Douglas Partners
Geotechnics / Environment / Groundwater

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Report on
Preliminary Geotechnical Assessment

Proposed Commercial Building
Lot 106 Williamtown Drive, Williamtown

Prepared for
Cox Architecture Pty Ltd

Project 39728.27
September 2022

Douglas Partners
Geotechnics / Environment / Groundwater

Document History

Document details

Project No.	39728.27	Document No.	R.002.Rev0
Document title	Report on Preliminary Geotechnical Assessment Proposed Commercial Building		
Site address	Lot 106 Williamtown Drive, Williamtown		
Report prepared for	Cox Architecture Pty Ltd		
File name	39728.27.R.002.Rev0		

Document status and review

Status	Prepared by	Reviewed by	Date issued
Revision 0	Patrick Heads	Scott McFarlane	16 September 2022

Distribution of copies

Status	Electronic	Paper	Issued to
Revision 0	1	0	John Ferendinos, Cox Architecture Pty Ltd

The undersigned, on behalf of Douglas Partners Pty Ltd, confirm that this document and all attached drawings, logs and test results have been checked and reviewed for errors, omissions and inaccuracies.

	Signature	Date
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Reviewer		16 September 2022

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FS 604853

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1. Introduction

This report presents the results of a preliminary geotechnical assessment undertaken for a proposed commercial building at Lot 106 Williamtown Drive, Williamtown. The investigation was commissioned in via signed agreement dated 14 August 2022 by John Ferendinos of Cox Architecture Pty Ltd and was undertaken with reference to Douglas Partners Pty Ltd (DP) proposal 39728.27.P.001.Rev0 dated 25 May 2022.

It is understood that the proposed development of the site includes the construction of a seven-level commercial structure.

The aim of this report was to undertake a desktop geotechnical assessment to provide preliminary comment on the following items:

- Expected subsurface soil conditions;
- Expected depth to groundwater;
- Hydraulic conductivity and groundwater level fluctuation;
- Shallow footing options and design parameters;
- Suitable pile types, preliminary geotechnical design parameters and estimated founding depths;
- Pavement design parameters;
- Earthworks preparation measures; and
- Preliminary discussion of earthquake factors.

The assessment comprised a review of existing investigation records within and in the vicinity of the site, along with comments and recommendations on the items listed above.

2. Proposed Development

The proposed development is presented on architectural drawings (Cox Architecture, reference 221182) and generally comprises the following:

- Construction of a seven-level commercial structure, including ground floor commercial and retail, first floor vehicle parking, five levels of commercial and a rooftop terrace;
- Construction of associated pavements and landscaped areas; and
- No basement excavation is proposed for the site.

3. Site Description

The site located within the proposed Astra Aerolab commercial subdivision. The site location is shown in Figures 1 and 2 below.

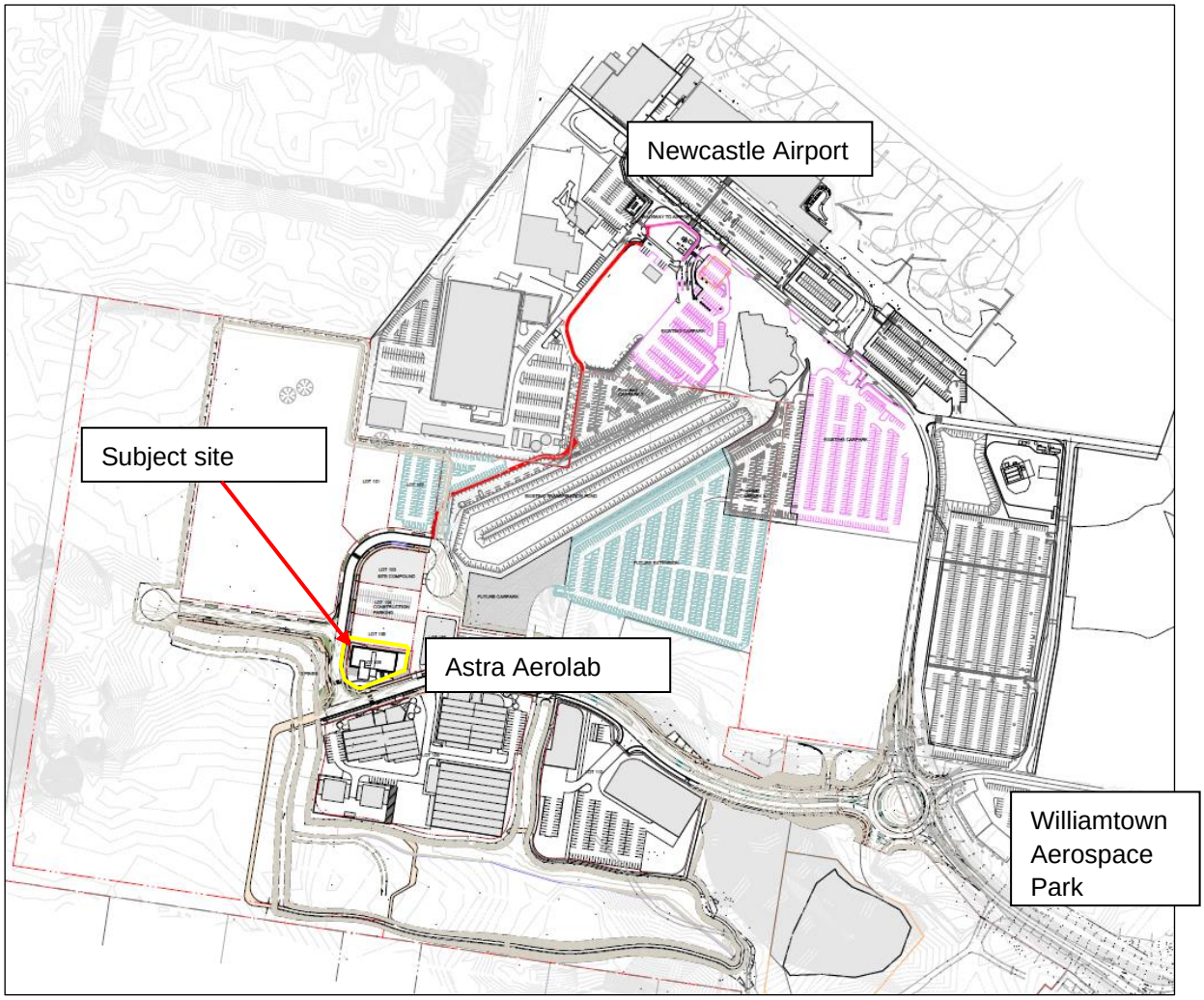

Figure 1: Approximate site location (yellow)

Figure 2: Approximate location of Lot 106 (red outline), within the Astra Aerolab Stage 1 site. (Cox Architecture, reference 221182)

Table 1 presents site identification details.

Table 1: Site Identification

Item	Details
Allotment Identification	Part Lot 11 DP1036501 (i.e. Proposed Lot 106, as identified above)
Street Address	38 Cabbage Tree Road Williamtown
Locality	Williamtown, NSW
Site Area	1338 m^2
Local Government Area	Port Stephens Council
Zoning	Business Park B7
Current Landuse	Vacant – proposed commercial subdivision
Current Owner	Newcastle Airport Pty Ltd

4. Published Data

4.1 Geology

Reference to the NSW Department of Primary Industries (DPI) NSW Coastal Quaternary Geology mapping indicates that a variety of Quaternary, (Pleistocene and Holocene) units are likely to be present on the site.

Figure 3 below shows the inferred DPI mapped geology overlaid on the site aerial photo, with an indicative location of proposed Lot 106.

The following table summarises the units that are mapped within Stage 1.

Table 2: Quaternary Alluvium Units Shown on Drawing 2

Geological Symbol	Age	Unit	Lithology
Qhas	Holocene	Backswamp	Organic mud, peat, silt, clay
Qheb	Holocene	Estuarine in-channel bar and beach	Marine sand, silt, clay, shell, gravel
Qhem	Holocene	Estuarine basin and bay	Clay, silt, shell, fluvial or marine sand
Qhes	Holocene	Saline swamp	Organic mud, peat, clay, silt, marine sand, fluvial sand
Qpb	Pleistocene	Undifferentiated	Marine sand, indurated sand
Qpbd	Pleistocene	Dune	Marine sand, indurated sand
Qpbw	Pleistocene	Beach-ridge swale and dune deflation hollow	Marine sand, indurated sand, organic mud, peat

Proposed Lot 106 is located within geological unit ‘Qpbd’, which is Pleistocene aged dune sand.

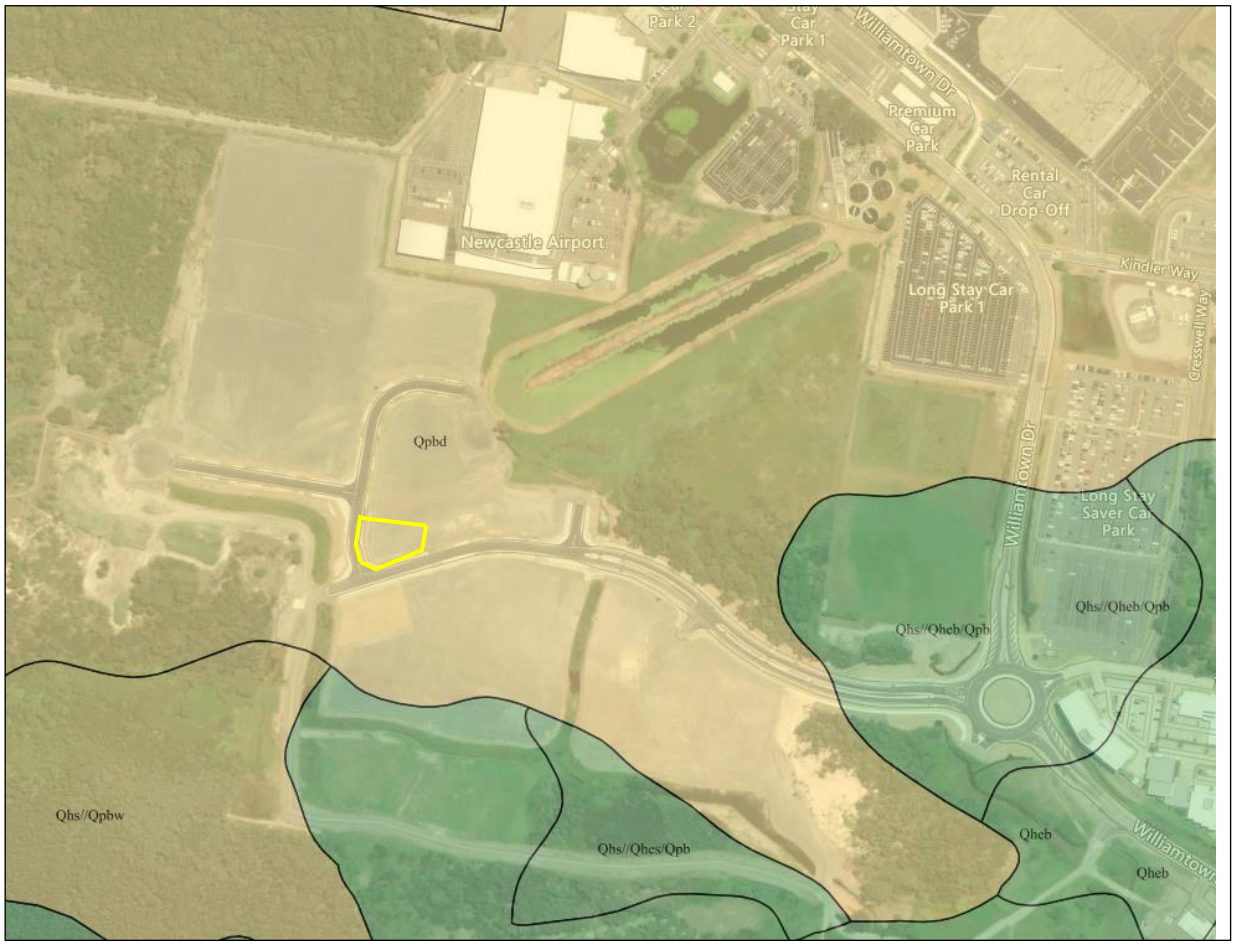

Figure 3: Quaternary Geology map for Astra Aerolab. Proposed Lot 106 in yellow

4.2 Hydrogeology

Based on the regional topography and the inferred flow direction of nearby water courses, the anticipated flow direction of groundwater beneath the site is to the south to south-east, towards Tilligerry Creek and Fullerton Cove, the likely receiving surface water bodies for the groundwater flow path.

Based on previous investigations conducted by DP in the area, groundwater depth is anticipated to be between the surface and 2 m below natural ground levels. It should be noted that groundwater levels are affected by factors such as climatic conditions and soil permeability and will therefore vary with time.

4.3 Soil Landscape

The site is within the 'Shoal Bay' Soil landscape area, generally comprising Pleistocene sand sheets and low dunes on the Tomago Coastal Plain. Limitations to this soil landscape type include Wind erosion hazard, ground water pollution hazard, steep slopes (localised), foundation hazard (localised, swamps), permanent waterlogging (localised, swamps), permanent high water tables (localised, swampy depressions) and seasonal waterlogging.

4.4 Acid Sulfate Soils

Reference to the NSW Acid Sulfate Soil (ASS) Risk map indicates that the site is within an area mapped as a low probability of occurrence of ASS at depths greater than 3 m below the ground surface.

5. Background

5.1 DP Reports

DP has undertaken a number of previous investigations on the site, as well as numerous other in the immediate surrounds and elsewhere in the Williamtown area.

- 39728.00: Preliminary geotechnical investigation for the proposed business park. Subsurface investigation to the south-east and east of the current site (i.e. adjacent to Nelson Bay Road and Williamtown Drive) indicated the presence of soft to firm clays/organic clays, underlain by medium dense to dense sand. The principal geotechnical features of the investigation area (i.e. to the east of the current site) were compressible clay soils and high groundwater levels;
- 39728.01 (DP (2008)): Preliminary geotechnical investigation over the greater Astra subdivision site, including the proposed Lot 106.
    - Subsurface conditions generally encountered sand soils, with compressible clays encountered at some test locations in the southern portion of the overall subdivision site (i.e. south of the proposed Lot 106).
    - Groundwater depths were encountered between the ground surface and 1.2 m below the surface.
    - Acid sulfate soil (ASS) testing indicated the potential for ASS within the proposed subdivision, particularly in the Holocene deposits in the southern portion of the proposed subdivision (i.e. to the south of proposed lot 106).
    - Recommendations included:
        - allowance for settlement of compressible clays, requiring ground improvement
        - the potential for liquefaction of loose sands below the water table during a seismic event;
        - shallow footings allowable in medium dense or better sand, or engineered fill
        - heavily loaded or settlement-sensitive structures could be founded on piles in the dense sand.
- 39728.04 (DP (2009a)): Preliminary geotechnical investigation over the greater Astra subdivision site, including the proposed Lot 106. Similar information to that provided in DP (2008);
- 39728.05 (DP 2009b): this report provided pre-load and earthworks requirements for construction, including areas of preload, depth of preload, requirements for bridging layers and embankment construction for a detention basin;

- 39728.19 (DP, 2019a): Acid Sulfate Soil Management Plan, Astra Aerolab Stage 1. This report presents a summary of ASS conditions encountered within the site from previous investigations, plus procedures for management and monitoring of ASS at the site. For the current assessment, proposed Lot 106 is mapped within an area of low probability of ASS at depths greater than 3 m below natural ground levels.
- 39728.20 (DP, 2019b): geotechnical Investigation, Stage 1 Astra Aerolab. The assessment comprised collation of existing geotechnical information, plus additional investigation for construction certificate documentation.
    - Additional investigation was conducted to further assess and delineate the soft clays and loose sands within the Stage 1 area. The results of the assessment were used to designate geotechnical zones for the Stage 1 area;
    - The proposed Lot 106 was designated to be within the 'Geotechnical Zone A' generally characterised by sandy soils, loose soils to depths of generally less than 3 m below natural ground levels and localised risk of near-surface soft clay up to about 0.5 m thick;
    - Indicative areas of the proposed Stage 1 to be subject to preload are presented in Figure 4 below. The approximate location of proposed Lot 106 is shown in Figure 4 and is located outside the indicative preload areas;
    - Relevant existing test locations located in or near proposed Lot 106, comprising CPT 101 and Pit 306, are shown on Drawing 1, Appendix B. The CPT plot and log for these locations are presented in Appendix A;
    - In-situ and laboratory testing and analysis indicated a saturated hydraulic conductivity of the sand soils within the Stage 1 area around 2 x 10^{-4} m/s.
- 39728.21: Assessment of proposed imported materials, Mayfield and Karuah. Several inspections were conducted at proposed source sites for imported materials for the Level 1 works at Astra Aerolab Stage 1.
    - Materials were sourced from a construction site in Mayfield and comprised ripped and sandstone. The materials were delivered to the Astra Aerolab site during earthworks to raise site levels. 207 loads were delivered between 22 August 2019 and 29 August 2019;
    - Further material was sourced from Karuah Quarry and Karuah East quarry, and generally comprised crushed igneous rock (rhyodacitic ignimbrite, based on geological mapping) as fine crushed rock and overburden.

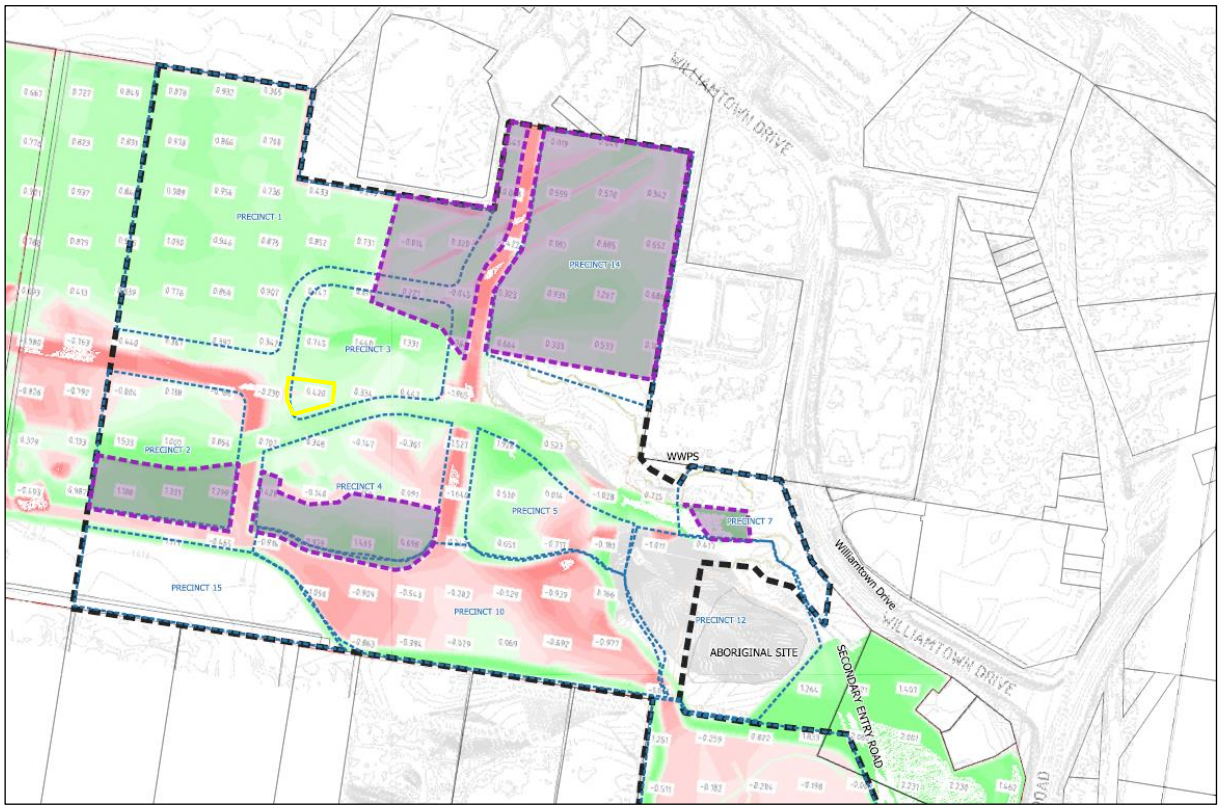

Figure 4: Stage 1 area (black dashed line), including indicative pre-load areas (purple shading) and proposed Lot 106 area (yellow)

5.2 Reports by Others

5.2.1 Valley Civilab (2020)

Valley Civilab report, dated 25 March 2020 (Ref: P1938-L1R-001-Rev0) reported on geotechnical Level 1 inspection and testing for fill placement in selected areas of Stage 1 of Astra Aerolab.

As noted in the report, The Level 1 Inspection and testing was undertaken by Valley Civilab, as directed by the client between 25 October 2019 and 12 November 2019 at the following locations:

- Access Road (including additional 1.5m of surcharge fill as required);
- Site Compound; and
- Stockpile areas.

The approximate location of the areas subject to filling and testing in Valley Civilab (2020) is provided in Figure 5 below.

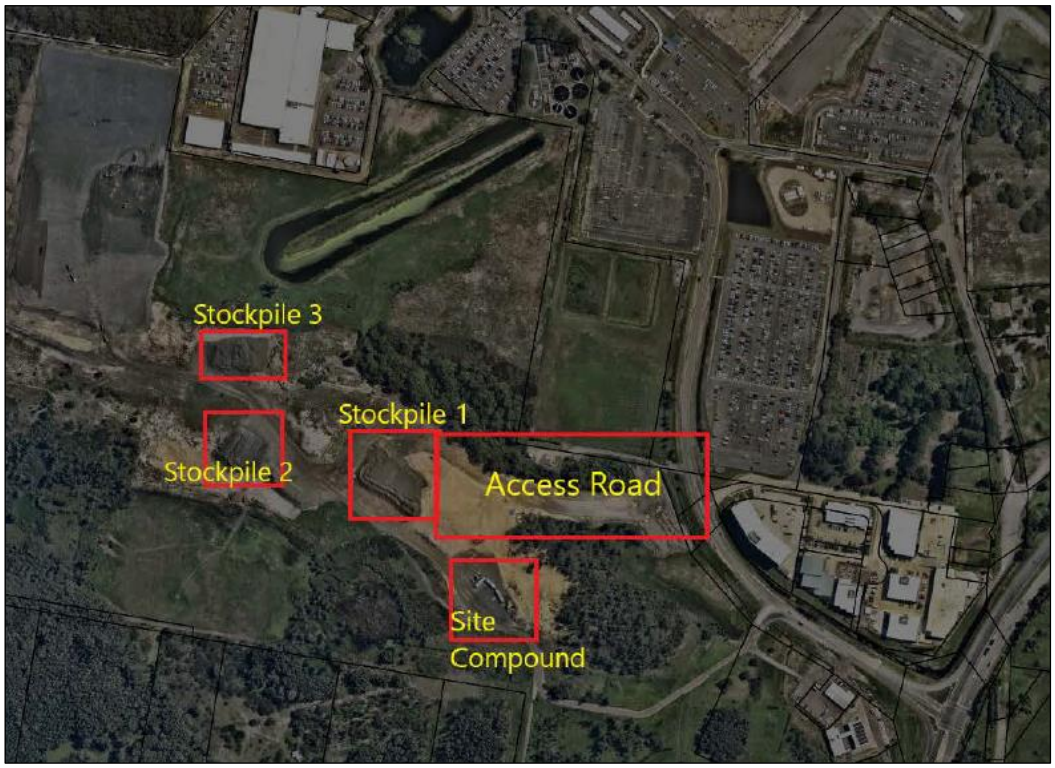

Figure 5: Approximate areas of fill and testing, Valley Civilab (2020)

It is noted, however, that the testing results provided in the report do not appear to cover all of the above areas, particularly Stockpile 2 and Stockpile 3 areas as indicated above.

The general scope of work as reported in Valley Civilab (2020) was as follows:

- Subgrade inspections and proof rolling at the above locations prior to fill placement;
- Imported material for fill placement comprised fine crushed rock from Karuah East Quarry;
- Field density testing was undertaken progressively on the compacted fill layers;
- Based on observations made by Valley Civilab and the results of field and laboratory tests, Valley Civilab concluded that the fill placed for the bulk earthworks for the proposed industrial development met the requirements of controlled fill as per the Australian Standard 3798-2007 'Guidelines for Earthworks for Commercial and Residential Developments' specifications.

5.2.2 Qualtest (2020)

Qualtest report, dated 12 November 2020 (Ref: NEW20P-0020-AB) reported on geotechnical Level 1 inspection and testing for fill placement in selected areas of Stage 1 of Astra Aerolab.

Qualtest (2020) included a plan showing the areas of regrading and testing conducted. The plan also shows the approximate extent of existing uncontrolled fill material previously placed by others, and left in place, as instructed by the client. The plan extract in Figure 6 indicates that existing fill was left in place within proposed Lot 106.

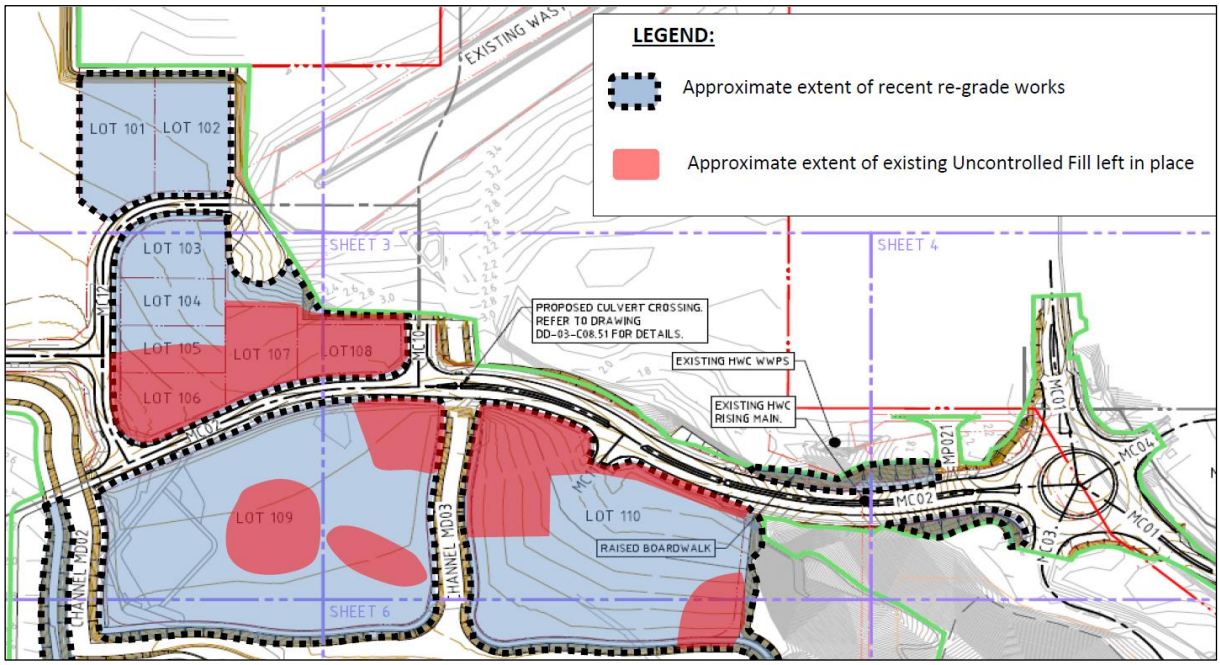

Figure 6: Approximate extent of Level 1 inspections and testing (blue) and areas where previously placed fill remained (red)

Re-grade works then consisted of filling with approved fill to proposed finish design levels. Filling was performed using either site sand material won from excavations cut from around the site, previously placed Uncontrolled Fill material removed and re-conditioned and approved prior to use (generally described as mixtures of sandy gravel and clayey gravel of low plasticity) or suitable and approved imported material sourced from a local quarry at Karuah (crusher dust or fine crushed rock).

It was noted in Qualtest (2020) that fill was placed within the proposed Lot 106 to a maximum thickness of 1.2 m.

Qualtest (2020) reported that all tests conducted exceeded the site-specific required Density Ratio of 100% Standard Compaction (or equivalent), either initially or after re-working, re-compaction and re-testing, and were generally within a suitable moisture content for the material used.

The Qualtest (2020) report also indicates the approximate fill/cut for the site prior to and following regrading works. An extract of the plan for the proposed Lot 106 is provided in Figure 7 below.

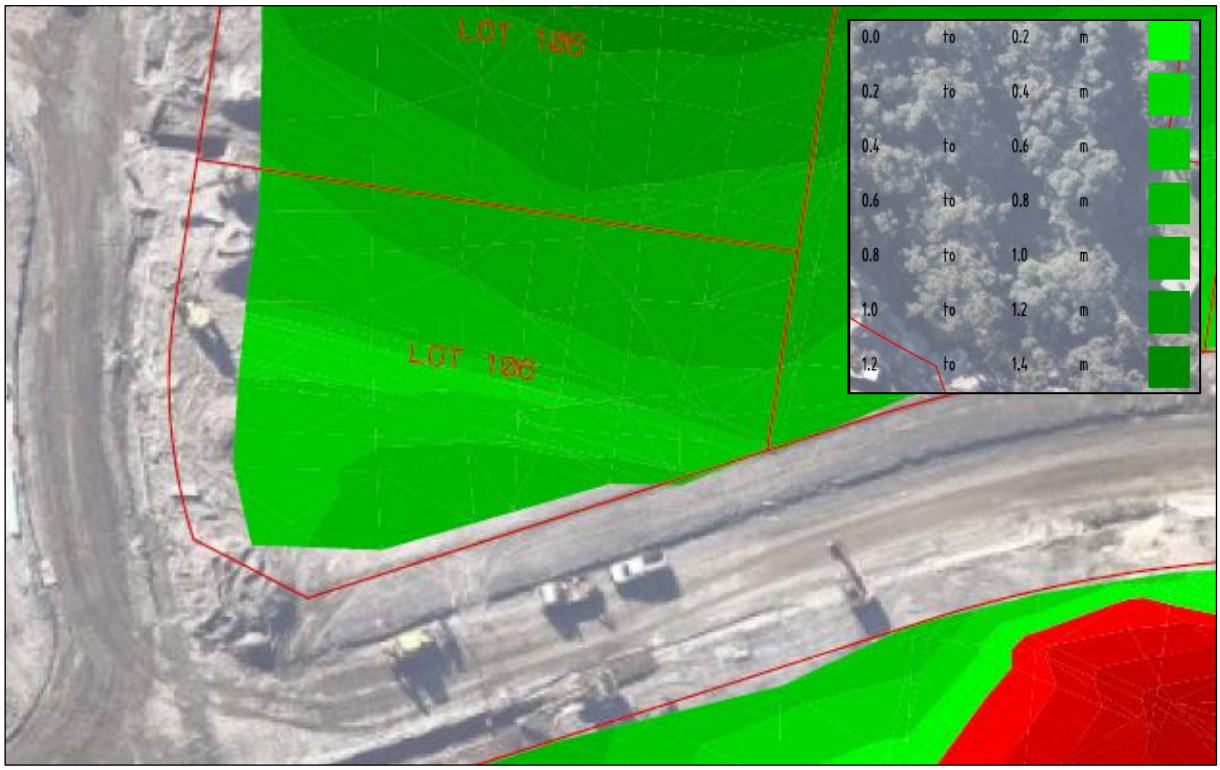

Figure 7: Approximate extent of fill on proposed Lot 106 (see legend insert)

Qualtest (2020) stated that bulk filling and cutting performed for the re-grade areas was carried out to Level 1 criteria as defined in Clause 8.2 – Section 8, of AS3798-2007, "Guidelines on Earthworks for Commercial and Residential Developments". The report stated that "The earthworks carried out are generally considered to be fit for purpose and suitable for their intended use, (i.e. as foundations for buildings, basin walls, supporting road embankments etc.), as part of the GNAPL Astra Aerolab development". However; the report noted that for areas where uncontrolled fill was left in place, suitability for intended use will be dependent on any site-specific geotechnical constraints and/or design advice provided.

6. Comments – Lot 106

6.1 Subsurface Conditions

Based on the review of existing information for the proposed Lot 106 (i.e. level 1 reports, imported material records and previous investigation), subsurface conditions are anticipated to generally comprise the following:

- Fill, generally comprising crushed quarry-sourced igneous rock, or crushed sandstone, up to about 1.2 m. Fill has been placed within the overall Stage 1 area under Level 1 conditions, however, Qualtest (2020) stated that 'uncontrolled' fill was left in place in Lot 106, as instructed by the client. It is noted, however, that Valley Civilab (2020) reported Level 1 supervision and testing on fill placed in the vicinity of proposed Lot 106 as part of works prior to that reported in Qualtest (2020) (i.e. stockpile 2 and stockpile 3 in Figure 5 above);

- Investigation results (CPT 101 and Pit 306), prior to placement of fill as described above, indicated the presence of loose sands from the ground surface to levels of approximately RL 3.15 to RL 2.5 AHD, underlain by medium dense to dense sands. CPT 101 indicated medium dense to dense sands to the extent of investigation at -11.89 AHD;

6.2 Depth to Groundwater

Groundwater was encountered at the test locations near or within proposed Lot 106 at around RL 2.4 AHD and 2.1 AHD. Groundwater depths are presented on the attached CPT plot and log in Appendix B. It is important to note that groundwater levels are affected by factors such as earthworks, climatic conditions and soil permeability and will therefore vary with time.

6.3 Hydraulic Conductivity and Groundwater Level Fluctuation

The ability of the subsurface profile to accept infiltration or the hydraulic conductivity of the soil is influenced by several factors, including the following:

- The subsurface profile;
- The presence of less permeable layers (ie silt, clay or indurated sands) within the soil profile; such layers may lower the permeability (hydraulic conductivity) of the subsurface profile by several orders of magnitude;
- Climatic conditions; and
- The presence of groundwater table.

In-situ and laboratory testing and analysis conducted within the Stage 1 area prior to fill placement indicated a saturated hydraulic conductivity of the underlying natural sand soils within the Stage 1 area being around 2 x 10^{-4} m/s. Furthermore, Fetter (1994) indicates the typical permeability for well-sorted sands in the range of 10^{-5} m/s to 10^{-3} m/s.

It is suggested that design for infiltration or groundwater adopt the range suggested by Fetta until more site-specific data is obtained.

It should be noted that the method used in estimation of permeability of the soil often over-predicts actual infiltration during storm periods, and runoff can be expected from time to time following extreme storm events. In addition, consideration should also be given to the clogging of the pores within the sand by silt from runoff. Based on previous experience, the clogging of pores within the sand can reduce the permeability of the sand by at least two orders of magnitude over time.

Groundwater levels measured in 2019 as part of investigation works for DP (2019b) indicate groundwater levels within the Astra Aerolab Stage 1 area of between 1.5 AHD and 2.5 AHD.

Work as executed plans in Qualtest (2020) indicated surface levels of Lot 106 between 3.6 AHD (south-western corner) to 4.2 AHD in the north-eastern corner of the proposed lot, suggesting that groundwater levels within Lot 106 could be in the vicinity of 1 m to 2 m below current ground levels.

Further groundwater level measurement and monitoring is recommended prior to construction to assist in design of footings, structures and dewatering requirements (if required).

6.4 Footings

6.4.1 Shallow Footings

Site-specific geotechnical investigation has not been conducted for the proposed development. Investigation, specific to the proposed development is recommended to confirm subsurface conditions and design parameters for footing types.

Due to the uncertainty in the location of “uncontrolled fill” at the site, it is recommended that shallow footings are not adopted for the development. Footings should be founded below the existing fill into the underlying natural medium dense or dense sand.

For lightly loaded structures which are not sensitive to settlement, high level footings up to about 1 m in width could be considered. As a guide for preliminary design, pad or strip footings could be proportioned for an allowable bearing pressure of 120 kPa but this should be confirmed following specific investigation and possibly penetrometer testing at each footing location, prior to casting with concrete.

6.4.2 Piles

The presence of clean ‘cohesionless’ sands would preclude the use of conventional uncased bored piles. Piled foundation options for this site could comprise driven piles and continuous flight auger (CFA) piles. Ground vibrations and noise associated with the installation of driven piles could be disruptive to nearby buildings and should be given consideration in conjunction with comments from specialist piling contractors. The methods for installation of CFA grout injected piles or steel screw piles are essentially vibration-free although CFA piles will need to consider management of spoil from an acid sulfate soil perspective.

Driven piles should be installed to a predetermined resistance or set, with measurements recorded during pile installation. The capacity of driven piles should then be further checked using an acknowledged pile driving formulae, such as the Hiley equation, or more sophisticated dynamic testing methods, such as CAPWAP or PDA. CPT report sheets should be checked when a founding set has been achieved to verify sufficient thickness of adequate founding material beneath the pile toe (at least four pile diameters).

For design purposes it is accepted practice to adopt lower bound values for the soil strengths to be conservative. When driving however, the pile behaviour will be governed by the actual soil strength. Therefore, the possibility of the pile refusing before the target depth defined by calculation is reached must be recognised. This will be especially true if an undersized hammer is used. To minimize this risk, a hammer capable of driving against the minimum required capacity (including testing requirements) should be selected such that if premature refusal occurs, adequate capacity should still be obtained (at least for compressive criteria). Nevertheless, selection of an appropriate piling hammer should be the responsibility of the piling contractor.

As an alternative to driven piles, cast in-situ CFA piles could be considered.

The ultimate parameters provided in Table 3 are suggested for the preliminary static design of driven piles subject to vertical compressive and uplift loads, with at least four pile diameters embedment into the founding strata and a consistent founding stratum extending to at least four pile diameters below the toe of the pile. The values provided for the sand layers are based on using buoyant unit weight in the calculation of effective stress.

A factor of safety of 2.5 should be applied to all ultimate values for working stress analysis. Alternatively, a basic geotechnical strength reduction factor (ϕ_{gb}) of 0.40 is recommended for limit state design of piles in accordance with (AS 2159, 2009). This is based on limited data and higher values of ϕ_{gb} may be applied if additional investigation is carried out at the site, and higher geotechnical strength reduction factor (ϕ_g) may be adopted if selected piles are subjected to confirmatory load testing.

It is recommended that the contribution of skin friction in the upper 1.0 m of soil and any shaft length that has been disturbed be ignored in any pile capacity calculations.

Table 3: Ultimate Unfactored Pile Design Parameters – Vertical Load (Driven and CFA)

Material Description	Ultimate Unfactored Pressure, $R_{d,ug}$ (kPa)	
	Shaft Adhesion	End Bearing
Medium dense sand	$5H_2^{*\#}$	$500H_1$
Dense sand	$10H_2^{*\#}$ (80 kPa Max)	$900H_1$

Notes to Table:
H_1 – depth to pile toe (in metres), limited to eight or 15 times pile diameter for medium dense and dense sands, respectively
H_2 – depth to centre of pile shaft within sand layer (in metres), limited to eight or 15 times pile diameter for medium dense and dense sands, respectively
* – shaft adhesion in compression only, reduce by 50% for uplift
# value should be reduced by 50% for CFA

6.5 Pavement Design Parameters

External pavements have been constructed as part of Stage 1 works at Astra Aerolab. This report does not provide additional design parameters for the external subdivision pavements.

On the basis of the information provided as part of this review, subgrade conditions are expected to comprise sand or crushed rock (sandstone and/or quarry materials), or a combination of these material types. A design CBR of 10% is considered appropriate for the design of internal pavement for the proposed development provided the subgrade preparation measures presented in Section 6.6 are undertaken.

6.6 Engineered Fill / Earthworks Preparation Measures

It is understood that bulk earthworks have been conducted on the Astra Aerolab Stage 1 site, including the proposed Lot 106. Requirements for site-specific earthworks for the proposed development are not know at this stage.

All fill intended to support buildings, road pavements, services and other settlement sensitive structures should be placed to the requirements of engineered filling. This also includes areas where replacement is required if near-surface soft clay soils have been excavated / removed.

Engineered filling should be free of organics and other deleterious materials, have a nominal maximum particle size of no greater than 150 mm, and be well graded. It may be possible to accept the occasional cobble up to 200 mm, but material greater than 150 mm should not be prevalent within the filling. Where coarse gravel / cobbles are used in the fill, they should be placed with sufficient finer grained material (ie sand) to prevent the occurrence of voids within the filling.

Clean sand should be used as backfill in submerged areas which need to be filled. Reactive (high plasticity) clays are not recommended for use.

It is recommended that engineered fill has a CBR of at least 10%, particularly in areas of road pavement. Engineered fill that is imported to site should meet the requirements of ENM or VENM. Locally available sand from the Williamtown and Anna Bay areas are expected to meet the geotechnical requirements of engineered fill. If material with a CBR of less than 10% is used in pavement areas, then the pavement thickness designs will need to be revised.

Treated acid sulfate soils may be suitable for re-use in select areas of the site provided that they meet the requirements presented above, ie: free of organics (non-peaty soils), and non-reactive.

The following general procedure is recommended for placement of engineered fill:

- Remove topsoil, uncontrolled fill and deleterious materials (refer additional comments below regarding areas where this is not required);
- Suitable fill should be placed in horizontal layers not exceeding 300 mm loose thickness and compacted to a 100% dry density ratio (Standard), or density index of 80% (sand);
- Moisture content should preferably be in the range -3% OMC (dry) to +1% OMC (wet), where OMC is the optimum moisture content at Standard compaction. These criteria should be confirmed once the material type has been selected.

It is noted that groundwater can at times be relatively shallow at the site. Compaction of engineered fill will be difficult in wet areas, and pumping of the soils could occur, the extent of which will likely depend on the prevailing weather conditions at the time of construction. In areas where existing engineered fill needs to be removed for construction, a non-plastic gravel bridging layer may be required prior to the placement of subsequent fill to construct a working platform on which to place the engineered fill. The bridging layer would usually be created by thickening up the placement of the first layer of filling.

Geotechnical inspections and testing should be performed during construction in accordance with AS 3798:2007.

Regardless of the above, site-specific geotechnical assessment would be required for the proposed development. Additional, pre-construction assessment will be required if cranes are to be used on the site during construction. Depending on the crane configuration and the lift loads, additional site preparation measures may be required.

6.7 Earthquake Provisions

Reference to Australian Standard AS 1170.4-2007 (AS 1170.4, 2007) and the anticipated subsurface conditions, a Sub-soil Class of Ce could apply to this site.

7. References

AS 1170.4. (2007). *Structural Design Actions, Part 4: Earthquake Actions in Australia.* Reconfirmed 2018. Incorporating Amendments 1 & 2: Standards Australia.

AS 2159. (2009). *Piling - Design and Installation.* Standards Australia.

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DP (2009a). *Report on Geotechnical Investigation, Williamtown Aerospace Park, Williamtown*, prepared for RPS Harper Somers O'Sullivan on behalf of Hunter Land Pty Ltd, Project 39728.04, Douglas Partners Pty Ltd.

DP (2009b). *Preload and Earthworks Requirements, Williamtown Aerospace Park, Williamtown Drive and Cabbage Tree Road, Williamtown,* prepared for RPS Harper Somers O'Sullivan on behalf of Hunter Land Pty Ltd, Project 39728.05, Douglas Partners Pty Ltd.

DP (2019a). *Acid Sulfate Soil Management Plan, Astra Aerolab Stage 1, Williamtown Drive, Williamtown*, prepared for APP Corporation on behalf of Newcastle Airport Pty Ltd, Project 39728.19, Douglas Partners Pty Ltd.

DP (2019b). *Report on Geotechnical Investigation, Astra Aerolab Stage 1, Williamtown Drive Williamtown*, prepared for Northrop Consulting Engineers Pty Ltd, Project 39728.20, Douglas Partners Pty Ltd.

Valley Civilab (2020). *Geotechnical Level 1 Inspection and Testing Report, Newcastle Airport, Williamtown*, prepared for KCE Pty Ltd, ref P1938-L1R-001-Rev0, Valley Civilab.

Qualtest (2020). *GNAPL Astra Aerolab – Williamtown Drive, Williamtown, Level 1 Site Re-grade Assessment Report*, prepared for Daracon, ref NEW20P-0020-AB, Qualtest Laboratory (NSW) Pty Ltd.

8. Limitations

Douglas Partners (DP) has prepared this report for this project at Astra Aerolab, Williamtown with reference to DP's proposal 39728.27.P.001.Rev0 dated 25 May 2022 and acceptance received from John Ferendinos of Cox Architecture dated 14 August 2022. The work was carried out under DP's Conditions of Engagement. This report is provided for the exclusive use of Cox Architecture for this project only and for the purposes as described in the report. It should not be used by or relied upon for other projects or purposes on the same or other site or by a third party. Any party so relying upon this report beyond its exclusive use and purpose as stated above, and without the express written consent of DP, does so entirely at its own risk and without recourse to DP for any loss or damage. In preparing this report DP has necessarily relied upon information provided by the client and/or their agents.

The results provided in the report are indicative of the sub-surface conditions on the site only at the specific sampling and/or testing locations, and then only to the depths investigated and at the time the work was carried out. Sub-surface conditions can change abruptly due to variable geological processes and also as a result of human influences. Such changes may occur after DP's field testing has been completed.

DP's advice is based upon the conditions encountered during this investigation. The accuracy of the advice provided by DP in this report may be affected by undetected variations in ground conditions across the site between and beyond the sampling and/or testing locations. The advice may also be limited by budget constraints imposed by others or by site accessibility. It is noted that significant site changes have occurred since DP conducted subsurface investigation on the subject site.

The assessment of atypical safety hazards arising from this advice is restricted to the geotechnical components set out in this report and based on known project conditions and stated design advice and assumptions. While some recommendations for safe controls may be provided, detailed 'safety in design' assessment is outside the current scope of this report and requires additional project data and assessment.

This report must be read in conjunction with all of the attached and should be kept in its entirety without separation of individual pages or sections. DP cannot be held responsible for interpretations or conclusions made by others unless they are supported by an expressed statement, interpretation, outcome or conclusion stated in this report.

This report, or sections from this report, should not be used as part of a specification for a project, without review and agreement by DP. This is because this report has been written as advice and opinion rather than instructions for construction.

The scope of work for this investigation/report did not include the assessment of surface or sub-surface materials or groundwater for contaminants, within or adjacent to the site. Should evidence of fill of unknown origin be noted in the report, and in particular the presence of building demolition materials, it should be recognised that there may be some risk that such fill may contain contaminants and hazardous building materials.

Douglas Partners Pty Ltd

Appendix A

About This Report

CPT Plot – CPT 101 (DP 2008)

Test Pit Log – Pit 306 (39728.06)

About this Report

Douglas Partners

Introduction

These notes have been provided to amplify DP's report in regard to classification methods, field procedures and the comments section. Not all are necessarily relevant to all reports.

DP's reports are based on information gained from limited subsurface excavations and sampling, supplemented by knowledge of local geology and experience. For this reason, they must be regarded as interpretive rather than factual documents, limited to some extent by the scope of information on which they rely.

Copyright

Borehole and Test Pit Logs

The borehole and test pit logs presented in this report are an engineering and/or geological interpretation of the subsurface conditions, and their reliability will depend to some extent on frequency of sampling and the method of drilling or excavation. Ideally, continuous undisturbed sampling or core drilling will provide the most reliable assessment, but this is not always practicable or possible to justify on economic grounds. In any case the boreholes and test pits represent only a very small sample of the total subsurface profile.

Interpretation of the information and its application to design and construction should therefore take into account the spacing of boreholes or pits, the frequency of sampling, and the possibility of other than 'straight line' variations between the test locations.

Groundwater

Where groundwater levels are measured in boreholes there are several potential problems, namely:

- In low permeability soils groundwater may enter the hole very slowly or perhaps not at all during the time the hole is left open;
- A localised, perched water table may lead to an erroneous indication of the true water table;
- Water table levels will vary from time to time with seasons or recent weather changes. They may not be the same at the time of construction as are indicated in the report; and
- The use of water or mud as a drilling fluid will mask any groundwater inflow. Water has to be blown out of the hole and drilling mud must first be washed out of the hole if water measurements are to be made.

More reliable measurements can be made by installing standpipes which are read at intervals over several days, or perhaps weeks for low permeability soils. Piezometers, sealed in a particular stratum, may be advisable in low permeability soils or where there may be interference from a perched water table.

Reports

The report has been prepared by qualified personnel, is based on the information obtained from field and laboratory testing, and has been undertaken to current engineering standards of interpretation and analysis. Where the report has been prepared for a specific design proposal, the information and interpretation may not be relevant if the design proposal is changed. If this happens, DP will be pleased to review the report and the sufficiency of the investigation work.

Every care is taken with the report as it relates to interpretation of subsurface conditions, discussion of geotechnical and environmental aspects, and recommendations or suggestions for design and construction. However, DP cannot always anticipate or assume responsibility for:

- Unexpected variations in ground conditions. The potential for this will depend partly on borehole or pit spacing and sampling frequency;
- Changes in policy or interpretations of policy by statutory authorities; or
- The actions of contractors responding to commercial pressures.

If these occur, DP will be pleased to assist with investigations or advice to resolve the matter.

About this Report

Site Anomalies

In the event that conditions encountered on site during construction appear to vary from those which were expected from the information contained in the report, DP requests that it be immediately notified. Most problems are much more readily resolved when conditions are exposed rather than at some later stage, well after the event.

Information for Contractual Purposes

Where information obtained from this report is provided for tendering purposes, it is recommended that all information, including the written report and discussion, be made available. In circumstances where the discussion or comments section is not relevant to the contractual situation, it may be appropriate to prepare a specially edited document. DP would be pleased to assist in this regard and/or to make additional report copies available for contract purposes at a nominal charge.

Site Inspection

The company will always be pleased to provide engineering inspection services for geotechnical and environmental aspects of work to which this report is related. This could range from a site visit to confirm that conditions exposed are as expected, to full time engineering presence on site.

CONE PENETRATION TEST

LOCATION: WILLIAMTOWN DRIVE, WILLAMTOWN

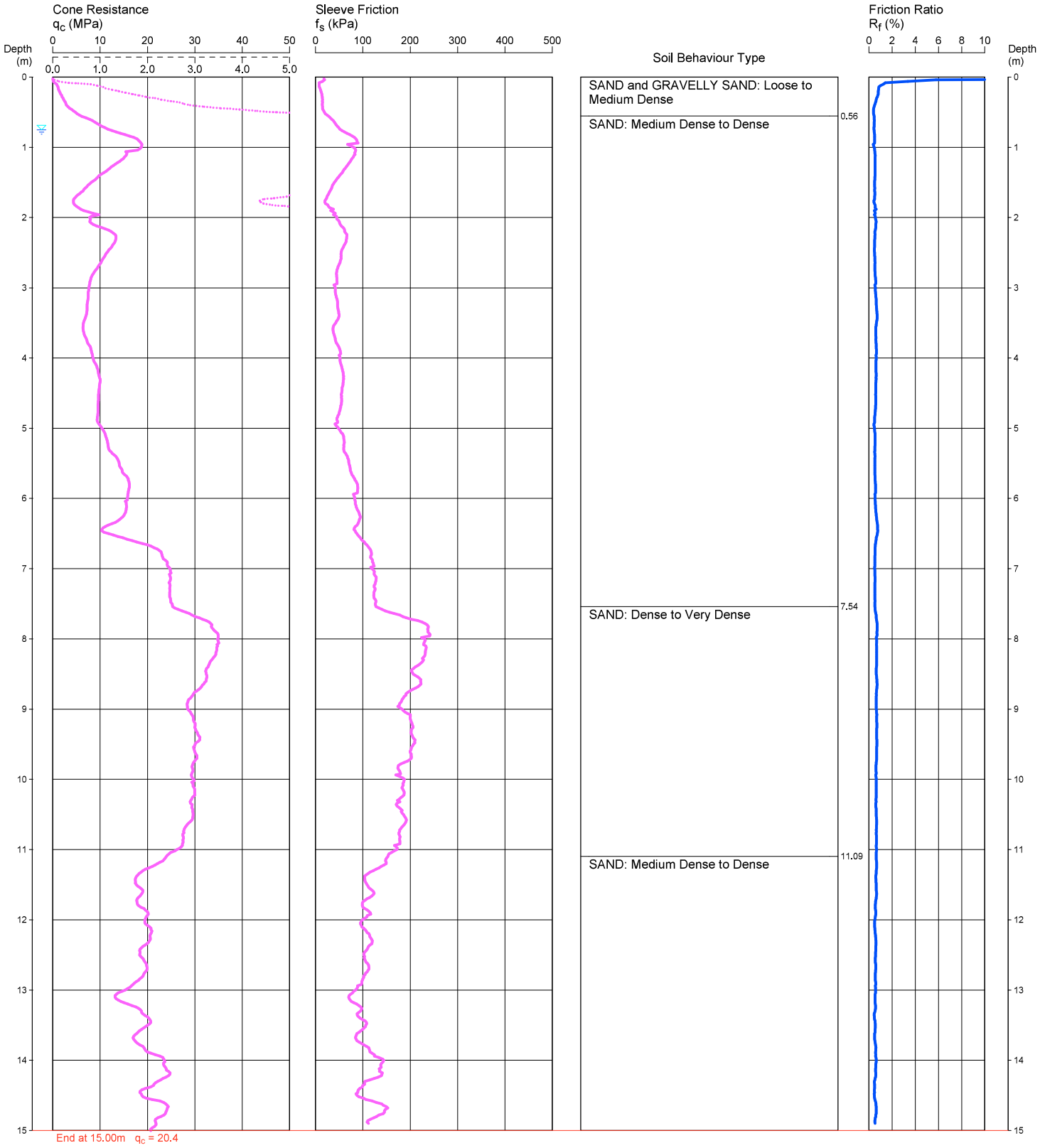
PROJECT No: 39728.01

CPT 101

Page 1 of 1

DATE 25/03/2008

SURFACE RL: 3.11



REMARKS: DEPTH TO WATER AT COMPLETION OF TEST : 0.75 m

Date
Plotted
Checked

File: P:\39728.01\Field\CPT Results\39728101.CP5
Cone ID: 400 **Type:** 2 Standard

ConePlot Version 5.8.1

Douglas Partners
Geotechnics · Environment · Groundwater

TEST PIT LOG

LOCATION: Williamtown Drive, Williamtown

SURFACE LEVEL: 3.5 AHD*
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

PIT No: 306
PROJECT No: 39728.06
DATE: 3/8/2010
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water
		SAND - Loose, light grey brown fine to medium grained sand, some rootlets, damp		D	0.2			
	0.35	SAND - Medium dense to dense, brown sand, trace to some silt, damp		D	0.5			
		From 0.6m, some dark brown weakley to moderately well-cemented zones (coffee rock)		D	1.0			
				D	1.6			
	1.7	Pit discontinued at 1.7m, collapse						

Dynamic Penetrometer Test (blows per 150mm)
5 10 15 20

RIG: 5.5 tonne excavator with 600mm bucket

LOGGED: Foote

SURVEY DATUM:

WATER OBSERVATIONS: Free groundwater observed at 1.4m

REMARKS: * Surface level estimated from digital terrain model and is approximate only

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

Appendix B

Drawing 1 – Site Plan and Previous Test Locations

Cox Architecture (Design Pack V3 NAPL Commercial Building 1 dated 5 May 2022)

Cox Architecture DA Submission Plans Ref 221182

Site Location

0 10 20 30 40 m

Drawing adapted from Metromap Image dated 19.9.2022.

Legend

Lot 106

Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT:	Cox Architecture Pty Ltd	TITLE:	**Site Plan and Previous Test Locations**
OFFICE:	Newcastle	DRAWN BY:	PLH		**Proposed Commercial Building 1**
SCALE:	1:1,000 @ A3	DATE:	13.September.2022		**Lot 106 Williamtown Drive, Williamtown**

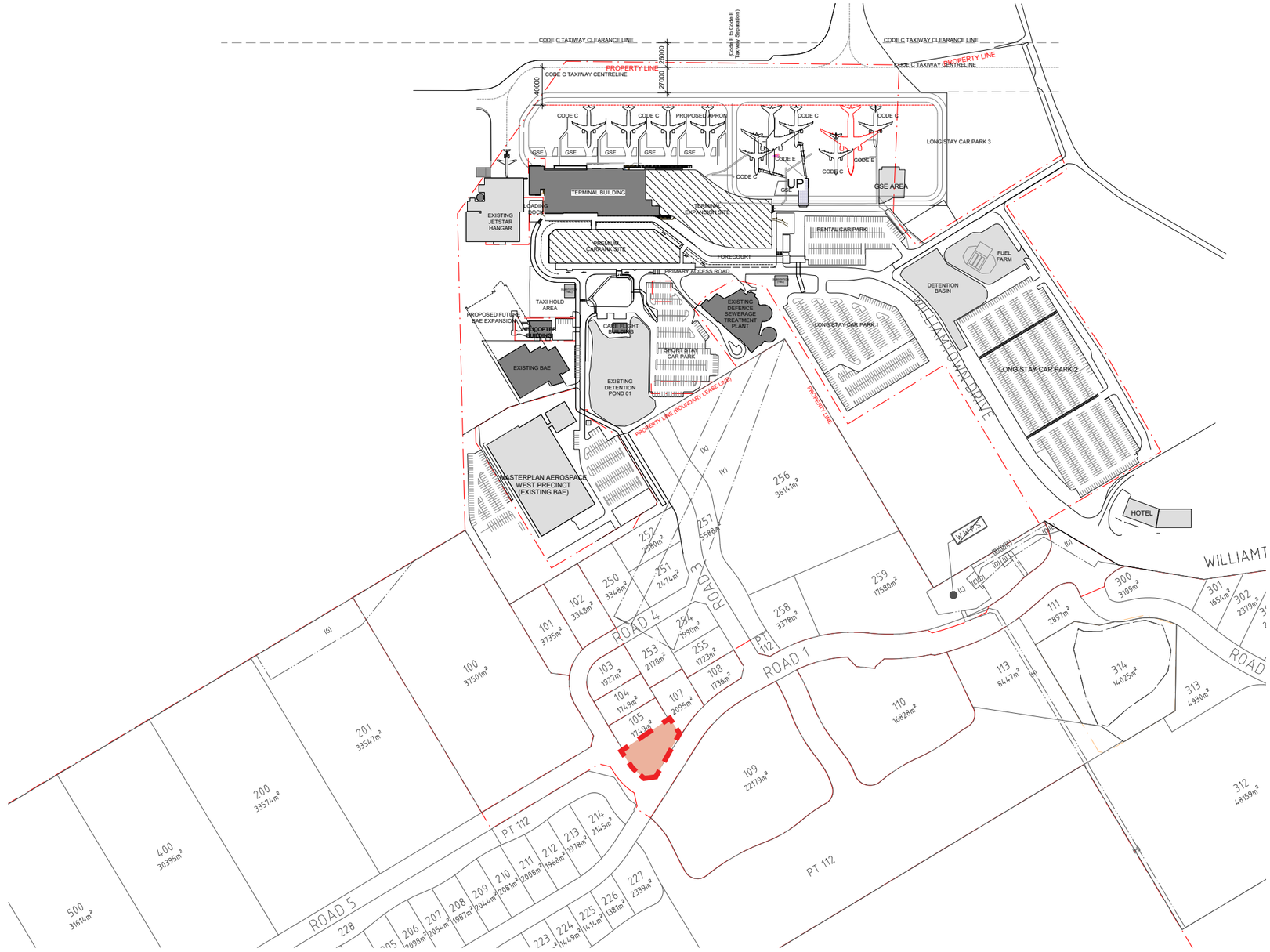
PROJECT No:	39728.27
DRAWING No:	1
REVISION:	0

5th May 2022

Design Package
NAPL - Commercial Building 1

Masterplan

Site Location - LOT 106

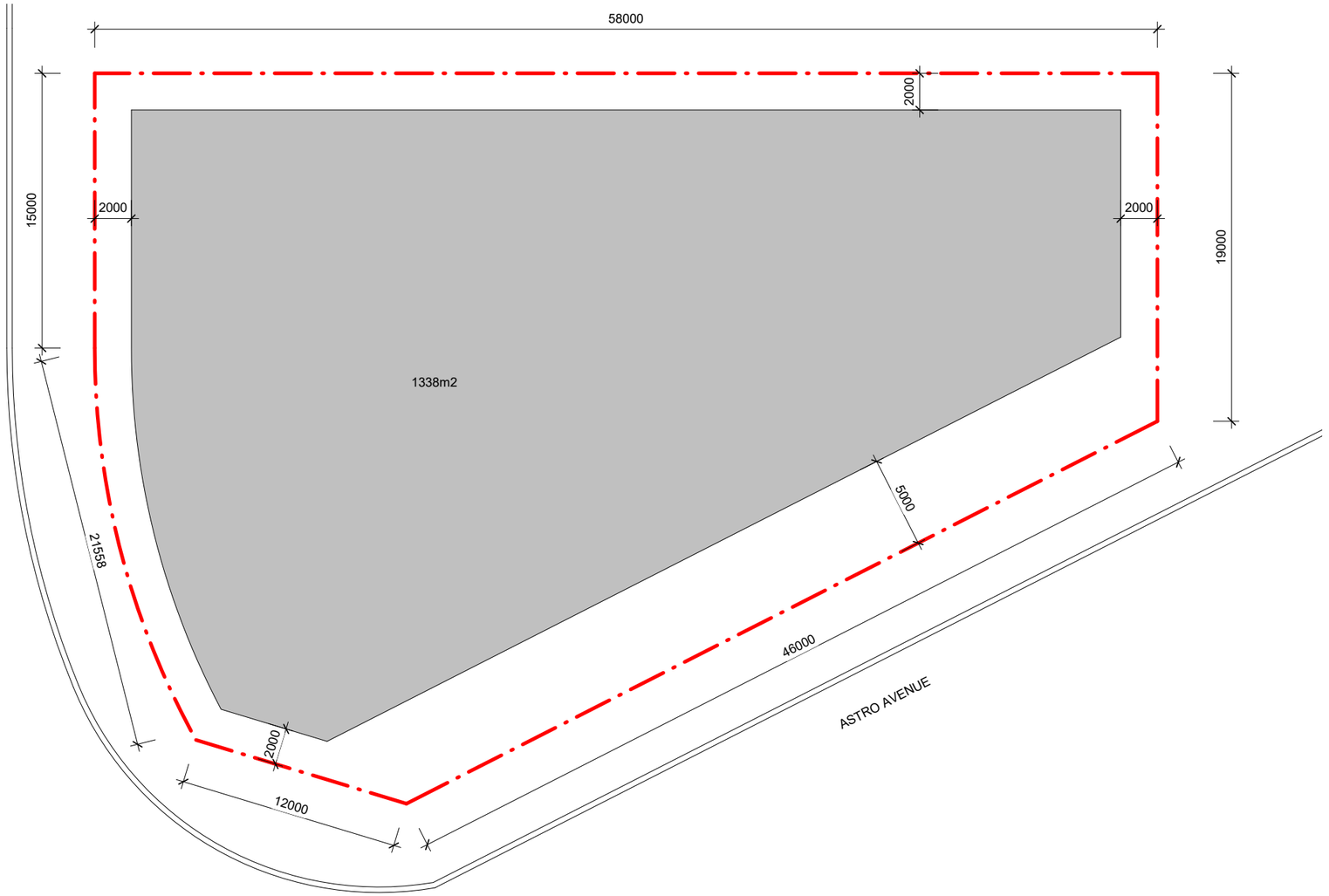


Site Plan - LOT 106

Site

Relationship to Surrounding Context

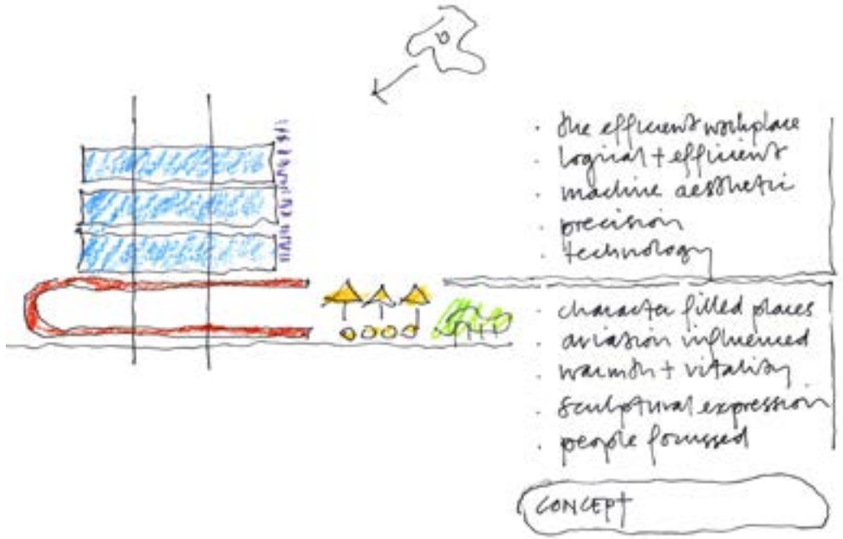
Overall Building Zone - 2m and 5m Setbacks

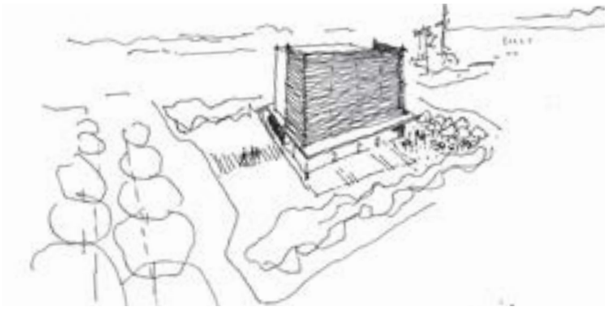


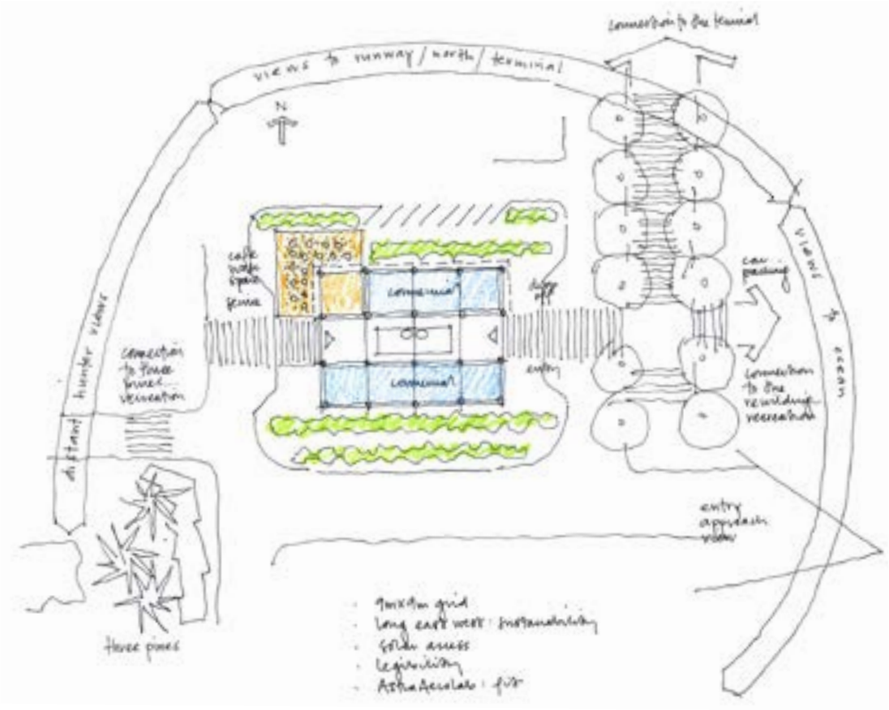
N

Concept

Initial Concept







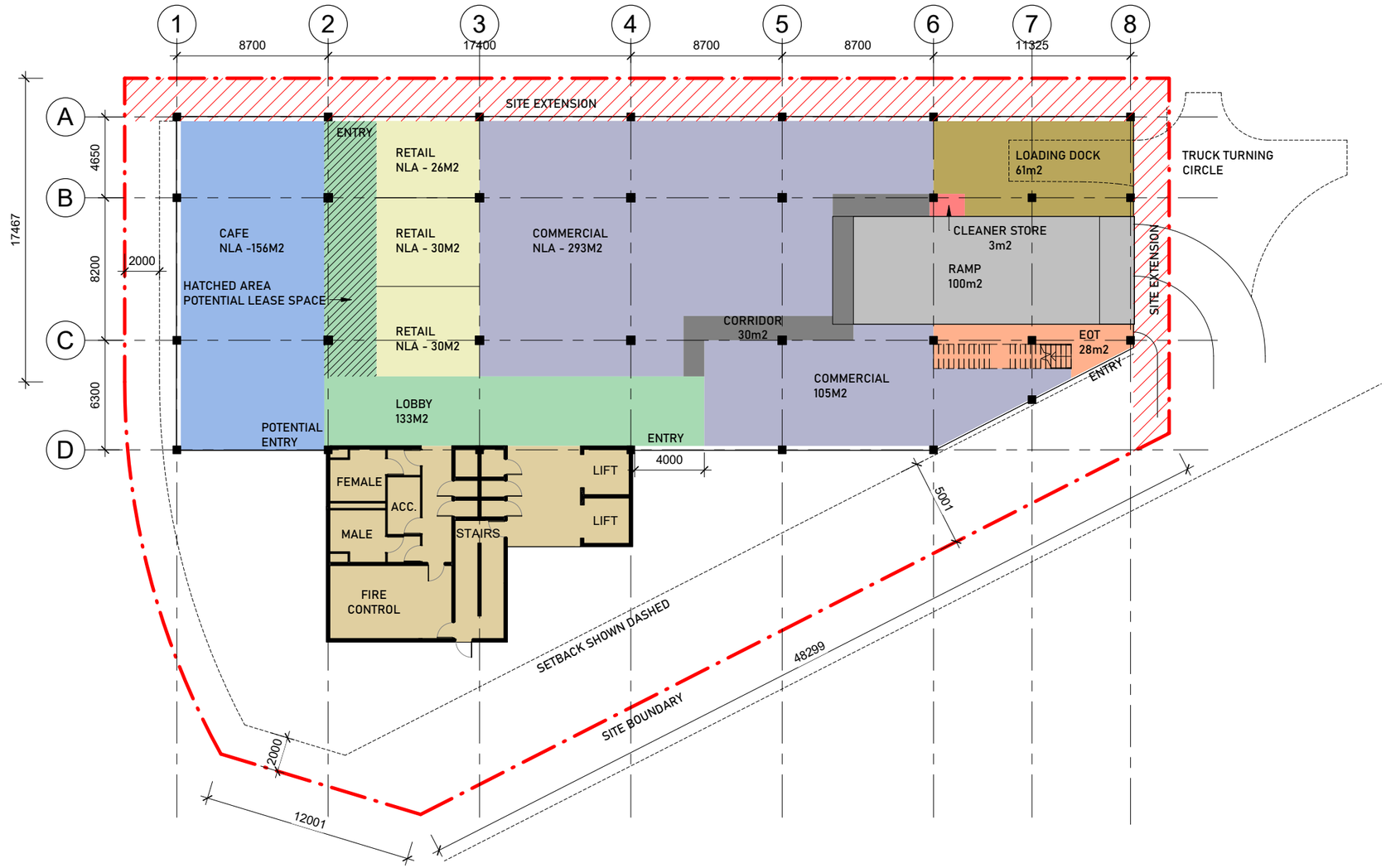
Form

Technology

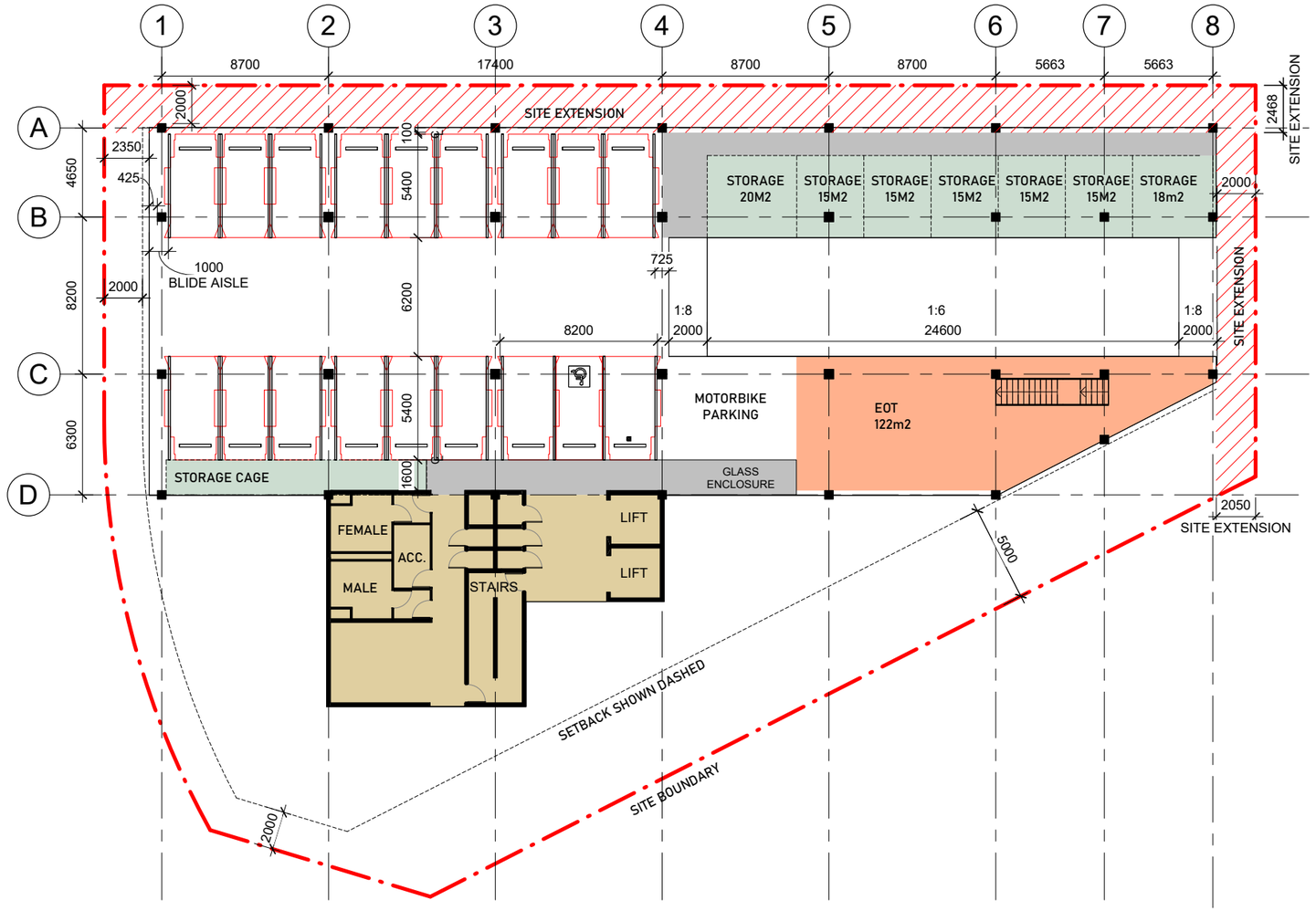
People

Overall Planning

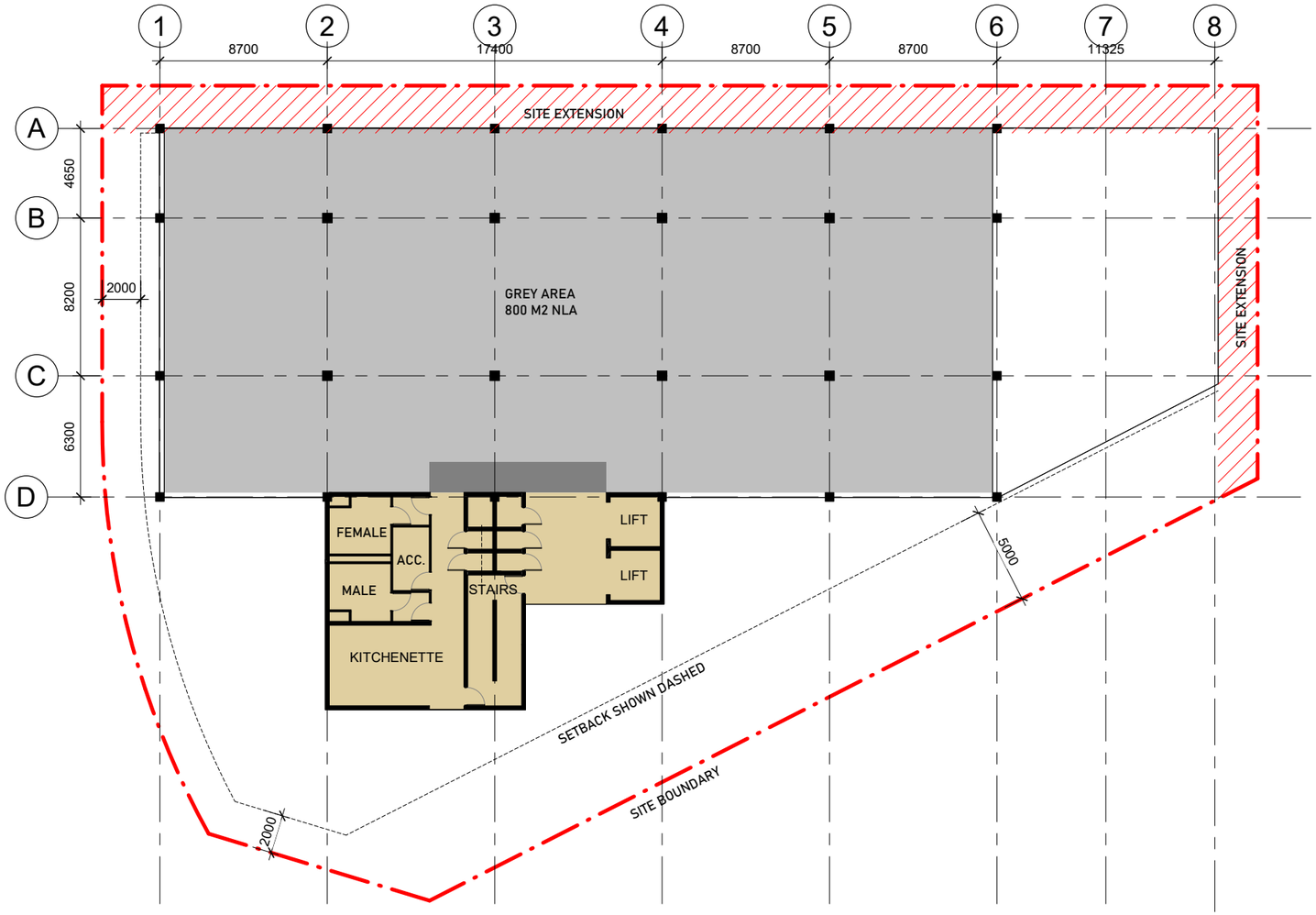
Ground Floor



Level 1 Carparking



Revised Typical Floor



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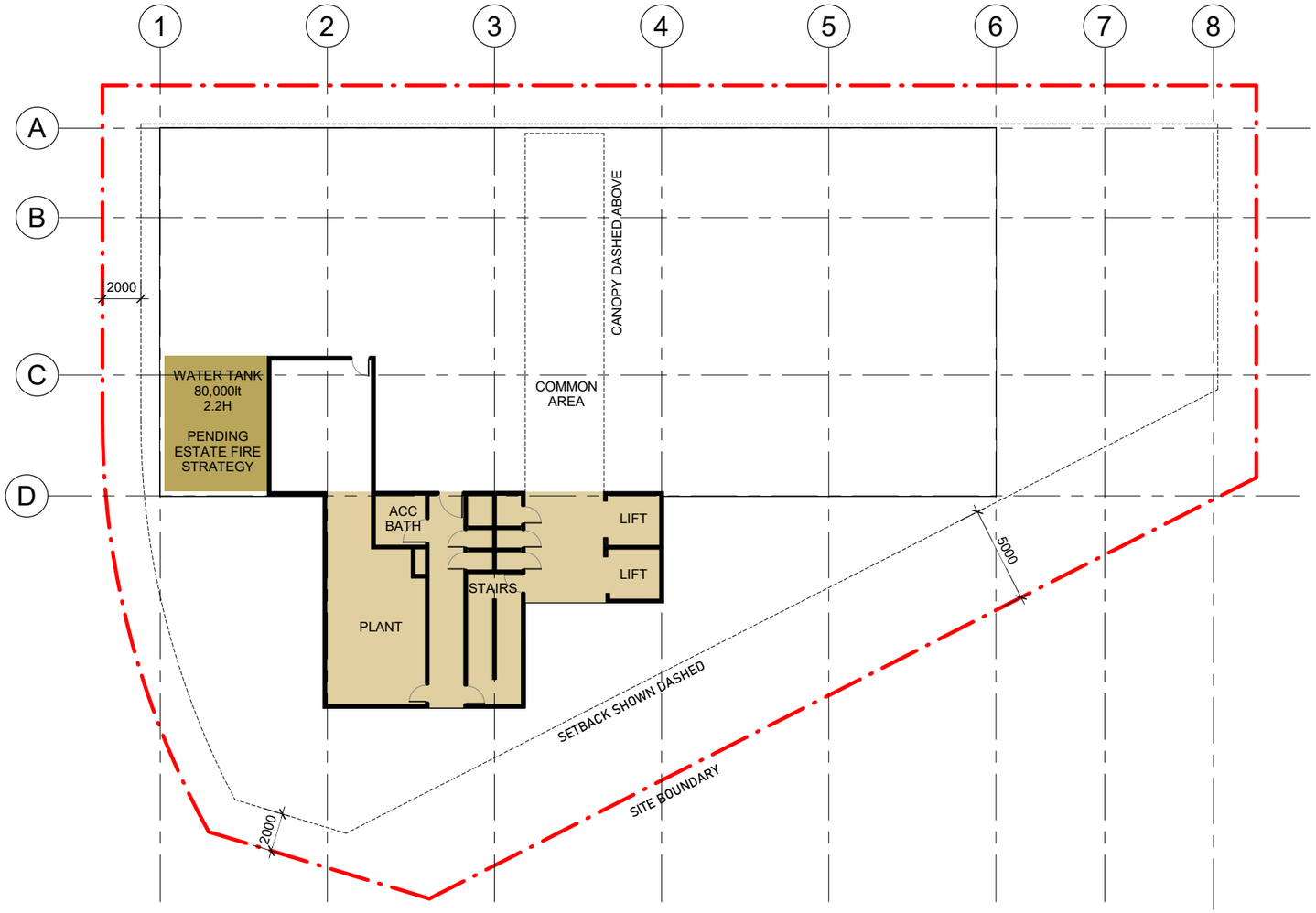
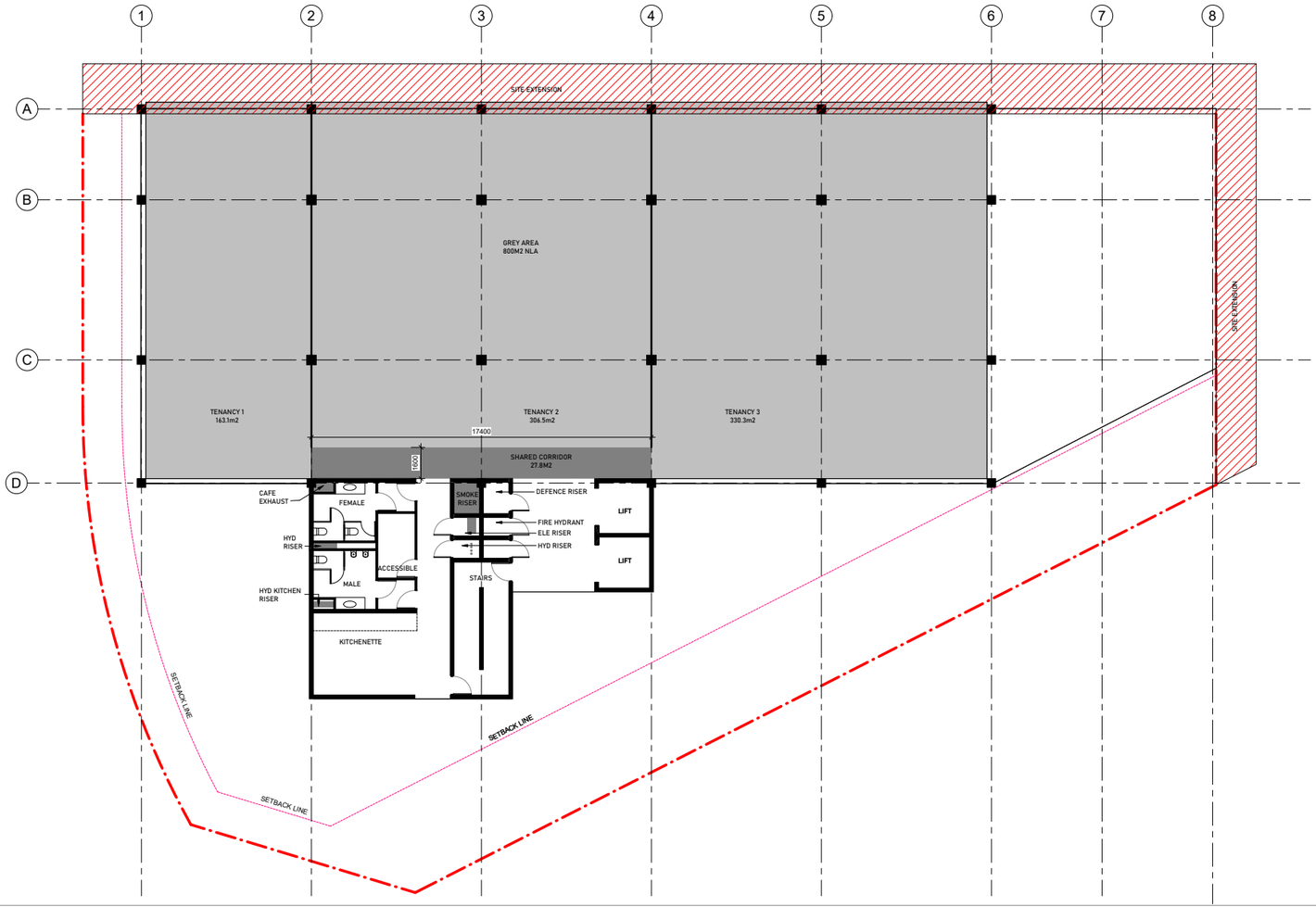
Roof Plan


1
2
3
4
5
6
7
8
A
B
C
D
2000
CANOPY DASHED ABOVE
WATER TANK
80,000lt
2.2H
PENDING
ESTATE FIRE
STRATEGY
COMMON
AREA
ACC
BATH
LIFT
LIFT
STAIRS
PLANT
5000
SETBACK SHOWN DASHED
SITE BOUNDARY
2000

N

Tenancy Layouts

Aligned to Columns



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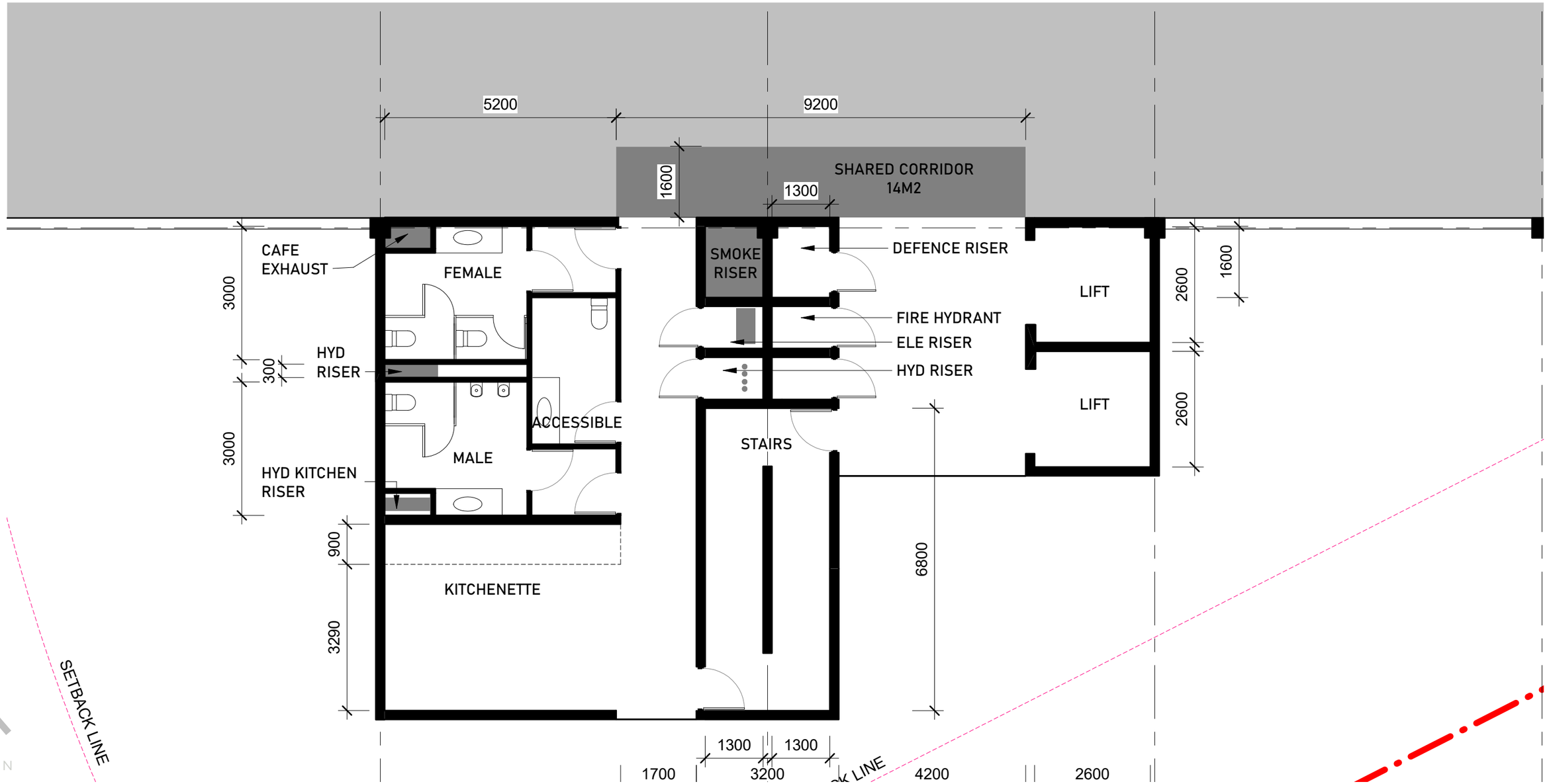
Core Planning


5200
9200
1600
1300
SHARED CORRIDOR
14M2
CAFE
EXHAUST
3000
FEMALE
SMOKE
RISER
DEFENCE RISER
LIFT
2600
1600
FIRE HYDRANT
ELE RISER
HYD
RISER
300
HYD RISER
LIFT
2600
3000
ACCESSIBLE
STAIRS
MALE
HYD KITCHEN
RISER
900
KITCHENETTE
6800
3290
SETBACK LINE
1300
1300
1700
3200
4200
2600
N

Area Schedule

Area Schedule

	GROSS AREA	NET LETTABLE AREA
GROUND	1175m²	640m²
LEVEL 1 CARPARKING	1175m²	260m²
LEVEL 2	999m²	800m²
LEVEL 3	999m²	800m²
LEVEL 4	999m²	800m²
LEVEL 5	999m²	800m²
LEVEL 6	999m²	800m²
LEVEL 7	999m²	800m²
ROOF	999m²	0m²

Ground		Level 1		Level 2		Level 3		Level 4		Level 5		Level 6		Level 7		Roof	
Core	180m²	Core	180m²	Core	180m²	Core	180m²	Core	180m²	Core	180m²	Core	180m²	Core	180m²	Core/ Plant	180m²
End of Trip	28m²	End of Trip	122m²	Shared Corridor	19m²	Shared Corridor	19m²	Shared Corridor	19m²	Shared Corridor	19m²	Shared Corridor	19m²	Shared Corridor	76m²	Common Area	76m²
Retail 1	26m²	Storage	138m²	Tenancy 1	262m²	Tenancy 1	262m²	Tenancy 1	262m²	Tenancy 1	262m²	Tenancy 1	262m²	Tenancy 1	262m²	Water Tank	38m²
Retail 2	30m²	Carparking	479m²	Tenancy 2	210m²	Tenancy 2	210m²	Tenancy 2	210m²	Tenancy 2	210m²	Tenancy 2	210m²	Tenancy 2	210m²	Unused space	705m²
Retail 3	30m²	Ramp	179m²	Tenancy 3	328m²	Tenancy 3	328m²	Tenancy 3	328m²	Tenancy 3	328m²	Tenancy 3	328m²	Tenancy 3	328m²		
Cafe	156m²	Corridor	77m²														
Loading Dock	61 m²																
Commercial	398m²																
Lobby	133m²																
Ramp	100m²																
Corridor	30m²																
Cleaners Store	3m²																

Benchmarks

Green Star 6 - 32 Smith St, Parramatta NSW

- Reduce light pollution to the night sky
- 95% of steel used in building sourced from responsible steel maker
- Ventilation system is designed for ease of maintenance and entry of pollutants is minimised
- Lighting level and quality comply with best practice guidelines and glare is eliminated
- Noise levels within the project are suitable to the activity type within the space
- Reverberation of sound is kept to a minimum
- Storm water discharged from site meets specified pollution reduction targets

50 First Avenue Maroochydore City Centre

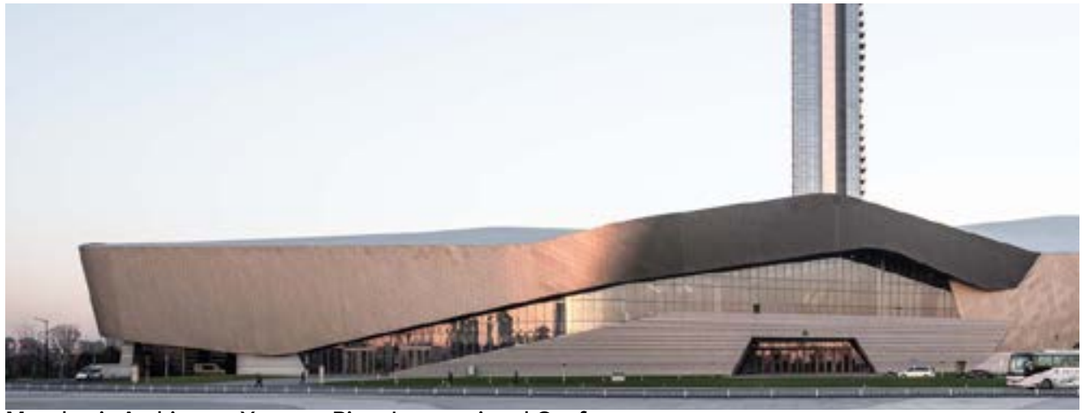
- Corner site is highly prominent and positioned
- Project is seen as a flagship which will set the standard and benchmark in quality for all future development.
- Large contiguous regular floor plates with large span structural grids
- A-Grade quality space and amenities, floor to ceiling glazing, roof terrace with views the ocean
- Podium car-parking, an extensive end-of-trip facility and unique food and beverage outlets at ground level
- Architectural approach utilises a series of simple, bold and singular expressions which clearly articulate and separate the key built-form elements of retail, podium and tower
- Robust tower form is further softened through its radiused corners

A Grade Office - Darby Plaza, Newcastle NSW

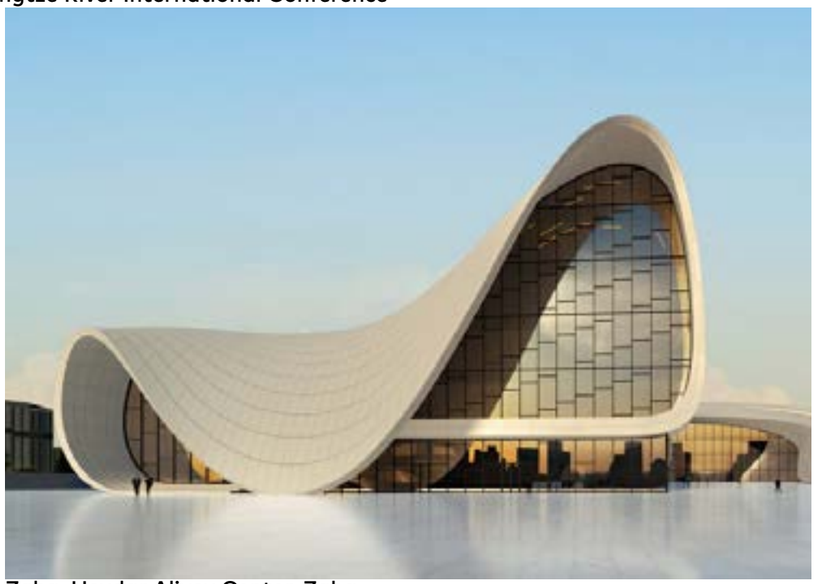
- Suites available from 100m²
- Contiguous whole floors up to 3,200m²
- Large efficient 1,600m² floor plates
- Lobby café with informal meeting spaces
- Expansive outdoor landscaped plaza with alfresco dining
- Balconies with harbour views
- Smart & sustainable building technologies
- Secure allocated car parking
- 4.5 star NABERS rating (targeted)
- High quality end of trip facilities with towel service
- Secure bicycle and surfboard storage

Materiality

Podium: Aluminum Panel with Secondary Steel Structure



Morphosis Architects, Yangtze River International Conference

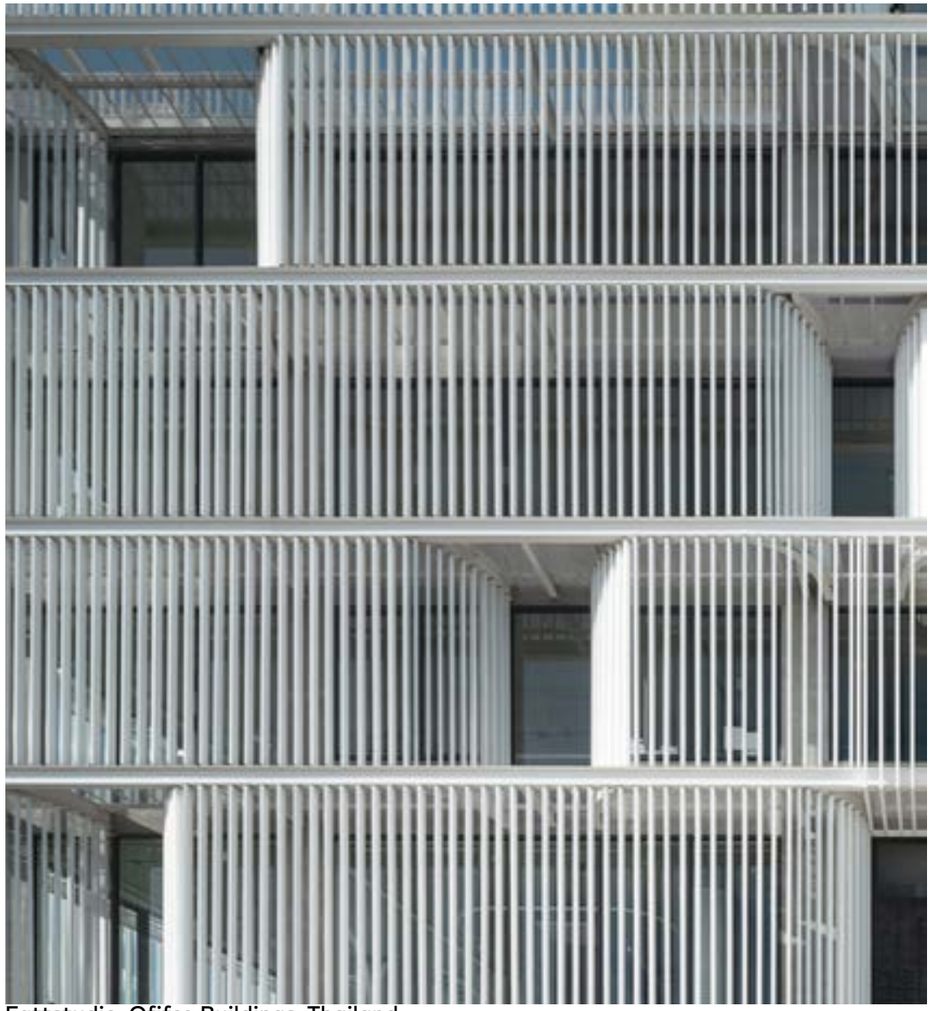


Zaha, Heydar Aliyev Center, Zaha

CGI - AS and GG Architecture

Tower: Glass and Metal Louvres

Cox, Sydney University, NSW

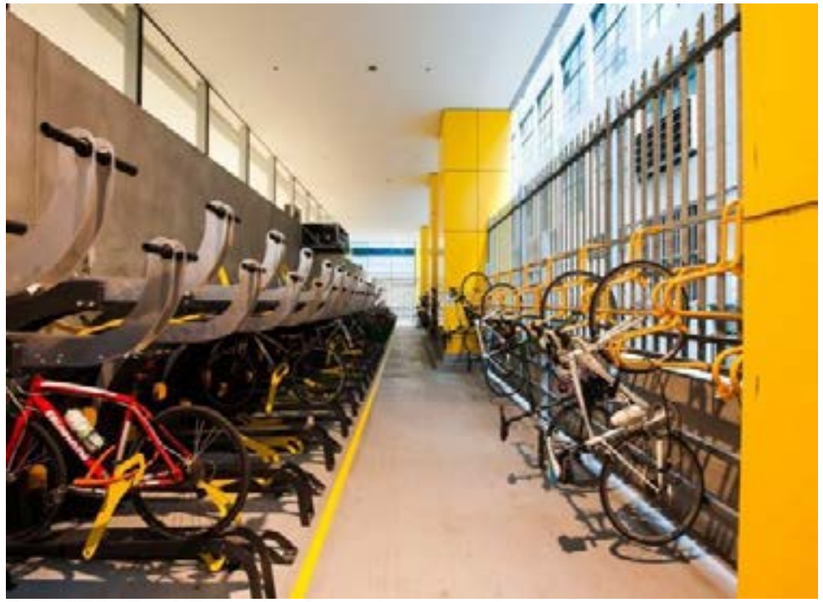


Fattstudio, Ofifce Buildings, Thailand

KSP Engel Vista

LPP office park, Gdansk Poland

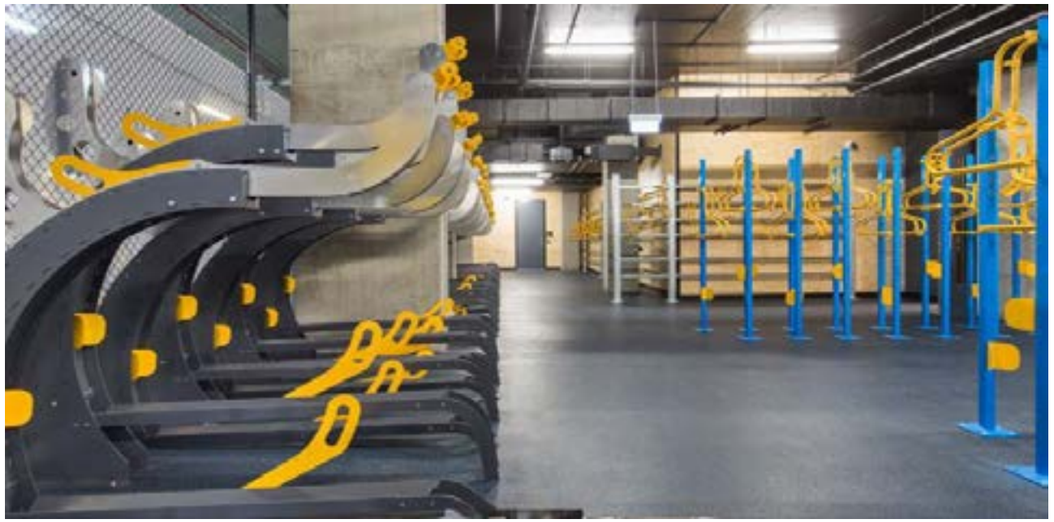
End of Trip - Precedent



End of Trip For 8 Exhibition Street (two storey)

Bicycle Parking / Ector Hoogstad Architecten

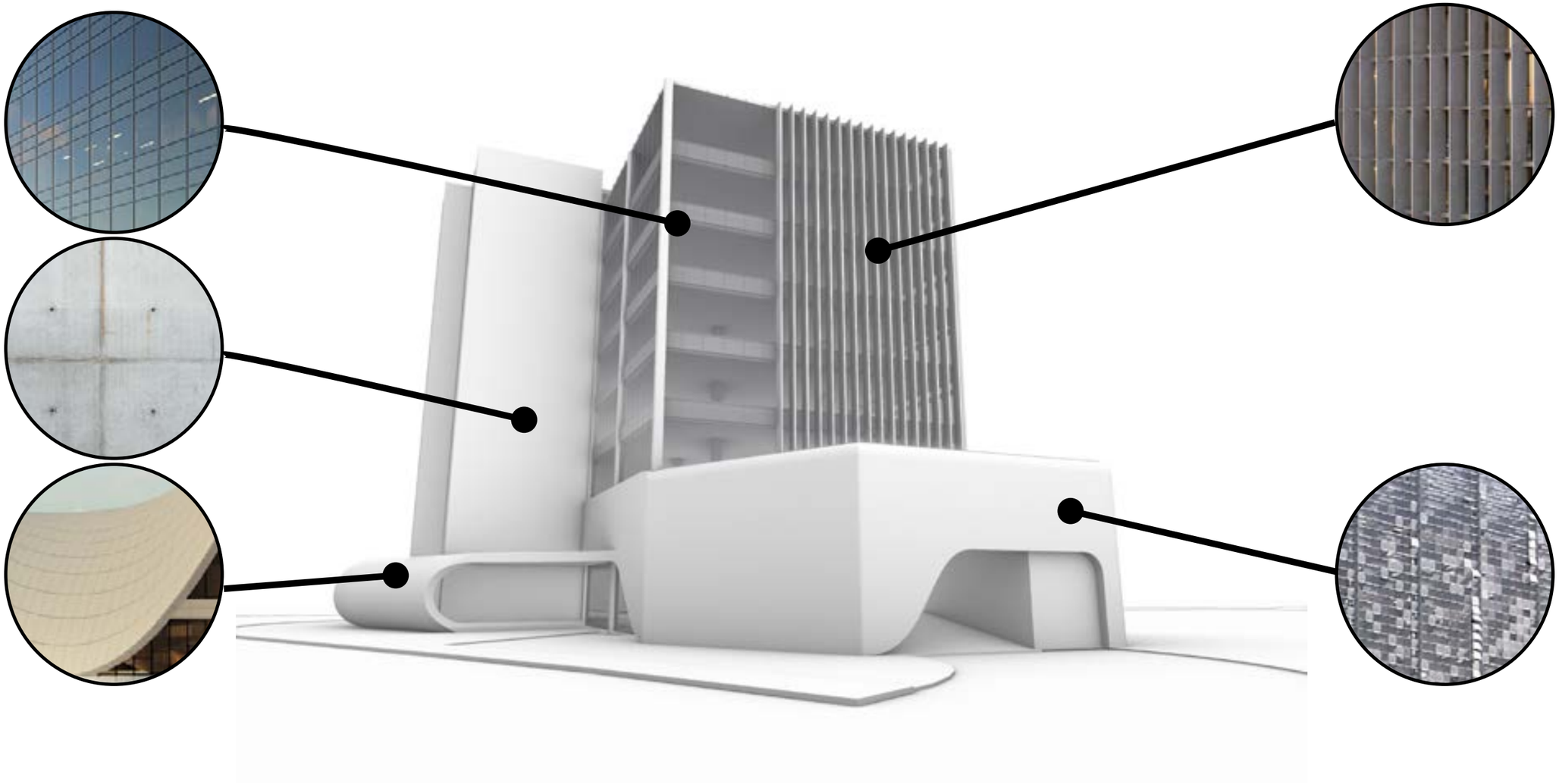
Sanifloor Shower in Monash Conference Centre | Saniflo



RACV Mobility Hub (Semi Private)

101 Collins Street, Melbourne

Form



Main Entry

Main Entry

Ramp Entry

Main Entry

Main Entry

Main Entry

Southern Facade

Southern Entrance Points

Southwestern Aerial

Southwestern Curved Canopy

Southwestern Entry

Northen Facade

Cafe

Southwestern Entry / Cafe

Southwestern Entry / Cafe

Southwestern Entry / Cafe

Louvre Studies

Option 1 - Vertical Louvres East/West, Horizontal Louvres North

South/WestFacade

East/South Facade

Northern Facade

Eastern Facade

Option 2 - Horizontal Louvres All Facades

South/WestFacade

East/South Facade

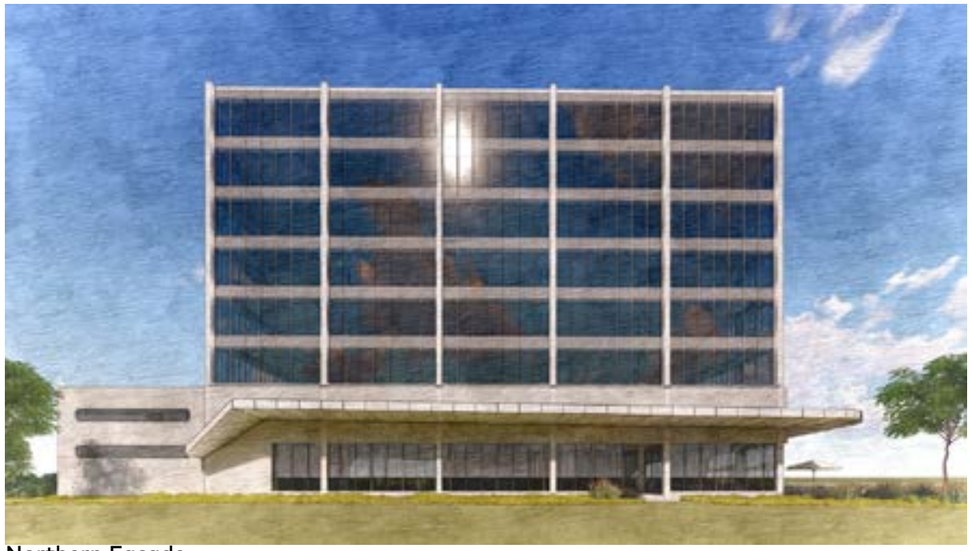
Northern Facade

Eastern Facade

Option 3 - Glass Facades All

South/WestFacade

East/South Facade



Northern Facade

Eastern Facade

Comparative Study

Vertical Louvres - South/West Facade

Horizontal Louvres - All Facades

Glass Facade - South/West Facade

Vertical Louvres - Eastern Facade

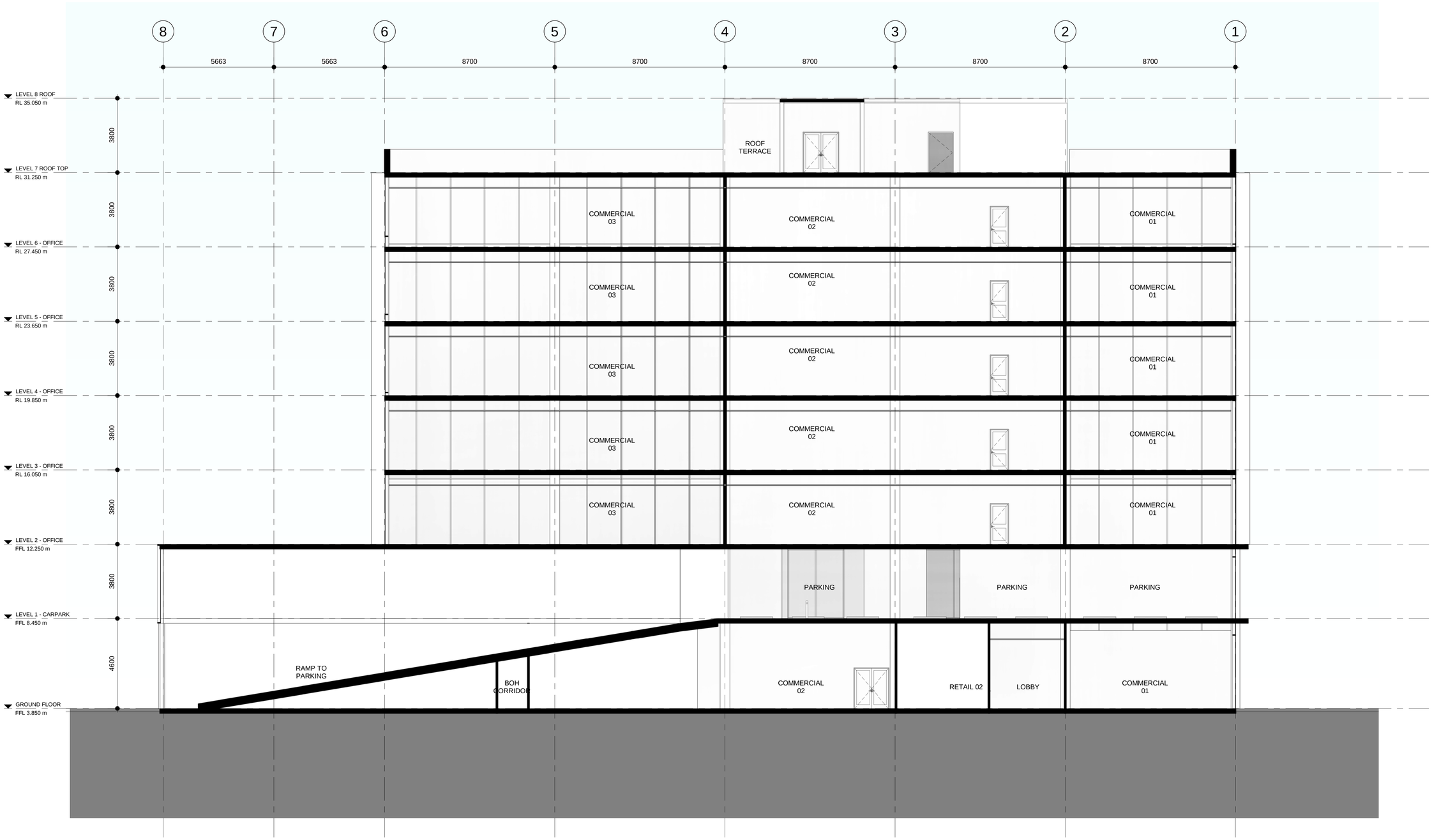
Horizontal Louvres - All Facades

Glass Facade - Eastern Facade

Cox Architecture
www.coxarchitecture.com.au

Client	NEWCASTLE AIRPORT PTY LIMITED
Project No.	221182
Document Control Status:	FOR INFORMATION
Project	NAPL - COMMERCIAL BUILDING 1 Astro Aerolab - Lot 106
Drawing Title	FLOOR PLAN - GROUND FLOOR
Co-ordinated:	JF
Drawn:	SP
Project Architect:	KM
Scale:	1 : 100 @ A1
Project Director:	DH
Date:	02/09/22
Drawing Number:	A-DA-2001
Revision:	

PLOT STAMP DATE: 5/09/2022 12:45:53 PM



Cox Architecture
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Client NEWCASTLE AIRPORT PTY LIMITED

Project No. 221182

Document Control Status: DA SUBMISSION

Project NAPL - COMMERCIAL BUILDING 1
Astro Aerolab - Lot 106

Drawing Title SECTION 01

Co-ordinated: Checker

Project Architect: Designer

Project Director: Approver

Drawing Number: A-DA-4001

Drawn: Author

Scale: 1 : 100 @ A1

Date: 07/21/22

Revision:

PLOT STAMP DATE: 17/08/2022 9:50:09 AM