.gov.au.

Definitions

AEP – *Annual Exceedance Probability* – the chance of a flood of this size occurring in any one year.

AHD – *Australian Height Datum* – A standard level datum used throughout Australia, approximately equivalent to mean sea level.

Legend

	Extent of 1% AEP local catchment overland flow path. Generally depths less than 150mm is not shown.

Notes:

1. The contours shown above in yellow numbering are at 0.5m intervals and are based on Aerial Laser Scanning (ALS) Survey undertaken in 2002. The contour levels are approximate and for general information only. Accurate ground levels should be obtained by a Registered Surveyor.
2. The flood level is based on current information available to Council at the date of issue. The flood level may change in the future if new information becomes available. The 1% AEP flood is the flood adopted by Council for planning controls. Rarer and more extreme flood events will have a greater effect on the property.
3. Council's studies are reflected in flood mapping for the City which show properties potentially affected by overland flows in excess of 150mm.
4. This property is shown on Council's flood mapping as potentially so affected.
5. Council imposes flood related development controls where, in its opinion, such controls are justified. Such controls may or may not be imposed with respect to this property in the event of an application for development consent.
6. If a development proposal is submitted with respect to this property, Council will consider the possibility of flood or overland flow in the context of the application. Council may impose a requirement that the applicant for development consent carry out a detailed assessment of the possible overland water flows affecting the property (a flood study) and/or may impose other controls on any development designed to ameliorate flood risk.
7. You are strongly advised if you propose to carry out development upon the property, that you retain the assistance of an experienced flooding engineer and have carried out a detailed investigation.
8. Council accepts no liability for the accuracy of the flood levels (or any other data) contained in this certificate, having regard to the information disclosed in Notes "1" to "3". As such you should carry out and rely upon your own investigations.

Penrith City Council
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Ratnam Thilliyar
Engineering Stormwater Supervisor

PENRITH CITY COUNCIL

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APPENDIX C

FLOOD COMPATIBLE MATERIALS

Building Component	Flood Compatible Material	Building Component	Flood Compatible Material
Flooring and Sub Floor Structure	• pier and beam construction or • suspended reinforced concrete slab	**Doors**	• solid panel with waterproof adhesives • flush door with marine ply filled with closed cell foam • painted material construction • aluminium or galvanised steel frame
Floor Covering	• clay tiles • concrete, precast or in situ • concrete tiles • epoxy, formed-in-place • mastic flooring, formed-in-place • rubber sheets or tiles with chemical set adhesive • silicone floors formed-in-place • vinyl sheets or tiles with chemical-set adhesive • ceramic tiles, fixed with mortar or chemical set adhesive • asphalt tiles, fixed with water resistant adhesive • removable rubber-backed carpet	**Wall and Ceiling Linings**	• brick, face or glazed • clay tile glazed in waterproof mortar • concrete • concrete block • steel with waterproof applications • stone, natural solid or veneer, waterproof grout • glass blocks • glass • plastic sheeting or wall with waterproof adhesive
Wall Structure	solid brickwork, blockwork, reinforced, concrete or mass concrete	**Insulation**	• foam or closed cell types
Windows	Aluminium frame with stainless steel or brass rollers	**Nails, Bolts, Hinges and Fittings**	• galvanised • removable pin hinges