Hydrogeological Assessment for 614 – 632 High Street, Penrith NSW

Land and Environment Court Sydney Proceedings 2021/00355201 - Urban Apartments Pty Ltd vs Penrith City Council

Final Report

P2208845JR01V01.docx

May 2022

Report Prepared by Ralph Erni for Urban Development Pty Ltd

environmental science & engineering

Project Details

Report Title	Hydrogeological Assessment for 614 – 632 High Street, Penrith NSW: Land and Environment Court Sydney Proceedings 2021/00355201 - Urban Apartments Pty Ltd vs Penrith City Council
Client	Urban Development Pty Ltd
Document	P2208845JR01V01.docx
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Document History

Issue	Issue Date	Status	Description / Comment	Author
1	20/05/2022	Review	Hydrogeological Advice	RE
2	27/05/2022	Final	Hydrogeological Advice	RE

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Contents

Tables

Figures

1 Introduction

1.1 Instructions

I have prepared this report in response to the Land and Environment Court of NSW (LEC) directions made in the Short Minutes of Order for case number 2021/00355201 in particular direction 1 (e) i to ii (relevant pages included at Appendix A):

Respondent's statement of facts and contentions

(i) Contention 19: 'Earthworks' (the parties' hydrogeologist are to confer on this contention insofar as it relates to hydrogeology);

(ii) Contention B2(g): '[A]quifer interference' (the parties' hydrogeologist are to confer on this contention insofar as it relates to hydrogeology);

(iii) Contention B2(m): '[G]eotechnical report';

I understand that a geotechnical report will be prepared by others to address direction 1(e) iii.

My opinions are based on my specialised training, study and experience as outlined in Section 1.4 of this report.

1.2 1.3 Expert Witness Code of Conduct

I have read part 31 of Division 2 of the Uniform Civil Procedure Rules 2005, Schedule 7 of the Uniform Civil Procedure Rules 2005. I understand my obligations to the Court and agree to abide by the rules in Part 31 and Schedule 7, as well as the Local Court expert witness policies.

1.3 1.4 Ralph Erni - Experience

I am a principal geotechnical engineer with some 28 years of industry experience. I am a certified practicing engineer (CPEng) in the disciplines of Civil and Geotechnical Engineering, currently on the National Engineers Register (NER) and a Member of the Institution of Engineers Australia (MIEAust).

I have undertaken or supervised many geotechnical and hydrogeological engineering investigations and carried out assessment and designs in the South Africa, UK, Hong Kong and Australia on behalf of both private organisations and various government departments, including assessments for deep basement construction.

I have provided expert testimony in legal proceedings relating to my various fields of expertise in the NSW Land and Environment Court and NSW Supreme Court.

A copy of my curriculum vitae is provided at Appendix B.

1.4 Background

1.4.1 Development Application

A development application (DA20/0167) was lodged with Penrith City Council (**Council**) for a 7 storey and part 46 storey mixed use development, including a 4 storey podium and single level basement car park, at Lot 10 in DP1162271 known as 614-632 High Street, Penrith NSW (the **Site**).

The applicant relied on architectural drawings by DKO Architecture (NSW) Pty Ltd in their development application (**DKO 2021**).

On 4 June 2021 Council issued a Notice of Determination refusing the development application.

On 15 December 2021 a Class 1 application was filed with the Land and Environment Court (**LEC**). Statement of Facts and Contentions (**SOFAC**) were filed by the LEC on 18 February 2022. Applicant's Statement of Facts and Contentions in Reply (**SOFACR**) were filed by the LEC on 8 March 2022.

The applicant is relying on amended architectural drawings by DKO in their application (**DKO 2022**), with the development proposal including:

- Four levels of podium car parking.
- A ground floor finished floor level (FFL): 27.6 mAHD.
- Proposed single basement FFL: 24.4 mAHD.

Based on existing ground levels (site survey by SDG, 2019, included at Appendix C) between approximately 27.1 and 27.6 meters above the Australian Height Datum (mAHD) and a bulk excavation level (BEL) of 24.1 mAHD, assuming 0.3 m thick floor slab, excavations to between 3 m and 3.5 m below ground level (mbgl) are expected.

1.4.2 Previous Assessment Reports Relied Upon

Geotechnical / environmental assessment reports previously prepared for site development, available for Martens review, included:

1. Cardno (2019), *Flood Impact Assessment 614-632 High St, Penrith*, reference AWE200065, dated 19 November 2019 (**Cardno 2019**).
2. Benviron Group (2019), *Detailed Site Investigation; 614-632 High Street, Penrith NSW*, reference E638, dated December 2019 (**Benviron 2019**).
3. EIAustralia (2019), *Geotechnical Investigation 614-632 High Street, Penrith*, reference E24300.G03_Rev0, dated 9 August 2019 (**EIAustralia 2019**).
4. EIAustralia (2020), *Additional Groundwater Investigation 614-632 High Street, Penrith NSW*, reference E24300.E03_Rev0, dated 30 January 2020 (**EIAustralia 2020**).

5. EIAustralia (2021), *Remediation Action Plan 614-632 High Street, Penrith NSW*, reference E24300.E06_Rev01, dated 7 April 2021 (**EIAustralia 2021**).

The above reports were prepared based on an above ground development, i.e. without a basement level.

1.4.3 Regulatory Framework and Guidelines

The following regulations and guidelines were considered:

1. NSW Department of Planning, Industry and Environment (DPIE, 2021), *Minimum requirements for building site groundwater investigations and reporting, Information for developers and consultants*, reference PUB20/940, published January 2021 (**DPIE 2021**).

2. Penrith Local Environmental Plan 2010 (**PLEP**), Clause 7.1.

3. Penrith Development Control Plan 2014 (**PDCP**), Clauses:

    - C10 10.5.1 Control 1
    - C10 10.5.1 Control 2
    - E11 11.4.2 Control 1
    - E11 11.4.2 Control 2

4. Sydney Water Corporation (SWC), *Specialist Engineering Assessment*, reference D0001870 Version No. 1, issued 19/02/2021 (**SWC SEA**).

1.4.4 Other Documents

I have reviewed the following documents, prepared for other developments in the vicinity of the site or providing information on surrounding asset locations, for the purpose of attaining an appreciation of site conditions:

1. Alliance Geotechnical (2019), *Geotechnical Investigation and Monitoring Report Proposed Multi-Level Car Park Soper Place, Penrith NSW 2750*, reference 9338-GR-1-1, dated 17 December 2019 (**AG 2019**).

2. DBYD plans, in particular Sydney Water Corporation asset, DBYD Job No. 31927396 Sequence No. 211274914 produced on 12/05/2022 (**DBYD SWC Plan**, attached as Appendix C).

Other previous reports prepared for site development but not available for review include:

1. Geotechnique (2007), *Contamination Assessment; 616 High Street, Penrith NSW*, reference 11437/1-AA, dated 16 July 2007.

   EIAustralia reports have considered the results of the Geotechnique assessment in preparing their reports. I have assumed for the purpose of this assessment the Geotechnique findings to be correct.

2 Hydrogeological Assessment

2.1 Assessment Objectives and Scope of Works

I understand the objectives of this hydrogeological assessment in addressing the hydrogeological related contentions of the SOFAC included assessing the following:

1. Feasibility of a single basement for the development.
2. Feasibility of additional basement levels for the development.
3. Implications of more than 1 basement level on the development, including:
    a. Likelihood of a multi level basement intercepting groundwater.
    b. Development risks of intercepting groundwater, including design and construction implications, such as excavation and excavation support and groundwater management requirements for basement construction, based on expected groundwater levels at the site.
    c. Necessary approvals where required, i.e. by WaterNSW and DPIE.

This hydrogeological assessment included:

1. Review of relevant guidelines (i.e. PDCP, PLEP and NSW Government guidelines).
2. Review of publicly available documents, aerial imagery and databases.
3. Review of relevant reports provided by the client.

I have not reproduced site details and investigation findings by others in this report except where necessary, where further discussion is warranted or for ease of reference.

2.2 Ground Conditions

2.2.1 Ground Profile

EIAustralia 2020 presents a generalised ground profile at the site, reproduced as Table 1 below and adopted for this assessment: [1]

Table 1: Generalised ground profile (reproduced from EIAustralia 2020).

Unit	Material	Depth to Top of Unit (m BEGL)	Observed thickness	Comments
1	Fill	Surface	0.2 to 1.2	Silty sand Fill, usually with fine to medium gravels and rootlets; poorly compacted
2a	Fluvial Soil (Silty Sand / Sandy Silt)	0.2 to 1.2	1.9 to 3.0	Fine to medium grained silty sand and low plasticity silt / sandy silt. SPT values ranged from 4 to 11. Note 1
2b	Fluvial Soil (Sandy Gravel)	2.3 to 3.5	9.4 to 10.7	Sandy Gravels, medium to coarse, sub-angular to sub-rounded, with silt. Notes 2 and 3
3	Low to Medium Strength Shale	12.9 to 13.0	2.1 to 3.2	Low to medium strength slightly weathered to fresh shale. Unit 4 was overlain by up to 350 mm of distinctly weathered, very low to low strength shale.
4	High Strength Shale	15.0 to 16.2	-	High strength, fresh shale.

Notes:

[1] SPT values suggest fluvial soils to be very loose to medium dense or soft to firm to between approximately 2.3 m and 3.5 mbgl.

[2] Borehole log descriptions included presence of cobbles and boulders in places.

[3] A rock roller and NMLC rock coring techniques were required to drill through the gravel layer (unit 2b). From my experience, this is not unusual given the typically very to extremely high strength of the quartz river gravels present within the Nepean River basin soil profile.

2.2.2 Ground Permeability

Site soils were assessed as highly permeable. [2] Hydraulic conductivities for silty sand and sandy gravel typically vary from 10^{-6} to 10^{-2} m/s (equivalent to 10,000 to 10^{-3} m/day). [3]

[1] EIAustralia 2019, Section 3.1, Table 3.1, page 5.

[2] EIAustralia 2019, Section 3.3 (below Table 3-3), page 6.

[3] R. A. Freeze, J. A. Cherry (1979), Groundwater, *Prentice-Hall*, Table 2.2, page 29.

2.3 Groundwater Conditions

2.3.1 Groundwater Level Measurements

Previously assessed groundwater level measurements are summarised in Table 2 below:

Table 2: Summary of groundwater observations (by others).

BH/MW ID	Measurement Period	GSL [4], [5] (mAHD)	SWL (mbgl)	SWL (mAHD)	Comments
Geotechnique 2007 MW01 [6]	2007	27.1	7.8	19.3	Note 1
EIAustralia BH1M [7] [8]	22 July 2019	27.7	7.8	19.9	Note 2
	25 July 2019		8.0	19.7	
	17 January 2020		5.78	21.92	Note 3
EIAustralia BH3M [9] [8]	25 July 2019	27.1	7.5	19.6	Note 2
	17 January 2020		5.5	21.6	Note 3
Alliance[10] BH101	10 October 2019 to 10 December 2019	32	7.8 to 9.1	24.2 to 22.9	Groundwater level in rock. No seepage into borehole during borehole drilling
Alliance BH102		31	7.8 to 8.1	23.2 to 22.9	Groundwater level in Alluvial clay. Seepage at 13 mbgl (18 mAHD) during borehole drilling
Alliance BH103		30	7.7 to 8.0	22.3 to 22	Groundwater level in Alluvium. Seepage at 8 mbgl (21.5 mAHD) during borehole drilling

Notes:

[1] Specific measurement period not known.

[2] Total July 2019 rainfall: 15.2 mm (refer BOM rainfall data for station Penrith Lakes AWS, Appendix E).

[3] Total January 2020 rainfall: 82 mm (refer BOM rainfall data for station Penrith Lakes AWS, Appendix E).

[4] Cardno 2019, Appendix B Site Survey by SDG,

[5] AG 2019, Borehole log attachments.

[6] EIAustralia 2021, Section 3.1 Table 3.1 row DSI (Benviron, 2019), Principal Findings, page 6, fourth dot point.

[7] EIAustralia 2020, Appendix C – Borehole Logs MW NO. BH1M.

[8] EIAustralia 2020, Section 8.1.2 Table 8.2, page 21.

[9] EIAustralia 2020, Appendix C – Borehole Logs MW NO. BH3M.

[10] AG 2019, Section 4 page 2 and borehole log attachments. Boreholes located 900 m east of site.

2.3.2 Groundwater Monitoring Bores

A review of the WaterNSW groundwater monitoring bore database identified 5 bores with relevant data located within 1.2 km of the site (refer to Figure 1 for monitoring bore locations). Bore data is summarised in Table 3 below.

Table 3: Summary of groundwater level data from WaterNSW groundwater bores within 1.2 km of the site.

Bore Number	Approximate Distance From Site (m)	Groundwater Standing Level (mbgl)	Water Bearing Zone Substrate
GW029710	230	7.9	Sand
GW101178	405	8.0	Gravel
GW103048	560	6.0	ND [1]
GW026231	840	8.5	Gravel
GW108041	1150	7.5	Gravel

Notes:

[1] ND = No data available.

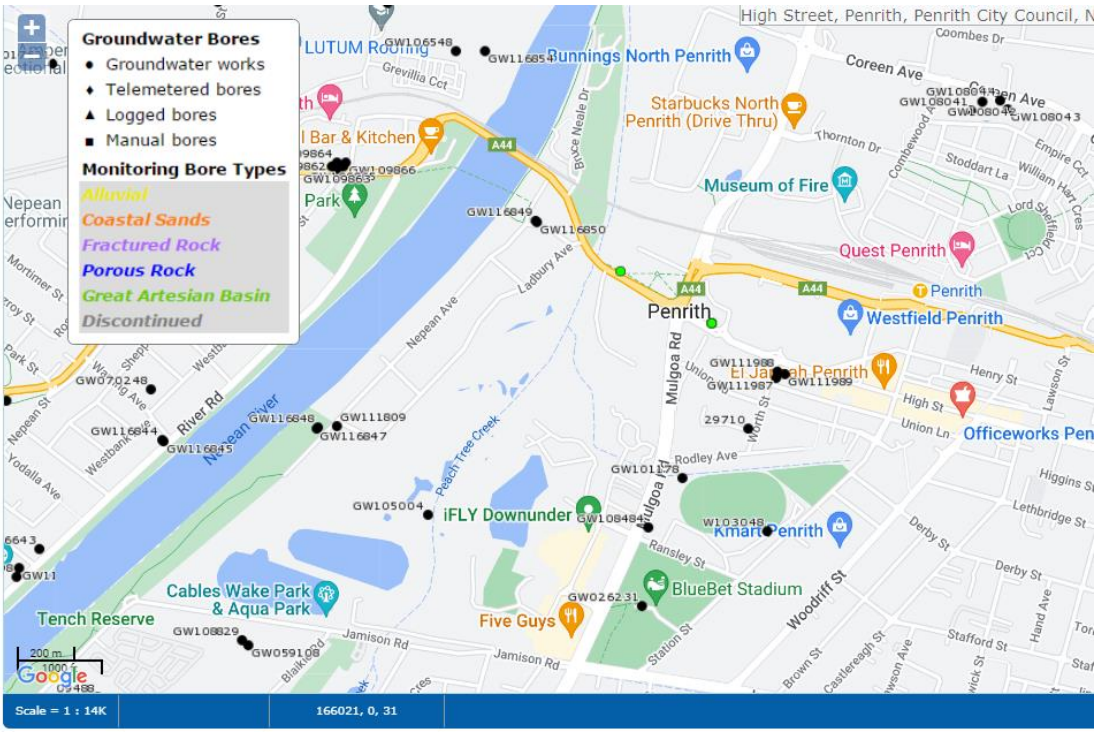

Figure 1: Groundwater bore data from WaterNSW groundwater bore database.

A groundwater level of 22.4 mAHD (5 mbgl) has been adopted, allowing for a 0.5 m variation to groundwater levels measured to date.

2.3.3 Groundwater Contamination

Laboratory testing undertaken by EIAustralia indicate concentrations of copper, nickel, zinc and TRH F3 at levels marginally exceeding ecological criteria. EIAustraila consider that:

1. Copper, nickel, zinc and TRH F3 concentrations in groundwater exceeded the ANZG (2018) Fresh Water Criteria.

2. The heavy metal concentrations are representative of, or at least consistent with, background conditions for urban (Sydney metropolitan) areas, including Penrith.

3. Detected TRH concentrations likely originated from former USTs, known to have been removed from the site in 1996.

4. Given the more than 500 m of the nearest surface water feature to where groundwater is likely to flow, heavy metals and TRH concentrations will likely attenuate prior to reaching the sensitive environmental receptors.

On the basis of no basement having been included in the development, EIAustralia conclude:

- *The heavy metal concentrations* 'are' *not considered to pose a human health risk due to the lack of exposure pathways, including extraction for local use (domestic / irrigation / industrial) was not identified and groundwater will not be disturbed during redevelopment as* 'no' *basement excavations are proposed.*

- *The groundwater quality identified at the site presents a low human health and environmental risk and is suitable for the proposed mixed residential and commercial towers with above ground car parking.*

2.4 Flood Impacts

The current site has a finished ground floor level of 27.55 mAHD, with habitable rooms commencing from Level 4 with finished level of 44.75 mAHD. [11]

Flood models indicate the current site will not be inundated by flooding in a 1 % AEP event with a peak flood level of 27.05 mAHD. [12]

A PMF event peak flood level is estimated to be 28.10 mAHD for local overland flood events and 32.9 mAHD for Hawkesbury-Nepean riverine flood events. [13]

[11] Tab 36 – Cardno Flood Impact Assessment, page 8, Table 4-1.

[12] Tab 36 – Cardno Flood Impact Assessment, page 6, Table 3-1

[13] Tab 36 – Cardno Flood Impact Assessment, page 9.

If basement carpark levels are undergrounded and habitable rooms are lowered, it may result in:

- Habitable rooms becoming inundated under occurrence of the PMF event.
- Implementation of evacuation strategies requiring residents to travel and temporarily shelter in other residential floors, causing stress and anxiety.
- Basement carpark levels will be inundated under 1 % AEP and PMF flood events, requiring a flood management plan.
- Increased risks to basement users as basement levels are increased in flood events. Flood mitigation measures would need to be re-evaluated based on the adopted number of basement levels.

3 Discussions

3.1 Single Level Basement

I consider a single level basement to be feasible for the site subject to the inclusion of appropriate geotechnical risk management.

3.2 Multi Level Basement

3.2.1 Overview

I consider multi level basements to be feasible for the site subject to the inclusion of appropriate geotechnical and hydrogeological risk management. However, I am of the opinion that excavations below groundwater level will significantly increase the geotechnical and hydrogeological risks. As the basement depth increases these risks will escalate. Further discussions are presented in the following sections.

3.2.2 Excavations

Bulk excavation for a multi level basement is expected to encounter:

1. Very loose and loose silty sand fill and fluvial silty sand / sandy silt to between approximately 1.9 m and 3 mbgl.
2. Fluvial sandy gravel, from between approximately 2.3 m and 3.5 mbgl. Based on my experience with Nepean River deposits, these typically subangular to subrounded gravels (and potentially cobbles) comprise very high strength Quartz and are present in lenses of variable extent and depth.
3. Groundwater from approximately 5 m depth.

The silty sand / sandy silt should be readily excavated using conventional tracked earthmoving equipment fitted with a mud bucket.

Bulk and pile excavation methodologies will need to consider the increased potential of very high strength Quartz gravels and possibly cobbles being present from 2.3 mbgl up to BEL. A 'toothed' bucket may be required to excavate the sandy gravel for basement excavations. Their presence can have a significant impact on pile excavations, such as:

- Hampering casing installation for bored piles, i.e. high casing penetration resistance.
- High potential for cobbles to deflect piling rig augers resulting in piles deviating from vertical.
- Over excavation due to the loosening and collapse of cobbles and boulders into uncased excavations.

Groundwater dewatering will be required for basement excavation. Dewatering strategies will need to be developed. These should need to limit adverse impacts on surround land and infrastructure as well as manage the risks resulting from hydrostatic pressures on excavation shoring / retaining structures and excavation / basement floors.

The deeper the bulk excavation, the more important will be the verticality of contiguous and secant perimeter piles to reduce construction and waterproofing risks associated with the increasing gaps between piles. Plugging of gaps may be possible under low hydrostatic pressure and narrow gaps. Plugging will rapidly become more difficult / impossible at depth particularly as gaps widen.

3.2.3 Excavation Impacts

The DBYD SWC Plan indicates the following SWC assets are located in close proximity to the site:

- A 150 mm diameter vitrified clay (VC) pipe along Union Lane to the south, with invert levels of between approximately 2.6 m and 3.73 mbgl.
- A 225 mm diameter cast iron cement lined (CICL) pipe along High Street to the north.

The zone of influence is defined as an area of soil below a hypothetical line extending down and away from the base of the feature in question at a nominal angle for sands of 30º below a horizontal line. Excavations into this area could lead to lateral deflection of excavation faces and associated settlement of existing ground surfaces and / or structural elements behind the excavation.

Proposed bulk excavations will extend into the zone of influence of common property boundaries and nearby existing infrastructure such as SWC assets. Excavations are therefore to be shored and permanently supported.

The risk of impact will increase as excavation depth increases i.e. excavation extends further below the zone of influence of the infrastructures / assets Excavations extending below groundwater level and groundwater dewatering will further increase risk of impact due to associated ground settlement potential.

In my experience, SWC is likely to request an assessment be undertaken of impacts on their assets due to construction of the proposed development, particularly for the multi level basement configuration. Design and construction methodologies are to ensure no adverse impacts on these assets.

Dilapidation surveys of adjacent structures and infrastructure are recommended to be carried out prior to excavation and following completion of the development for clear identification of damage caused by the excavation process.

3.2.4 Excavation Support

Temporary shoring and permanent retention should seek to reduce potential excavation induced impacts on surrounding land and infrastructure. I recommend the use of contiguous or secant pile or diaphragm walls.

Owing to the potentially collapsible nature of the soil profile and groundwater levels at the site, I recommend piles (contiguous or other) are constructed using:

- A continuous flight auger (cfa) grout injecting piling rig.
- Bored piles using auger attachments to an excavator, with liners installed during boring to prevent soil collapse into excavations and manage groundwater inflows.

Development of pile designs and construction methodologies will need to consider:

- The presence of very high strength gravel and potential cobbles, which is expected to hamper liner installation and pile boring.
- Impacts on groundwater 'through-flow' beneath the basement, which can be limited by staggering shoring pile depths.
- Making an allowance for 'making good' gaps between contiguous shoring piles in order to prevent loss of retained soils and groundwater inflow and subsequent induced movements of retained ground.

Shoring and retaining walls may be designed as cantilevered walls, with sufficient socket length below BEL to achieve the desired lateral restraint and limit groundwater inflows during basement excavation and construction. Pile depths may be reduced with:

- Temporary tieback anchors or internal props and bracing during construction.
- Permanent bracing provided by building slabs.

Permission will need to be sought from land owners or stakeholders for installation of any ground anchors that extend beyond site boundaries.

Shoring and retaining wall design should consider additional surcharge loading from:

- Existing and proposed structures.
- Construction equipment.
- Vehicle traffic.
- Backfill compaction.
- Static water pressures and water pressure fluctuations.

3.2.5 Groundwater Management

3.2.5.1 Groundwater dewatering

Bulk excavations will encounter groundwater at approximately 1.5 m above BEL for a multi level basement. A high groundwater inflow rate is likely to be experienced within the fluvial profile during excavation, including upward seepage within the base.

Piping failures or 'quick' conditions have been known to occur during excavation in sands, even immediately above the groundwater level. The critical hydraulic gradient is not to be reached during excavation and dewatering. This can occur when the effective stress in the sand is reduced to zero due to the upward flow of water in the base. Groundwater dewatering will be required to reduce the groundwater level to at least 2 m below bulk excavation level for basement excavation and construction to be completed.

A dewatering management plan must be prepared. Dewatering requirements can be mitigated against by:

- Installing 'cut off' walls to increase the groundwater flow path length, e.g. by increasing the perimeter wall length or extending the perimeter pile wall to rock.
- Basement tanking.

Owing to the highly permeable soil profile, dewatering for multi level basement excavation will require the use of cut off walls along the basement perimeter. This will impact on natural groundwater flow conditions.

3.2.5.2 Groundwater interference

Construction activities associated with the multi level basement are considered 'aquifer interference activities' in accordance with the NSW DPIE as they:

- Penetrate an aquifer.
- Interfere with water in an aquifer.
- Obstruct water flow in an aquifer.
- Take water from an aquifer.
- Dispose of water taken from an aquifer.

Furthermore, the project is considered to be a high risk project in accordance with the NSW DPIE as it requires:

- Construction dewatering.
- Injection works.
- Potential activities that can damage the structural integrity of an aquifer.

NSW DPIE requires development applicants to seek the appropriate authorisation before commencing construction, including:

- One or more water access licenses.
- Aquifer interference license.

I note that the NSW DPIE indicates that:

1. "Getting development consent does not automatically include permission to take groundwater".
2. Developers must submit a request for a variation to the minimum requirements "at least six months before lodgement of each development or license application".

3.2.5.3 Impacts on surroundings

Groundwater drawdown during temporary dewatering can lead to settlement of adjacent land, shallow building foundations and infrastructure. The amount of settlement would depend on a number of factors including:

- Depth of excavation.
- Depth of drawdown.
- Cone of drawdown impact, which increases with depths and is dependent on aquifer conditions, including soil permeability.
- Duration of drawdown.
- Compressibility of the soil.

The amount of drawdown may be limited by the use of a cut-off wall and / or groundwater recharging. Groundwater wells should be installed outside the excavation footprint to monitor groundwater levels during excavation and dewatering.

Further assessments will need to be undertaken of impacts on adjacent land, shallow building foundations and infrastructure due to construction of the proposed development, including groundwater drawdown.

Should basement perimeter walls extend to rock, this Is expected to result in permanent groundwater damming upgrade and reduction in groundwater levels downgrade of the development.

I expect the additional onerous requirements to limit impacts on surroundings, over and above the requirements associated with a single level basement, will impact the environment, add substantial risks and costs to the development and result in significant project delays.

3.2.6 Basement Tanking

The NSW DPIE asserts that basements should be watertight (fully tanked) for the life of the building.

Basement tanking design will need to consider:

- Groundwater level fluctuations considering the highly permeable soil profile.
- Hydrostatic pressures on basement walls and floor slabs, increasing proportionately with depth.
- Buoyancy, particularly following ceasing dewatering after basement construction and prior to building load application.
- Waterproofing requirements, which will increase in extent and associated risks with basement depth.

I expect the additional onerous requirements associated with tanking, over and above the requirements associated with a single level basement, will impact the environment, add substantial risks and costs to the development and result in significant project delays.

3.2.7 Additional Assessments

Additional comprehensive investigations into the groundwater system and further assessment requirements in accordance with NSW DPIE include:

1. Additional assessment before excavation to reasonably calculate the amount of groundwater likely to be taken. This should include:
    - Comprehensive water level monitoring that demonstrates the practical range of natural water level variation under wet and dry conditions.
    - Hydraulic conductivity testing
    - Groundwater quality testing.
    - Calculation of groundwater quantity using site specific data only.
    - Analytical or numerical hydrogeological computer modelling of potential dewatering impacts on surroundings.
2. Develop an accurate conceptual hydrological model for the project.
3. Identify potential adverse effects as a result of the groundwater take.
4. Prepare a geotechnical and hydrogeological monitoring plan to provide suitable monitoring during construction including location of instruments and trigger levels.

I note the period of monitoring pre development was not specified and could add significant delays to the project schedule. Groundwater monitoring wells are also required outside the basement footprint within neighbouring land to allow monitoring of groundwater levels and quality throughout the occupational phase of the building.

I expect the additional onerous groundwater assessment requirements, over and above the requirements associated with a single level basement, will add substantial costs to the development and result in significant project delays.

4 Conclusions

I conclude the following:

1. A single level basement is feasible for the site subject to the inclusion of appropriate geotechnical risk management.

2. A multi level basement may be feasible, although will be subject to inclusion of appropriate geotechnical and hydrogeological risk management and additional groundwater assessments. The multi level basement will be impacted by the following, the risk of which will increase with basement depth:

    a. Deeper excavations into highly permeable sandy gravel containing very high strength river gravels and cobbles.

    b. Permanent groundwater above BEL and basement base level. As a result, the project becomes a high risk project in accordance with the NSW DPIE, triggering the need for an aquifer interference license application. This application will require additional provisions in accordance with NSW DPIE prerequisites, including:

        - Further comprehensive water level monitoring, including monitoring well installation at the site and in surrounding land.
        - Extensive assessments to model natural water level variation under wet and dry conditions.
        - Hydraulic conductivity testing and calculation of groundwater dewatering quantities using site specific data only.
        - Analytical or numerical hydrogeological computer modelling of potential dewatering impacts on surroundings.
        - Preparation of a groundwater management plan to limit any adverse impacts on groundwater conditions and on surrounding land, structures and infrastructure.
        - Tanking of the basement.

    NSW DPIE's declares that "Getting development consent does not automatically include permission to take groundwater". Owing to the highly permeable soil profile, dewatering for multi level basement excavation will require the use of cut off walls along the basement perimeter. This will impact on natural groundwater flow conditions. In developing a plan to limit such impacts, to be reviewed and approved by NSW DPIE, it is not guaranteed that the plan will be accepted and approved by NSW DPIE.

3. Multi level basement construction, including groundwater drawdown, will impact on adjacent land, shallow building foundations and infrastructure. Further assessments will need to be undertaken to develop appropriate designs and construction methodologies to limit such impacts.

4. I expect the additional onerous groundwater assessments and management works required as a result of multi level basement excavations below groundwater level will result in additional project risks and substantial cost and project schedule impacts.

5 Resources

Alliance Geotechnical (2019), *Geotechnical Investigation and Monitoring Report Proposed Multi-Level Car Park Soper Place, Penrith NSW 2750*, reference 9338-GR-1-1, dated 17 December 2019.

Benviron Group (2019), Detailed Site Investigation; 614-632 High Street, Penrith NSW, reference E638, dated December 2019.

Bureau of Meteorology (BOM), http://www.bom.gov.au, accessed on 29 April 2022.

Cardno (2019), *Flood Impact Assessment 614-632 High St, Penrith*, reference AWE200065, dated 19 November 2019.

DKO Architecture (2021), Development Application drawings for reference project number 00012012, dated April 2021 (DKO 2021).

DKO Architecture (2021), Post S34 Hearing Issue drawings for reference project number 00012012, dated May 2022 (DKO 2022).

EIAustralia (2019), Geotechnical Investigation 614-632 High Street, Penrith, reference E24300.G03_Rev0, dated 9 August 2019.

EIAustralia (2020), *Additional Groundwater Investigation 614-632 High Street, Penrith NSW*, reference E24300.E03_Rev0, dated 30 January 2020.

EIAustralia (2021), *Remediation Action Plan 614-632 High Street, Penrith NSW*, reference E24300.E06_Rev01, dated 7 April 2021.

NSW Department of Planning, Industry and Environment (DPIE, 2021), *Minimum requirements for building site groundwater investigations and reporting, Information for developers and consultants,* reference PUB20/940, published January 2021.

Penrith Local Environmental Plan 2010.

Penrith Development Control Plan 2014.

SDG Land Development Solutions (2019), DETAIL AND LEVEL SURVEY OF LOT 36 IN DP731213, LOTS 12 & 13 IN DP717196, LOT 3 IN DP 242506, LOTS 1 & 2 IN DP1202310, LOT 1 IN DP5544302, LOTS 10 & 11 IN DP1162271, HIGH ST, PENRITH, NSW, Issue C dated 10 October 2019.

WaterNSW (2022) All Groundwater Map, https://realtimedata.waternsw.com.au/ accessed on 26 April 2022.

Appendix A – Letter of Instruction

SHORT MINUTES OF ORDER

COURT DETAILS	
Court	Land and Environment Court of New South Wales
Class	1
Case number	2021/00355201
TITLE OF PROCEEDINGS	
First Applicant	**Urban Apartments Pty Ltd**
Respondent	**Penrith City Centre**
FILING DETAILS	
Filed for	**Urban Apartments Pty Ltd, Applicant**
Legal representative	Aaron Gadiel Mills Oakley Level 7, 151 Clarence Street Sydney NSW 2000
Legal representative reference	AZGS/JZAS/3554691
Contact name and telephone	Julide Ayas, (02) 8035 7918
SHORT MINUTES OF ORDER	

The Court directs that:

1 Under rr 31.19 and 31.20 of the Uniform Civil Procedure Rules 2005 ("UCPR"), the Court makes the following directions regarding expert evidence:

(a) Peter Smith (Applicant's urban design expert) and Adam Byrne (Applicant's town planning expert) and Gabrielle Morrish (Respondent's urban design expert) and Nathan Croft (Respondent's town planning expert) are to confer in relation to the **town planning and urban design issues** arising from:

Respondent's statement of facts and contentions:

(i) Contention 1 'Design Competition';

(ii) Contention 2: 'Design Excellence';

(iii) Contention 3: 'Community Infrastructure Offer';

(iv) Contention 4: 'Height';

(v) Contention 5: 'Density, Bulk and Scale';

(vi) Contention 6: 'Design Principles';

(vii) Contention 7: 'Context and character of the area';

(c) Brett Phillips (Applicant's flood engineer) and Dean Dehghan-Khalaji (the Respondent's stormwater engineer) are to confer in relation to the **flooding** issues arising from:

Respondent's statement of facts and contentions

(i) Contention 8: 'Flood Planning'.

(ii) Contention B2(n): 'Evacuation Strategy',

under UCPR 31.24 and prepare a joint expert report.

The joint flood engineering report is to be filed and served by **20 June 2022**.

(d) Sam Haddad (Applicant's stormwater engineer) and Dean Dehghan-Khalaji (Respondent's stormwater expert) and Tim Gowing (Respondent's WSUD expert) are to confer in relation to the **stormwater and WSUD** issues arising from:

Respondent's statement of facts and contentions

(i) Contention 12: 'Water and Stormwater Management';

(ii) Contention 16: 'ESD';

(iii) Contention B2(c): 'WSUD Policy water conservation requirements';

(iv) Contention B2(f): '[C]ompliance with Penrith CBD Public Domain Technical Manual';

(v) Contention B2(p): 'HGL Analysis';

(vi) Contention B2(q): 'Amended Stormwater Concept Plans',

The joint stormwater and WSUD report is to be filed and served by **20 June 2022**.

(e) Sam Haddad (Applicant's civil engineer) and Daniel Martens (Applicant's hydrogeologist) and Kim Chan (the Respondent's geotechnical engineer and hydrogeologist) are to confer in relation to the hydrogeology and geotechnical issues arising from:

Respondent's statement of facts and contentions

(i) Contention 19: 'Earthworks' (the parties' hydrogeologist are to confer on this contention insofar as it relates to hydrogeology);

(ii) Contention B2(g): '[A]quifer interference' (the parties' hydrogeologist are to confer on this contention insofar as it relates to hydrogeology);

(iii) Contention B2(m): '[G]eotechnical report';

The joint hydrogeology and geotechnical report is to be filed and served by **20 June 2022**.

(f) Tony Guirguis (Applicant's contamination expert) and the Helen Bakker (Respondent's contamination expert) are to together confer in relation to the **contamination** issues arising from:

Respondent's statement of facts and contentions

(i) Contention 13 'Remediation of land';

Appendix B – CV of Ralph Erni

martens
consulting engineers since 1989

Curriculum Vitae

Qualifications

M.Eng Geotechnical, University of NSW, 2009

B.Sc. Civil Engineering, University of Cape Town, 1992

Certifications

CPEng NER (Civil, Geotech)

RPEQ (2021)

Professional Affiliations and Appointments

Member of:

Institute of Engineers Australia,

Australian Geomechanics Society

Australia Tunnelling Society

APEC Engineers

International Professional Engineers

Training

Senior First Aid (current)

Rail Industry Safety Induction (RISI) WR32 (current)

Confined space entry: (2020)

General Induction for Construction Work in NSW-Workcover NSW (2005).

Ausgrid – Substation Entry and Release and Rescue from Live Low Voltage Mains and Apparatus (2012)

Concrete Technology Modules 1, 2 – Portland Cement Institute School of Concrete Technology South Africa (1994)

Ralph Erni

Principal Geotechnical Engineer / Geotechnical Group Leader

Key Skills and Experience

Ralph joined Martens & Associates in July 2014 as Senior Geotechnical Engineer and Geotechnical Group Leader. His wide-ranging expertise in civil and geotechnical engineering stems from over 28 years local and international experience in both contracting and consulting environments. Ralph has developed excellent understanding of engineering involvement in projects from planning stage to detailed design and construction, including quality control and construction verification, from amongst others:

- Involvement in multidisciplinary civil engineering projects, e.g.: Lesotho Highlands Water Transfer Tunnel Project (South Africa); Clarence Court Quarry Redevelopment, Jersey Heritage Trust (Jersey, UK); Parramatta Rail Link pre-tender conceptual design; M7 Motorway design and construction; and Pacific and Great Western Highway upgrades;
- Managing geotechnical, environmental and laboratory services within large and mid-tier consultancies.
- Managing and supervising teams of geotechnical engineers, environmental scientists, laboratory staff, factory workers and construction workers;
- Managing numerous concurrent projects, including resources, OH&S, budgets, schedules;
- Carrying out and managing geotechnical investigations, risk assessments and design development, at times in combination with contaminated site assessments;
- Supervision and verification of construction works, including excavations, shallow footing and deep pile construction, dam liner installation, shotcrete placement, underbore construction, cast in-situ concrete tunnel segmental lining construction and quality control testing of concrete, earthworks placement and water;
- Technical reviewing of geotechnical deliverables;
- Developing and maintaining clientele within local and state governments and private sectors, including consultants, contractors, architects and lawyers.

Fields of specialisation include:

- Land development, including commercial, industrial and residential subdivision, single lot development and multi-storey development;
- Infrastructure development, including tunnels, roads, dams, telecommunication and power supply and transmission networks; greenfield and upgrade of power substations;
- Rock and soil slope stability risk assessments; and
- Construction verification and quality control.

With over 15 years experience in project management and management of engineering services of mid-tier consultancies, Ralph has developed skills in business management, including environment health & safety, financial, quality control, staff and risk management. Ralph has fostered an appreciation of the value of developing, implementing and monitoring systems and procedures and communicating these to project teams and stakeholders to facilitate safe, effective and efficient problem solving and risk management. His easy rapport with people and ability to understand clients' and colleagues' needs has provided Ralph with a track record of establishing excellent and sustained client/ colleague relationships. He has solved problems in challenging conditions to achieve common goals through successful integration of teams of varying disciplines and use of innovative methodologies. Ralph also continues to provide expert testimony in legal proceedings relating to his various fields of expertise in the NSW Land and Environment Court and NSW Supreme Court.

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Ph 02 9476 9999 **Fax** 02 9476 8767 **Email:** mail@martens.com.au
www.martens.com.au
MARTENS & ASSOCIATES P/L
ABN 85 070 240 890 ACN 070 240 890

EMPLOYMENT

2014 – Present **Martens & Associates Pty Ltd**

Senior / Principal Geotechnical Engineer / Geotechnical Group Leader

Technical oversight of > 500 projects across Australia. Technical responsibilities include oversight of and undertaking geotechnical engineering, hydrogeological, site contamination and land capability feasibility assessments, investigations, modelling, designs and reporting. Current clients include Hanson Construction Materials P/L, KBR P/L, Sydney Water Corporation, WaterNSW.

Managing and supervising a team of geotechnical engineers, environmental scientists and drill rig operating staff.

Providing expert testimony in legal proceedings in the NSW Land and Environment Court.

2013 – 2014 **Environmental Investigations Australia, Sydney**

Senior Geotechnical Engineer / Geotechnical Group Leader

Developing a geotechnical group within the organisation, including staff recruitment and procedure and process development, and managing and supervising the geotechnical engineering team.

Tendering for, carrying out and managing geotechnical investigations and designs in combination with contaminated site assessments for new infrastructure, infrastructure upgrade and land development projects for private industry.

2008 – 2013 **Golder Associates, Sydney**

Senior Geotechnical Engineer

Tendering for, carrying out and managing geotechnical investigations and designs in combination with contaminated site assessments for land development, new high risk infrastructure and infrastructure upgrade projects in private and public sectors.

2002 – 2008 **Brink & Associates, Sydney and Central Coast**

Engineering Manager and Senior Geotechnical Engineer

Managing and supervising teams of geotechnical engineers, environmental scientists and laboratory staff in Sydney and Central Coast offices.

Carrying out and managing geotechnical investigations and designs in combination with contaminated site assessments for land development, new infrastructure and infrastructure upgrade projects in private and public sectors.

1999 – 2002 **Maunsell Australia, (now AECOM) Sydney**

Geotechnical Engineer and Senior Geotechnical Engineer

Geotechnical design of pile supports, excavation retention systems and concrete tunnel support.

Developing geological models and excavation support and geotechnical design specifications for Parramatta Rail Link ('PRL') pre-tender conceptual design and M7 Motorway preliminary design.

1998 – 1999 **Geo-Engineering, United Kingdom**

Resident Engineer and Geotechnical Engineer

Designing rock face stabilisation for a quarry redevelopment followed by site works supervision and quality control verification of stabilisation works. Works included excavations, rock bolt and anchor installation, rock fall catch structure installation, concrete buttress construction, shotcrete placement, shallow footing construction and concrete control testing.

Assisting in developing alignments and rock defect mapping for train tunnels in Middle East and England.

1993 – 1997 **Hochtief-Marti-Concor Joint Venture (South Africa)**

Factory Engineer / Site Engineer / Laboratory Manager / Quality Assurance Officer

As factory engineer managing concrete segmental tunnel lining production, storage and utilisation, including quality and material utilisation control.

As site engineer assisting in supervising temporary rock support installation, cast in-situ concrete tunnel lining construction and earthworks placement.

As laboratory manager of two site laboratories, quality assurance of concrete, earthworks and water.

Overall project quality control, including cost controls and raising contractual variations.

GENERAL AREAS OF EXPERTISE

Geotechnical and Hydrogeological Engineering	Tunnelling, including underbores for road, rail, water, gas.
	Rock and slope stability risk assessments for residential developments and roads.
	Foundations, excavation retention and support and earthworks for commercial, industrial, public and residential structures and associated infrastructure.
	Lot classification and site characterisation including salinity, thermal resistivity, durability and acid sulfate soils assessments.
	Road concept designs and pavement design for residential and industrial developments and council roads.
	On-site stormwater storage and oil separation & treatment dam liner specification.
	Contaminated site assessments for remediation of residential, commercial and industrial properties and public infrastructure.
	High risk development, e.g. greenfield and upgrade of electrical substations (Ausgrid, Transgrid).
Management And Communication Experience	Geotechnical group leader for mid-tier Sydney consultancies (Brink & Associates, Martens & Associates and Environmental Investigations Australia).
	Engineering Manager of geotechnical and environmental disciplines and laboratories services of mid-tier consultancies (Brink & Associates, Martens & Associates and Environmental Investigations Australia).
	Site laboratory manager responsible for quality control testing of concrete, earthworks and water at two on site laboratories (LHWTTP).
	Independent audit of earthwork placement confirming compliance with project needs (Moorebank Quarry redevelopment).
	Condition audits (Freight rail link between Melbourne and Brisbane; Sydney Airport Authority foreshore assets).
	Earthworks & concrete testing verification as GTA (M7; GWH-Leura to Katoomba; PH-Ourimbah; Entrance Rd; Tumbi Umbi Rd to Ocean View Dr, Wamberal).
	Construction Verification of excavations, shotcrete placement, shallow footing and deep pile construction, rock bolt and anchor installation (Commonwealth Bank, Homebush; Sydney Uni Law School).
	Geotechnical engineering expert witness, preparing advice on numerous matters before the courts, including NSW Land and Environment Court, on behalf of applicants. I have given evidence in areas of geotechnics and civil engineering.
Process Management	Process Engineer as factory engineer for construction, storage and utilisation of precast concrete tunnel lining segments (LHWP).
	Site Supervision of temporary rock support installation, cast in-situ concrete tunnel lining construction and earthworks placement (LHWTTP).
	Resident Engineer for rock stabilisation works associated with redevelopment of quarry (Clarence court for Jersey Heritage Trust, UK).
	Construction monitoring of settlement against alert and stop work levels during underbore construction beneath a Sydney Water main (Ausgrid Cable mains under Condamine St, Balgowlah).

Appendix C – Site Survey

MGA 56 (PM 12652)
1°06'50" TRUE NORTH

PERFORMING ARTS CENTRE
RENDERED/GLAZED METAL ROOF
No.601-611

HIGH STREET

BM CUT IN KERB
RL 27.11 (AHD)

WORTH STREET

2-STOREY RENDERED COMMERCIAL BUILDING
No.594-596

MULTI STOREY GLAZED OFFICE
No.606

BLOCK BUILDING METAL ROOF
No.612

BLOCK WORKSHOP METAL ROOF
No.634-638

CHEMIST

GROVE

TIPPING

JOHN

MULGOA ROAD

UNION LANE

UNION ROAD

BM CUT IN KERB
RL 26.74 (AHD)

BM CUT IN KERB
RL 27.10 (AHD)

8 STOREY RENDERED & BRICK APARTMENT BLOCK METAL ROOF
No.83-85

SEE SHEET 2 FOR WINDOW INFORMATION

5 STOREY RENDERED APARTMENTS METAL ROOF
No.79-81

2 STOREY CONCRETE OFFICE METAL ROOF
No.75-77

BRICK WORKSHOP METAL ROOF
No.71-73

3 STOREY BRICK DWELLING TILE ROOF
No.2

BRICK DWELLINGS TILE ROOF
No.82-84

2 STOREY BRICK DWELLING TILE ROOF
No.78-80

2 STOREY BRICK DWELLING TILE ROOF
No.72-76

2 STOREY BRICK DWELLING TILE ROOF
No.4

12 D.P.717196 (151.4m²)
13 D.P.717196 (2217m²)
3 D.P.242506 (1784m²)
1 D.P.544302 (3272m²)
36 D.P.73121 (2993m²)
2 D.P.1202310 (1331m²)
1 D.P.1202310 (802.1m²)
11 D.P.1162271 (1592m²)
10 D.P.1162271 (4715m²)
2 D.P.525160
C D.P.153855
D D.P.153855
15 D.P.1022974
1 D.P.567138
2 D.P.588803
100 D.P.711464
5 D.P.33490
10 D.P.33490
25 D.P.32610

S.P.32531
S.P.19207
S.P.45602
S.P.55112
S.P.58263
S.P.7375
S.P.35311
S.P.60128
S.P.79328

(A) ROAD WIDENING 1.4 WIDE

LEGEND:-

VC denotes VEHICLE CROSSING
PC denotes PRAM CROSSING
TK denotes TOP OF KERB
D:S:H: denotes DIAMETER, SPREAD and HEIGHT of TREE
SV denotes STOP VALVE
HYD denotes HYDRANT PIT
TEL denotes TESLTRA PIT
SMH denotes MAN HOLE
TL denotes TRAFFIC LIGHT
SB denotes SIGNAL BOX

GENERAL NOTES:-

1. THE BOUNDARIES OF THE LAND HAVE NOT BEEN SURVEYED. FEATURES SHOWN ON THE PLAN HAVE BEEN PLOTTED IN RELATION TO THE OCCUPATIONS

2. ONLY VISIBLE SERVICES HAVE BEEN LOCATED AND THE RELEVANT AUTHORITIES SHOULD BE CONTACTED TO DETERMINE THE FULL EXTENT OF SERVICES.

3. UNDERGROUND SERVICES HAVE BEEN PLOTTED FROM DIAL BEFORE YOU DIG PLANS. THE RELEVANT AUTHORITIES MUST BE CONTACTED TO DETERMINE THE FULL EXTENT OF SERVICES PRIOR TO ANY WORKS ON OR NEAR THE SITE.

4. ONLY TREES GREATER THAN 3.5 METRES IN HEIGHT ARE SHOWN ON THIS PLAN AND THEIR POSITION IS DIAGRAMMATIC ONLY AND MAY REQUIRE ADDITIONAL SURVEY WHERE CRITICAL TO DESIGN.

5. CONTOURS ARE INDICATIVE AT GROUND FORM ONLY. SPOTS LEVELS ONLY SHOULD BE USED FOR CALCULATIONS OF QUANTITIES WITH CAUTION.

6. CONTOUR INTERVAL 0.5 m.

7. ALL SETOUT LEVELS MUST BE REFERRED TO THE BENCH MARK.

8. THE ORIENTATION OF THIS PLAN IS MGA NORTH BASED ON DP1162271. THE DIFFERENCE BETWEEN MGA NORTH & TRUE NORTH IS APPROXIMATELY 1°06'50".

8. AFFECTING LOT 12 DP 717916 IS
- RESTRICTIONS ON THE USE OF LAND AS SETOUT IN TRANSFER No X435593

AFFECTING LOT 13 IN DP 717196 IS
- COVENANT AS SETOUT IN TRANSFER No W941858

AFFECTING LOT 10 IN DP 1162271 IS
- RESTRICTIONS ON THE USE OF LAND AS SETOUT IN DP1162271

UNDERGROUND SERVICES LEGEND

- UNDERGROUND SEWERMAIN
- UNDERGROUND WATERMAIN
- UNDERGROUND GASMAIN
- UNDERGROUND TELSTRA COMMUNICATIONS CABLES
- UNDERGROUND ELECTRICITY CABLES
- UNDERGROUND OPTUS CABLES
- UNDERGROUND STORMWATER PIPE

APPROXIMATE POSITION ONLY VIDE DIAL BEFORE YOU DIG PLANS JOB No. 880350 WHERE CRITICAL TO DESIGN UNDERGROUND SERVICES SHOULD BE LOCATED BY GROUND PENETRATING RADAR PRIOR TO DESIGN OR EXCAVATION.

CAUTION: FIBRE OPTIC CABLES ARE PRESENT IN THIS AREA

2 4 6 8 10 20 30 40 50
1:500

ISSUE	DATE	AMENDMENT
A	18/02/15	ORIGINAL SURVEY
B	19/03/18	ADDITIONAL INFORMATION LOT 11 DP 1162271
C	10/10/19	TRANSFERRED TO MGA CO-ORDS - PM12652 ADOPTED

CLIENT: HIGH 618 PTY LTD

SCALE 1:500
ORIGIN OF LEVELS: PM 12651 RL 27.165
DATUM: A.H.D.
REF.: 6578
DATE: 19/03/2018
SURV/CHK: SW/MD/VT
SHEET 1 OF 2 SHEETS
PLAN A1
ISSUE B

DETAIL AND LEVEL SURVEY OF
LOT 36 IN DP731213, LOTS 12 & 13 IN DP717196, LOT 3 IN DP242506
LOTS 1 & 2 IN DP1202310, LOT 1 IN DP5544302, LOTS 10 & 11 IN DP1162271
HIGH ST PENRITH, NSW

SDG LAND DEVELOPMENT SOLUTIONS
A.B.N. 85 213 523 821
Unit 7 1B Kleins Road
NORTHMEAD 2152
P.O.Box 2572
NORTH PARRAMATTA 1750
t: (02) 9630 7955
e: office@sdg.net.au
w: www.sdg.net.au

Appendix D – Development Plans (Selective)

Development Application

614 - 632 High Street, Penrith NSW 2750

Sheet Index		
Layout ID	**Layout Name**	**Revision**
DA000	Title Page	C
DA001	Calculations	D
DA100	Site Analysis	C
DA102	Site Plan	C
DA200	Basement 01 Plan	E
DA201	Ground Floor Plan	G
DA202	Mezzanine Floor Plan	E
DA203	Level 1	E
DA204	Level 2	E
DA205	Level 3 Plan	E
DA206	Level 4 Plan	E
DA207	Level 5 Plan	E
DA208	Level 6 Plan	E
DA209	Level 7 Plan	E
DA210	Level 8-9 Plan	E
DA211	Level 10 Technical Floor	E
DA212	Typical Levels 11,12,13,15,16,18,19, 21, 22, 24	E
DA213	Terrace Levels 14,17,20, 23, 25	E
DA214	Typical Levels 26,27,29,30,32,33,35,36	E
DA215	Terrace Levels 28,31,34,37	E
DA216	Level 38 Plan	E
DA217	Level 39 Plan	E
DA218	Level 40 Plan	E
DA219	Level 41 Plan	E
DA220	Level 42 Plan	E
DA221	Level 43 Plan	E
DA222	Roof Plan	E
DA225	Pre & Post Adaptable Unit Layouts	C
DA226	Accessible Unit Layouts	C
DA227	Silver Standard Livable Housing Unit Layouts	C
DA300	Elevations - Sheet 01	E
DA301	Elevations - Sheet 02	E
DA302	Elevations - Sheet 03	E
DA303	Elevations - Sheet 04	E
DA304	Sections - Sheet 1	E
DA305	Sections - Sheet 2	E
DA307	Streetscape Montage	C
DA308	Streetscape Montage	C
DA309	Finishes Board	C
DA400	Solar Calculations	C
DA401	Solar Calculations	C
DA402	Eye of the Sun	D
DA403	Solar Study	C
DA404	Cross Ventilation Calculations	C
DA405	GFA Calculations	D
DA406	GFA Calculations	D
DA407	C.O.S & Deep Soil Calculation	C
DA408	Apartment Mix	C
DA409	Storage Diagrams	C
DA410	Public Art Location Plan	C
DA411	Building Separation	B
DA412	Overshadow Analysis	B
DA413	Communal Open Space	B
DA417	Overshadowing Study - Sheet 1	B
DA418	Overshadowing Study - Sheet 2	B
DA419	Overshadowing Study - Sheet 3	B
DA420	Overshadowing Study - Sheet 4	B
DA421	Shadows Study RE1 Zone - Winter Solstice	A
DA422	Shadows Study RE1 Zone - Summer Solstice	A
DA425	Apartment Mix	A
DA500	Light Spill Diagram	A

Rev.	Date	By	Ckd	Description
B	1/04/2020			DA
C	9/05/2022	CR	DF	POST S34 HEARING ISSUE

URBAN

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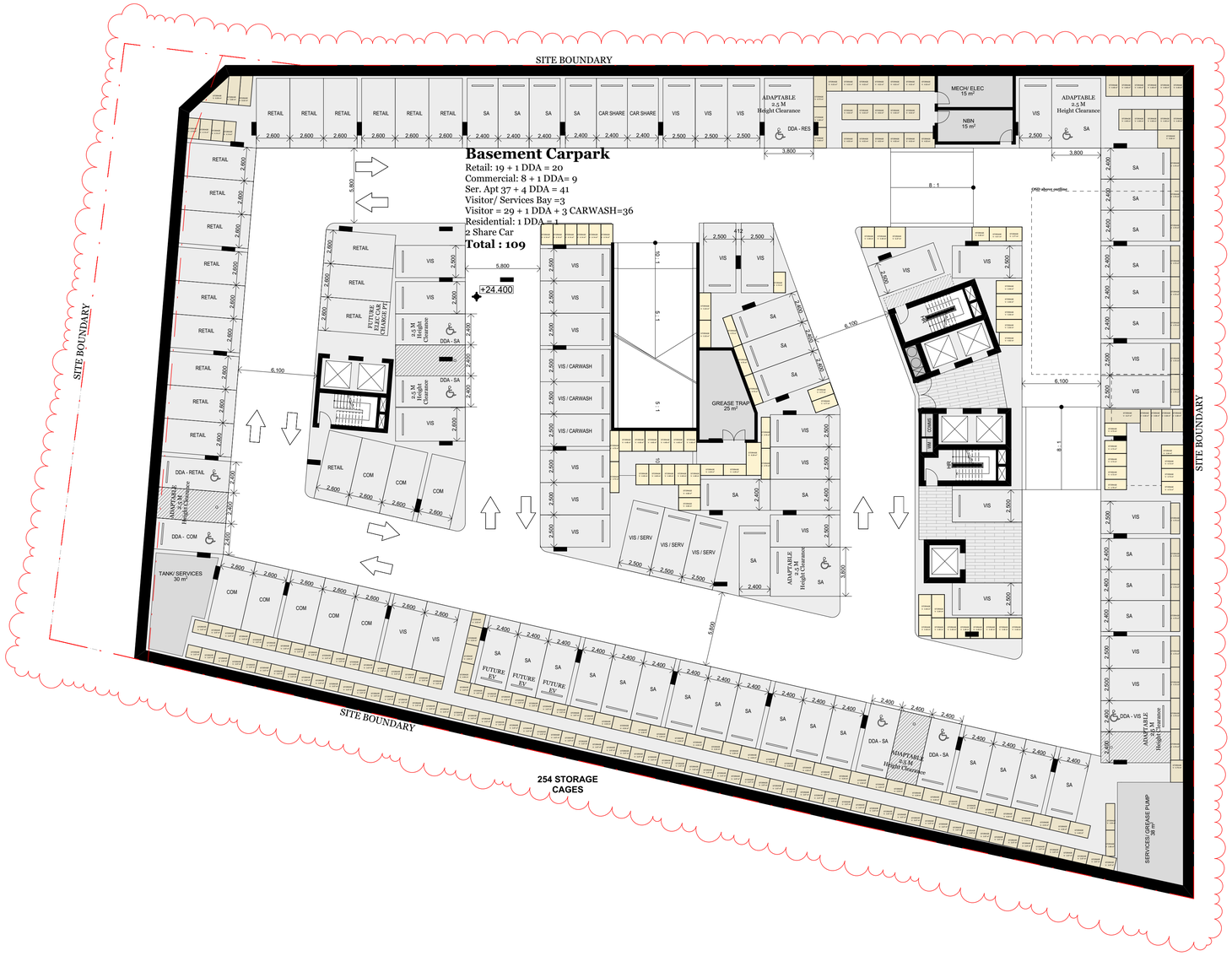
ABN: 81956706590
NSW: Nominated Architects
Koos de Keijzer 5767
David Randerson 8542

DKO

Project Name	High Street Penrith	Project Number	00012012
Project Address	614-632 High Street, Penrith, NSW 2750	Drawing Name	Title Page
		Scale	
		Date	
		Scale	1:2.84@A1
		Date Commenced	March 2019
Client	Urban Apartments	Drawing Number	DA000
		Revision	C



Rev.	Date	By	Ckd	Description
C	26/10/2020			DA
D	7/04/2021			DA
E	9/05/2022	CR	DF	POST S34 HEARING ISSUE

URBAN

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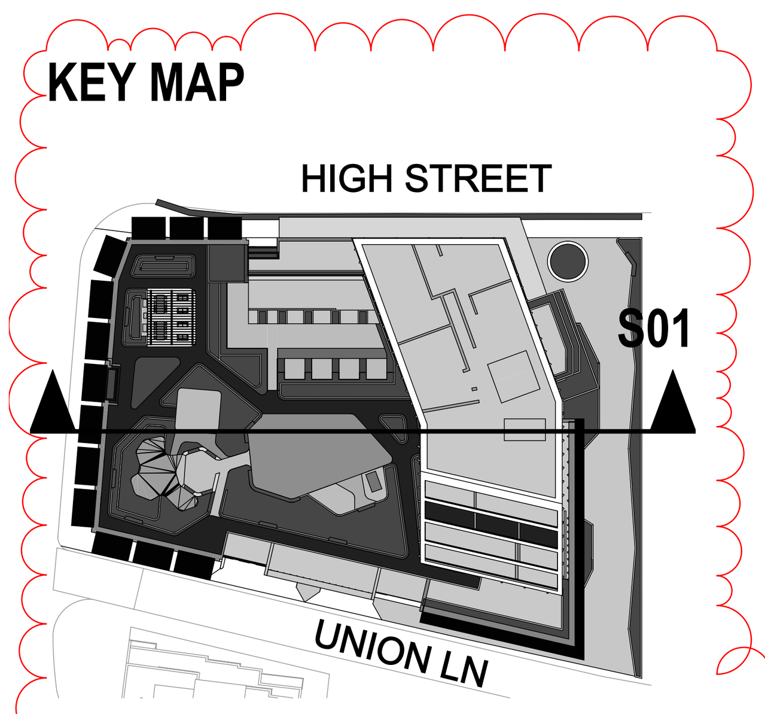
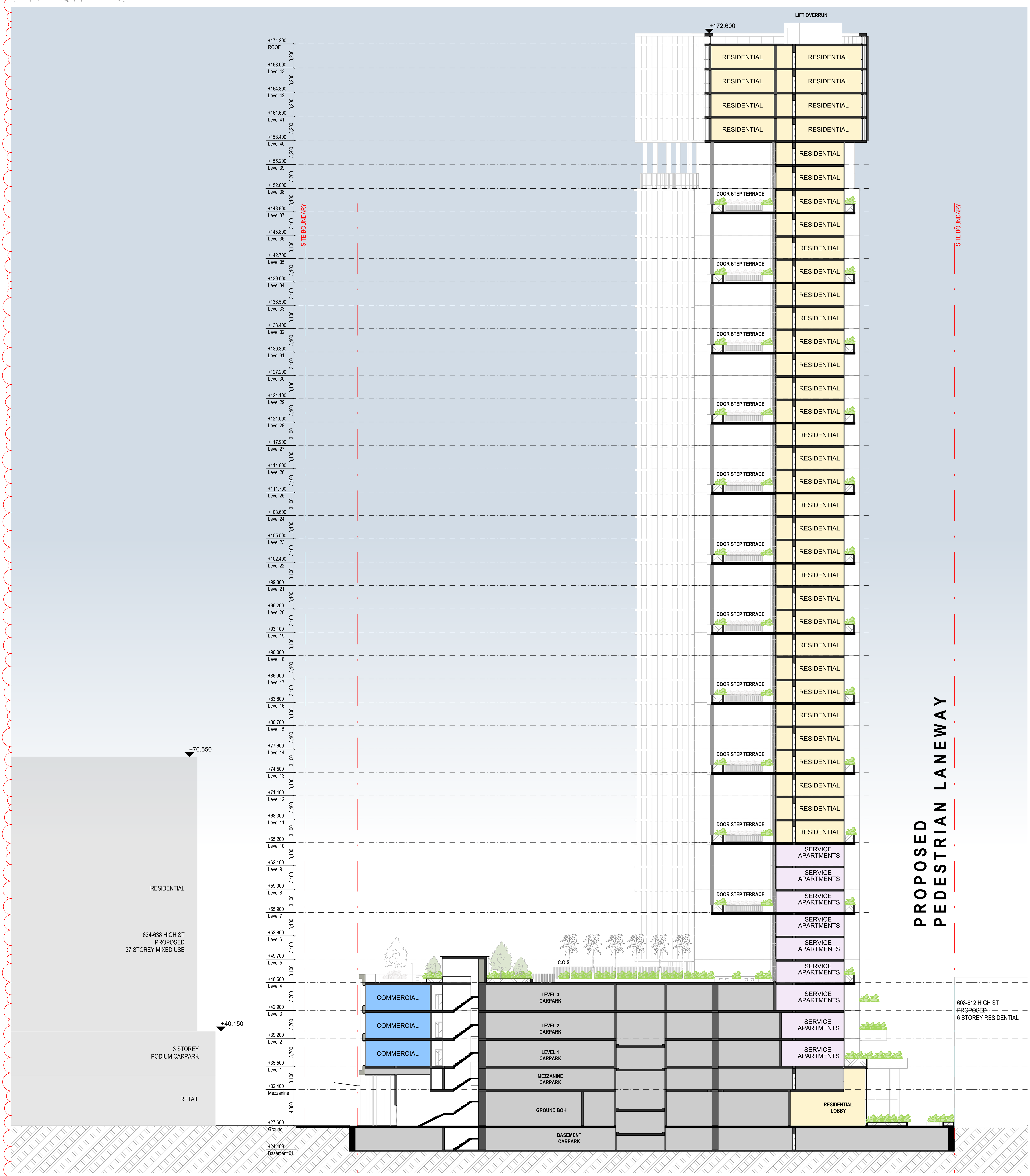
Koos de Keijzer 5767
David Randerson 8542

DKO

Project Name	High Street Penrith
Project Address	614-632 High Street, Penrith, NSW 2750
Client	Urban Apartments
Project Number	00012012
Drawing Name	Basement 01 Plan
Scale	
Date	
Scale	1:200@A1
Date Commenced	March 2019
Drawing Number	**DA200**
Revision	**E**





Builder/Contractor shall verify job dimensions before any job commences
Figured dimensions take precedence over drawings and job dimensions.
All shop drawings shall be submitted to the Architect/Consultant, and manufacture shall not commence prior to return of inspected shop drawings by the Architect/Consultant

Rev.	Date	By	Ckd	Description
B	1/04/2020			DA
C	26/10/2020			DA
D	7/04/2021			DA
E	9/05/2022	CR	DF	POST S34 HEARING ISSUE

CLIENT

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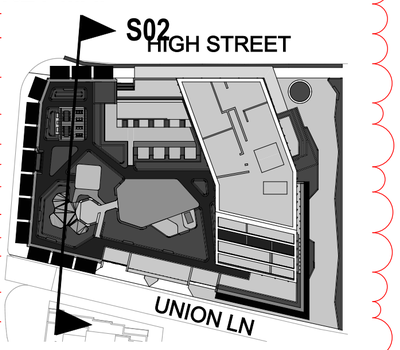
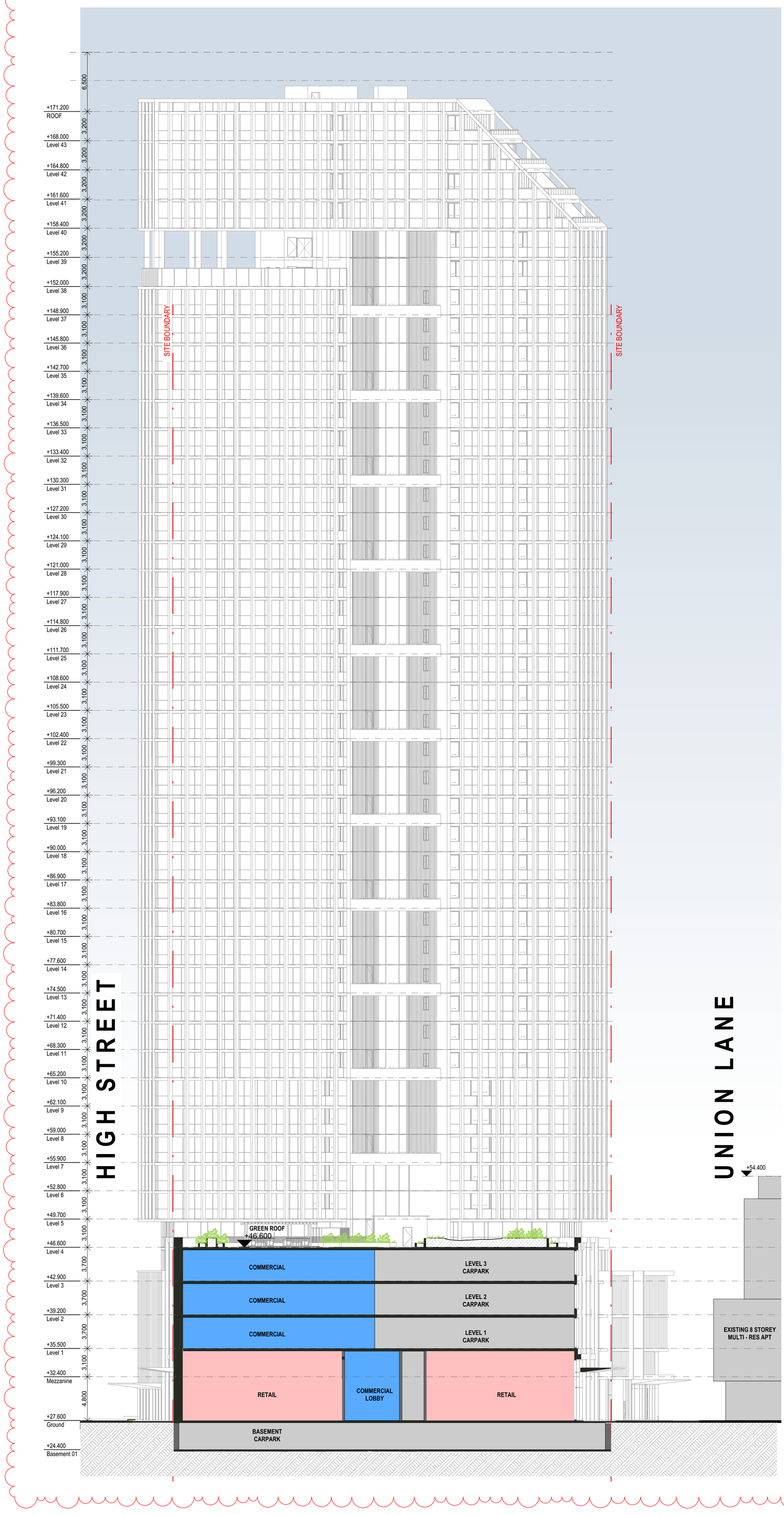
DKO

Project Name: High Street Penrith
Project Number: 00012012
Project Address: 614-632 High Street Penrith NSW 2750 Australia
Drawn By
Checked By
Date: March 2019
Scale

Drawing Series: Elevations & Sections
Drawing Name: Sections - Sheet 1
Drawing Number: DA304
Revision: E

KEY MAP





Rev.	Date	By	Ckd	Description
B	1/04/2020			DA
C	26/10/2020			DA
D	7/04/2021			DA
E	9/05/2022	CR	DF	POST S34 HEARING ISSUE

CLIENT

URBAN

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NSW: Nominated Architects
Koos de Keijzer 5767
David Randerson 8542

DKO

Project Name	High Street Penrith
Project Number	00012012
Project Address	614-632 High Street Penrith NSW 2750 Australia
Drawn By	
Checked By	
Date	March 2019
Scale	

Drawing Series	Elevations & Sections
Drawing Name	Sections - Sheet 2
Drawing Number	DA305
Revision	E

Appendix E – Figures

Daily rainfall

Penrith Lakes AWS

About this page | 1 year of data | All years of data | PDF

Observations of Daily rainfall are nominally made at 9 am local clock time and record the total for the previous 24 hours. Rainfall includes all forms of precipitation that reach the ground, such as rain, drizzle, hail and snow. About rainfall data

Station: Penrith Lakes AWS | Number: 67113 | Opened: 1995 | Now: Open | Lat: 33.72° S | Lon: 150.68° E | Elevation: 25 m | Details

Show in table... | Key: Units = mm *12.3* = Not quality controlled. ↓ = Part of accumulated total

28.0 Move mouse over rainfall total to view the period of accumulation.

2019	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Graph												
1st	*6.0*	0.4	*0*	*0*	*0*	*0*	*0*	*0*	*0.2*	*0*	*0*	*0*
2nd	*0*	*2.4*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
3rd	*0*	*4.4*	*0*	*2.0*	*0*	*0.2*	*0.2*	*0*	*0*	*0*	*0*	*0*
4th	*0*	*0.2*	*0*	*0*	*9.2*	*15.6*	*0.4*	*0.2*	0	*0*	*16.0*	*0*
5th	*0.2*	*0*	*0*	*1.0*	*0*	*0*	*9.8*	*0*	*0*	*5.2*	*0*	*0*
6th		*0*	*0*	*4.2*	*0*	*1.2*	*2.2*	*0*	*0*	*0.4*	*0*	*0*
7th	*0.6*	*0*	*0*	*0.2*	*0*	*0*	*1.8*	*0*	*0*	*0*	*0*	*0*
8th	1.8	*0*	*0*	*0*	*0*	*0*	*0.6*	*0*	*0*	*0.2*	*0*	*0*
9th	*8.0*	*0.2*	*0*	*0*	*0*	*0.4*	*0.2*	*0*	*0*	*0*		*0*
10th	*0*	*0.2*	*0.6*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
11th	*5.4*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*1.0*	*0*	*0*
12th	*6.6*	0	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*13.6*	*0*	*0*
13th	*0.2*	*0*	*0*	*0*	*0*	*0.2*	*0*	*0*	*0*	*5.2*	*0*	*0*
14th	*0*	*0*	*0.4*	*0*	*0*	*0*	*0*	*0*	*0*	*0.2*	*0*	*0*
15th	*0*	*0*	*35.0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
16th	*0*	*0*	*14.0*	*0*	*0*	*2.6*	*0*	*0*	*0*	*0*	*0*	*0*
17th	*0*	*0*	*24.0*	*0*	*0*	*3.8*	*0*	*0*	*19.4*	*0*	*0*	*0*
18th	*0*	*0*	*10.0*	*0*	*0*	*0.2*	*0*	*0*	*45.2*	*0*	*0*	*0*
19th		*0*	*6.0*	*0*	*0*	*4.0*	*0*	*0*	*15.6*	*0*	*0.2*	*0*
20th	*0*	*1.6*	*3.8*	*0*	*0*	*0*	*0*	*0*	*3.6*	*0*	*0*	*0*
21st	*40.2*	*0.8*	*0.6*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
22nd	*0.6*	*8.0*	*0*	*0*	*0*	*0*		*0*	*0*	*0*	*0*	*0*
23rd	*2.6*	*0.2*	*1.8*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*3.2*	*0*
24th	*0*	*0*	*2.2*	*0*	*0*	*11.8*	*0*	*0*	*0*	*0*	*2.0*	*0*
25th	*0*	*0.4*	*8.8*	*0*	*0*	*5.4*	*0*	*0*	*0*	*0*	*0*	*0*
26th	*0*	*0.2*	*0.6*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*2.4*	*0*
27th	*0*	*0*	*0*	*0*	*0*	*0.2*	*0*	*0.4*	*0*	*0*	*1.0*	*0*
28th	*5.2*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
29th	*0*		*0*	*0*	*0*	*0.2*	*0*	*0*	*0*	*0*	*0*	*0*
30th			*23.8*	*0*	*0*	*0*	*0*	*9.0*	*0*	*0*	*0*	*0*
31st	*0*		*0.2*		*0*		*0*	*0*		*0*		*0*
Highest Daily	*40.2*	*8.0*	*35.0*	*4.2*	*9.2*	*15.6*	*9.8*	*9.0*	*45.2*	*13.6*	*16.0*	*0.0*
Monthly Total	77.4	19.0	*131.8*	*7.4*	*9.2*	*45.8*	*15.2*	*9.6*	84.0	*25.8*	*24.8*	*0.0*

Annual total for 2019 = *450.0* mm | View all monthly data | Plot year of daily data

Figure 2: BOM Station Penrith Lakes AWS rainfall for 2019.

Daily rainfall

Penrith Lakes AWS

About this page

1 year of data | All years of data | PDF

Observations of Daily rainfall are nominally made at 9 am local clock time and record the total for the previous 24 hours. Rainfall includes all forms of precipitation that reach the ground, such as rain, drizzle, hail and snow. About rainfall data

Station: Penrith Lakes AWS
Number: 67113 Opened: 1995 Now: Open
Lat: 33.72° S Lon: 150.68° E Elevation: 25 m
Details

Show in table...

Key: Units = mm *12.3* = Not quality controlled. ↓ = Part of accumulated total
28.0 Move mouse over rainfall total to view the period of accumulation.

2020	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Graph												
1st	0	0	0	0.2	8.6	0	0	0.2	0.8	0.2	12.0	0.2
2nd	0	0	0	0	0	0	0.2	0	0	0	0.2	9.0
3rd	0	21.4	0	6.6	0	0	0	0	0	0	0.2	6.4
4th	0	0.2	10.2	10.2	0	0	0.2	0	0	0	0	0
5th	0	0	8.2	0	0	0	0	0	3.2	0	3.6	0.2
6th	0	0.2	18.6	0	0	0.2	0	0	0	0	26.0	5.0
7th	0	33.4	0	0	0	0	0	0	0	0	0	0
8th	0.4	41.2	3.6	0	0	0.4	1.0	12.4	0	0.2	0	0
9th	0	82.2	0.8	0.2	0	1.0	0.2	0.6	2.2	0.2	0	0
10th	0.2	112.2	3.4	1.8	0	0.8	0	36.4	8.0	0	0.2	0
11th	0.4	9.6	0	1.0	0	0.2	5.2	0.4	0	0	0	0
12th	0.4	0	0	0.2	0	0	1.4	0	0	0	0	0
13th	0.2	21.6	0	0	0	0.4	0.4	0.2	0	0	2.8	0
14th	0	9.6	1.2	0	0	4.2	8.6	0	0.2	0	1.2	2.0
15th	0	0	11.0	0	0	0	0	10.2	0	0	0.2	3.4
16th	18.8	4.0	2.6	0	0.8	0	0	0	0	0	0	14.8
17th	24.6	0.2	1.6	0	0.2	0.2	0	0	0	0	0	9.6
18th	7.0	4.0	0	0	0	1.0	0	0	0	0	9.4	0
19th	5.4	15.2	0	0	1.2	0.2	0	0	0.4	8.2	0.2	1.4
20th	4.6	0	0	0	0	0	0	0.8	7.0	0	0	3.6
21st	0.2	0	0	0	0.2	6.8	0	0	2.4	0.2	6.6	0.2
22nd	0	0	0	0	42.2	0.2	0	0	0.2	0	1.6	20.6
23rd	0	1.6	0.4	0	0.6	0.4	0	0	0	0	0.2	0
24th	13.4	0	0	0	1.2	0	0.2	0	0	7.2	0.2	0
25th	3.0	0	0.2	0	0	0	0.2	0	0	17.2	0.8	0.2
26th	0	0	12.8	0	2.4	0	6.2	0	2.2	40.4	0.2	1.4
27th	3.0	0.2	2.8	0	1.4	0	70.0	0	0	1.8	0	5.4
28th	0	0	0.2	0	0.2	0	7.0	0	0	0	0	0
29th	0.4	0	2.8	0	0	0	0	0	0	7.2	0	22.0
30th	0		1.6	18.4	0	0.2	0.2	0	0	1.4	0.2	12.4
31st	0		0		0.2		0	0		0.4		2.4
Highest Daily	24.6	112.2	18.6	18.4	42.2	6.8	70.0	36.4	8.0	40.4	26.0	22.0
Monthly Total	82.0	356.8	82.0	38.6	59.2	16.2	101.0	61.2	26.6	84.6	65.8	120.2

Annual total for 2020 = *1094.2* mm View all monthly data Plot year of daily data

Figure 3: BOM Station Penrith Lakes AWS rainfall for 2020.

Appendix F – SWC DBYD Plan

A3

Contingency Plan Penrith Plaza_Penrith

ST

JOHN TIPPING GR

HIGH

UNION

LANE

ST

PDE VILNITS

UNION

ST

UNION

DBYD Address:
614-632 High Street
Penrith NSW 2750

DBYD Job No: 31927396

DBYD Sequence No: 211274914

Scale: 1:1500

Date of Production: 12/05/2022

Plan 1 of 1

N

0m 9m 18m 27m 36m

Guide to reading Sydney Water DBYD Plans

This guide will help you understand our plans and what our services are.

Symbol	Meaning	Symbol	Meaning
	Sewer main with flow arrow and size type text.		Sewer vertical
	Disuses sewer main This means the sewer has been disused but remains in the ground.		Sewer pumping station
	Sewer maintenance hole with upstream depth invert.		
	Sewer Sub-surface chamber		Pressure sewer main These are also found in Vacuum sewer areas.
	Sewer Maintenance hole with overflow chamber		Pressure sewer Pump unit Alarm, electrical cable and pump unit.
	Sewer Ventshaft EDUCT		Pressure sewer property valve boundary assembly
	Sewer Ventshaft IDUCT		Pressure sewer stop valve
	Sewer property connection point With chainage to downstream maintenance hole.		Pressure sewer reducer / taper
	Sewer concrete encased section		Pressure sewer flushing point
	Sewer Rehabilitation		Vacuum sewer division valve
	Sewer terminal maintenance shaft		Vacuum sewer vacuum chamber
	Sewer maintenance shaft		Vacuum sewer clean out pot
	Sewer rodding point		Stormwater pipe
	Sewer lamphole		Stormwater channel

Symbol	Meaning	Symbol	Meaning
	Stormwater gully		Potable water stop valves with Tapers
	Stormwater maintenance hole		Potable water closed stop valve
200 PVC	Watermain – potable drinking water With size type text.		
	Disconnected watermain potable drinking water This means the watermain has been disused but remains in the ground.		Potable water air valve
	Recycled watermain		Potable water valve
	Special supply conditions – potable drinking water		Potable water scour
	Special supply conditions – recycled water		Potable water reducer / taper
	Restrained joints – Potable drinking water		Potable water vertical bends
	Sewer concrete encased section		Potable water reservoir
	Restrained joints – Potable drinking water		Recycled water is shown as per potable above. Colour as indicated
	Potable water hydrant		Private potable water main
	Potable water maintenance hole		Private recycled water main
	Potable water stop valve		Private sewer main
	Potable water stop valve with By-pass		

Pipe types

PIPE TYPES		PIPE TYPES	
ABS	Acrylonitrile Butadiene Styrene	AC	Asbestos Cement
BRICK	Brick	CI	Cast Iron
CICL	Cast Iron Cement Lined	CONC	Concrete
COPPER	Copper	DI	Ductile Iron
DICL	Ductile Iron Cement (mortar) Lined	DIPL	Ductile Iron Polymeric Lined
EW	Earthenware	FIBG	Fibreglass
FL BAR	Forged Locking Bar	GI	Galvanised Iron
GRP	Glass Reinforced Plastics	HDPE	High Density Polyethylene
MS	Mild Steel	MSCL	Mild Steel Cement Lined
IPE	Polyethylene	PC	Polymer Concrete
PP	Polypropylene	PVC	Polyvinylchloride
PVC - M	Polyvinylchloride, Modified	PVC - 0	Polyvinylchloride, Oriented
PVC - U	Polyvinylchloride, Unplasticised	RC	Reinforced Concrete
RC-PL	Reinforced Concrete Plastics Lined	S	Steel
SCL	Steel Cement (mortar) Lined	SCL IBL	Steel Cement Lined Internal Bitumen
SGW	Salt Glazed Ware	SPL	Steel Polymeric Lined
SS	Stainless Steel	STONE	Stone
VC	Vitrified Clay	WI	Wrought Iron
WS	Woodstave		

DIAL BEFORE YOU DIG www.1100.com.au

Further Information

Please consult the Dial Before You Dig enquiries page on our website.

For general enquiries please call the Customer Contact Centre on 132 092

In an emergency, or to notify Sydney Water of damage or threats to its structures, call 13 20 90 (24 hours, 7 days)