Douglas Partners
Geotechnics / Environment / Groundwater

Integrated Practical Solutions

Remediation Action Plan

Proposed Apartment Development
10 Dangar Street, Wickham

Prepared for
Dangar Street Wickham Pty Ltd

Project 39961.02
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Douglas Partners
Geotechnics / Environment / Groundwater

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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.

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1. Introduction

This remediation action plan (RAP) was prepared for a proposed apartment development at 10 Dangar Street, Wickham. The work was commissioned in a signed services order dated 20 September 2018 by David Goldman of Dangar Street Wickham Pty Ltd and was undertaken with reference to Douglas Partners Pty Ltd (DP) proposal NCL180390 dated 5 July 2018.

The RAP has been developed based on available standards and guidelines prepared by the relevant authorities, the results of the previous investigations (Refs 1, 2) and recent preliminary site investigation (Ref 3) and detailed site investigation (Ref 4) conducted by DP for the proposed development.

The previous investigations conducted by DP (Refs 1 to 4) identified the following contamination issues:

- The presence of hydrocarbon impacts in soil and groundwater associated with underground storage tank(s) (UST) and associated infrastructure (i.e. presumed former petrol bowser and fuel lines) in the north-western portion of the site;
- The presence of elevated total PAH concentrations in several fill samples;
- The presence of asbestos containing materials (ACM) within filling across the site.

This RAP has been prepared to describe procedures for the remediation/management of the following:

- Former UST area:
  - Decommissioning and removal of remnant fuel infrastructure (if any);
  - Excavation, remediation and/or off-site disposal of identified localised hydrocarbon-impacted soils;
  - Treatment of remnant groundwater contamination (if required).
- General site filling containing PAH and asbestos:
  - Off-site disposal of impacted filling to an appropriately licensed landfill.

It is noted that the above remediation methodology has been conducted successfully on nearby similar developments.

The RAP includes an unexpected finds protocol and contingency measures to manage other issues which may arise during the course of remediation and redevelopment works.

The results of previous soil and groundwater analysis conducted by DP with comparison to NEPM 2013 criteria are provided in Reference 4.

This RAP details the aims, methods and procedures by which the remediation and site validation will be achieved. It will enable the site to be declared suitable for the proposed high-density residential development.

This RAP has been prepared with reference to the NSW EPA Guidelines for Consultants Reporting on Contamination Sites (Ref 5).

2. Methods and Objectives of the RAP

The following remediation methods are proposed:

- Decommission and remove USTs and associated infrastructure, remediate localised hydrocarbon impacted soils (and groundwater, if required) with subsequent validation to confirm appropriate removal;
- Excavation and off-site disposal of soils impacted by PAHs and ACM as part of basement construction at the site. It is noted that the Architectural Plans (Team 2 Architects Ref 918, Rev 4 dated 17.9.2020, as provided in Appendix A) indicate that the majority of the site will be excavated for basement construction, which will result in the removal of impacted soils. For those localised areas not excavated for basement construction, it is recommended that upper impacted filling be excavated and removed from site and be replaced with verified imported materials.

The objective of the RAP is to ensure that the site is remediated in an acceptable manner, with minimal environmental impact, to a condition suitable for proposed high density residential development. The objectives of this RAP are therefore to provide a strategy for site remediation which:

- Minimises impacts from the site on the environment and on public health and safety during site remediation;
- Maximises the protection of workers involved with site remediation;
- Renders the site safe for the proposed landuse and substantially reduces potential exposure pathways to contaminants;
- Minimises impacts on the local environment during and following site remediation.

The RAP also provides an outline working plan for the excavation, stockpiling, management and disposal of excess spoil and sediment controls and a contingency plan.

The extent of “chase-out” excavation of contaminated soil would necessarily be limited by the proximity of the impact to site boundaries and consideration of adjacent underground services.

Based on the above considerations the remediation excavations will be extended to the extent practicable. If residual contamination is present at the practical limit of excavation then either; (a) risk assessment would be conducted to assess the actual risk associated with the residual contamination and/or (b) a mitigation and management strategy will be devised to appropriately manage the residual contamination. It is noted that the previous investigation by DP (Refs 2, 4) has assessed the approximate extent of hydrocarbon impact associated with the former UST area. Based on previous results and the proximity of USTs to the northern site boundary, it is anticipated that some localised contamination may be present beyond the northern site boundary.

3. Review of Site Information

3.1 Site Description

The site is identified as Lot 1, DP1197377 and is known as 10 Dangar Street Wickham. The site is an irregular-shaped area of approximately 2930 m^2.

The site is bounded to the east by Hannell Street, to the north by Dangar Street, and residential development, to the west by Charles Street, Station Street and commercial development, and to the south by the Newcastle Transport Interchange (i.e. former rail corridor).

The subject lot is shown in Figure 1 below.

Figure 1: Subject site, in yellow

The site is currently occupied by a vehicle retailer. It is understood that that the site is zoned B3 Commercial Core, which permits a range of landuses with consent, from childcare centres to commercial premises.

Reference to NSW LiDAR topographic imaging for the site indicates that surface levels are in the order of RL1.5 to RL2.0 (AHD), with the site being generally flat.

The site was previously identified as the following lots, as presented in Ref 1:

- Lot 30, DP 635397;
- Lot 1, DP 735415; and
- Lots 34-39, DP 1086794.

3.2 Background

DP has conducted geotechnical and contamination assessment on the site as follows:

- DP, 'Report on Preliminary Contamination and Geotechnical Assessment, Proposed Multi-storey Commercial Development, 10 Dangar Street Wickham', Project 39961, September 2008 (Ref 1);
- DP, 'Report on Additional Contamination Assessment, Proposed Multi-storey Commercial Development, 10 Dangar Street Wickham', Project 39961.01, November 2008 (Ref 2);
- DP, 'Report on Preliminary Site Investigation, Desktop Geotechnical and Acid Sulfate Soil Assessment, Proposed Apartment Development, 10 Dangar Street Wickham', prepared for Dangar Street Wickham Pty Ltd, Project 39961.02 dated 18 October 2018 (Ref 3);
- DP, 'Report on Detailed Site Investigation, Proposed Apartment Development, 10 Dangar Street Wickham', prepared for Dangar Street Wickham Pty Ltd, Project 39961.02 dated 23 November 2018 (Ref 4).

The assessments comprised the following:

- Desktop assessment of published information;
- Site history assessment, comprising review of historical aerial photos, discussions with previous site occupiers, Council records search and NSW EPA search;
- Drilling of boreholes across the site to target potential contamination sources and provided an overall assessment of site condition;
- Groundwater well installation and sampling to assess potential groundwater impacts and possible migration of hydrocarbon impact in groundwater; and
- Preparation of reports presenting the results of the assessments.

The results of site history indicated the following:

- Possible former site uses included a transport terminal, distribution centre, motor workshop, motor vehicle storage, motor vehicle auction warehouse, removalists, courier/freight terminal and residential dwellings (i.e. prior to commercial site use);
- Underground fuel storage is located in the north-western corner of the site (i.e. underground tank and possible bowsers in an alcove in the north-western corner of the structure); and

- Demolition of previous structures (e.g. residential dwellings) had occurred prior to construction of the warehouse structure.

A site walkover was conducted in 2008 as part of the previous works (i.e. prior to refurbishment of the site structure and pavements to the current configuration). Relevant features included the following:

- Presence of fibro fragments (possible asbestos containing materials – ACM) at the surface in the eastern portion of the site;
- Fibro sheeting (possible ACM) used as exterior cladding on the site structure;
- Raised floor levels within the warehouse building (i.e. possible filling beneath the structure); and
- Observations of filling in unpaved areas at the surface including ash, slag, rail ballast and building rubble.

On the basis of the above, a conceptual site model (CSM) was prepared with reference to the National Environment Protection (Assessment of Site Contamination) Measure 1999 (Amendment Measure 2013) Schedule B2 (Ref 6). The CSM from Reference 3 is reproduced in Table 1 below.

Table 1: Conceptual Site Model

Known and Potential Primary Sources	Primary Release Mechanism	Secondary Release Mechanism	Potential Impacted Media	Contaminants of Concern	Exposure Pathway	Potential Receptors	
						Current	Future
Filling imported across the site (subject to source)	Placement of filling on-site	Long-term leaching of contaminants via runoff, rain water infiltration / percolation or exposure / disturbance during proposed development	Soil, groundwater, surface water	TRH, BTEX, PAH, Metals, Pesticides, PCB, asbestos	Dermal contact, inhalation (dust/vapours), ingestion	Site workers, maintenance workers, consultants, trespassers, surface water bodies, groundwater, neighbouring properties in the case of groundwater or surface water migration	Site workers, residents, maintenance workers, consultants, trespassers, surface water bodies, groundwater, neighbouring properties in the case of groundwater or surface water migration
USTs & associated Infrastructure on site and off site	Potential leaks and spills from USTs, bowsers and associated pipework	Long-term leaching of contaminants via runoff, rain water infiltration / percolation, through soil or cracks/joints in concrete, groundwater migration or exposure/disturbance during proposed development	Soil, groundwater, surface water	TRH, BTEX, PAH, Metals, VOC	Dermal contact, inhalation (dust/vapours), ingestion		
Demolition of former structures or renovations to existing / former buildings	Demolition of buildings / structures	Long-term leaching of contaminants via runoff, rain water infiltration / percolation or exposure / disturbance during proposed development	Soil, groundwater, surface water	Metals, PCB, asbestos	Dermal contact, inhalation (dust/vapours), ingestion		
Car Parking on unpaved areas	Spills and leaks	Long-term leaching of contaminants via runoff, rain water infiltration / percolation, through soil or cracks / joints in concrete or exposure/disturbance during proposed development	Soil, groundwater, surface water	TRH, BTEX, PAH, Metals, VOC, acids	Dermal contact, inhalation (dust/vapours), ingestion		

Table 1: Conceptual Site Model (continued)

Known and Potential Primary Sources	Primary Release Mechanism	Secondary Release Mechanism	Potential Impacted Media	Contaminants of Concern	Exposure Pathway	Potential Receptors	
						Current	Future
Repairs/servicing/ storage of vehicles and storage of vehicles / parts	Spills and leaks, hydrocarbon sources and solvents	Long-term leaching of contaminants via runoff, rain water infiltration / percolation, through soil or cracks / joints in concrete or exposure/disturbance during proposed development	Soil, groundwater, surface water	TRH, BTEX, PAH, Metals, VOC	Dermal contact, inhalation (dust/vapours), ingestion		
Refurbishment of existing structure	Partial demolition of buildings / structures, removal of hazardous materials	Long-term leaching of contaminants via runoff, rain water infiltration / percolation or exposure / disturbance during proposed development	Soil, groundwater, surface water	Metals, PCB, Asbestos	Dermal contact, inhalation (dust/vapours), ingestion		

Preliminary subsurface assessment was conducted to investigate the above potential contamination sources. Field work conducted at the site as part of the Initial assessment in September 2008 comprised the following:

- Drilling of eight boreholes using a drilling rig and hand tools;
- Near-surface soil sampling at two locations;
- Sampling of observed potential ACM at the surface; and
- Installation of two groundwater monitoring wells (Bores 4 and 10) to assess groundwater depth and quality.

The results of initial subsurface investigation and laboratory testing indicated the following with respect to contamination:

- The presence of benzo(a)pyrene and PAH impact above the adopted landuse criteria associated with near-surface soils and dumped stockpiles within the vacant south-western portion of the site (generally 0.55 m thick – based on Bore 6);
- The presence of asbestos fines materials (small fragments and fibre bundles) in near-surface filling within Bore 1, 4, 5 and 6, likely to be associated with demolition of former structures at the site (generally 0.2 m to 0.8 m thick); and
- The presence of hydrocarbon impact in soil and groundwater in the northern portion of the site associated with the underground fuel storage tank(s) and associated pipework, bowsers, etc. (impact observed in Bore 10 from 0.7 m depth to the depth of investigation).

Based on the results of the initial investigation, fill materials were generally observed to depths of up to about 2 m within the site, with an average of 1.3 m depth. Fill materials more likely to contain potential contamination (i.e. those observed to contain anthropogenic materials such as building rubble) were generally up to 0.8 m thick across the site, with an average thickness of 0.5 m. It is also noted that the raised floor area within the building contained fill with anthropogenic inclusions to a depth of 1.45 m (the raised floor level was about 1.1 m above the surrounding ground levels).

It was noted that there was potential for contamination to be present within fill materials across the site due to the following:

- Absence of detailed information on the original source or quality of fill materials used at the site;
- Historical information indicating demolition of former structures at the site; and
- The results of the subsurface investigation, indicating the presence of imported fill materials at some locations, and potential for impact from former site activities.

Test locations from the initial investigation (test locations 1 to 10, Ref 1) are shown on Drawing 1, Appendix A.

Following initial subsurface investigation (Ref 1), additional subsurface investigation was conducted to further assess potential contamination and possible migration of hydrocarbon impacts from the underground fuel storage tank in the north-western portion of the site (Ref 2). The additional work comprised the following:

- Drilling of eight boreholes (Bores 101 to 108) and installation of groundwater monitoring wells in each of the boreholes;

- Soil and groundwater sampling from each location;
- Laboratory analysis of selected sample for target contaminants; and
- Preparation of a report presenting the results of the assessment.

The additional boreholes were drilled in the vicinity of the underground fuel storage tank, and within the downgradient road pavement and footpath within Dangar Street, immediately north and north-east of the site. Test locations (Bores 101 to 108) are shown on Drawing 1, Appendix A.

The results of the additional investigation indicated the following with respect to contamination and possible off-site migration of hydrocarbon contamination associated with the UST(s) located within the north-western corner of the site:

- Presence of hydrocarbon-impacted soil and groundwater in the immediate vicinity of the UST(s) – Bore 10 (north-western portion of the site);
- Presence of minor off-site hydrocarbon impact in soil and groundwater (Bore 102 - approximately 5 m north-east (generally downgradient of the UST(s));
- Presence of minor PAH impact in groundwater to the north-east of the site (i.e. Bore 108);
- The presence of heavy metal impact in groundwater within the site and in off-site bores; and
- Groundwater flow is generally in an east-north-easterly direction (i.e. towards Throsby Basin).

The results suggested that hydrocarbon impact in soil and groundwater associated with the UST(s) had migrated beyond the site boundary, however, the extent of off-site migration appeared to be limited (i.e. only minor impact within Bore 102 located 5 m from the site boundary and approximately downgradient of the UST). Elevated petroleum hydrocarbons were not detected in the remaining bores.

The possible source of PAH impact on groundwater in Bore 108 was not certain. Such impact may be due to diffused sources other than the UST (i.e. regional presence of general fill materials). The potential for PAH impact to be a result of migration from the UST(s), however, cannot be discounted.

Based on the results of the previous investigations, on-site hydrocarbon contamination and minor off-site impact (associated with the UST(s)) was assessed to have occurred. Site remediation was recommended for future residential or commercial development, to address the following identified contamination:

- Hydrocarbon contamination associated with the UST(s) within the north-western corner of the site (Bores 10 and 102, Ref 2);
- PAH contamination present in near-surface fill materials within the south-western corner of the site (Bore 6 – generally 0.55 m thick – Ref 1); and
- Asbestos contamination in near-surface soils at Bores 1, 4, 5 and 6 (0.2 m to 0.8 m thick – Ref 1).

It is noted that fill materials containing deleterious materials were generally 0.2 m to 0.8 m thick across the site (average of 0.5 m). There is a risk that such materials may also contain contaminants such as asbestos.

An updated preliminary site investigation (Ref 3) was prepared by DP for the site in October 2018, which generally comprised collation of previous assessment and supplementary site history searches to assess the current site condition and potential for contamination. The report concluded that the site could be made suitable for the proposed development, subject to the remediation of previously identified impacts. The potential contamination sources were generally similar to those identified in previous DP assessment.

Reference should be made to the PSI (Ref 3) for an assessment of the current site condition.

A detailed site investigation (DSI) was conducted by DP in November 2018 (Ref 4), which included additional subsurface investigation at five locations, groundwater well installation, soil and groundwater sampling and analysis and preparation of a report presenting the results of the investigation.

The results of the DSI reinforced the results of previous investigation, indicating the presence of hydrocarbon impact in soil and groundwater in the vicinity of identified underground fuel storage tanks, plus PAH and metal impacted upper filling. The DSI also indicated the presence of potential acid sulfate soils (PASS) within the site, inclusive of sand filling and underlying natural sands.

Active groundwater remediation was generally not considered to be necessary within the site based on the results of testing. Hydrocarbon impacts in groundwater are proposed to be addressed via the removal of the source of possible impacts (i.e. removal and remediation of underground fuel infrastructure and hydrocarbon-impacted soils). Further groundwater testing during and following soil was recommended to confirm groundwater conditions and requirements (if any) for further remediation or management. It was noted that due consideration should be given to the possible risk of vapour intrusion associated with basement design and construction if hydrocarbon impacts remain adjacent to the site boundary following remediation.

3.3 Proposed Development

It is understood that the development of the site will include construction of a 14-level retail, commercial and residential development with three basement levels. Development drawings indicate that the ground floor use comprises retail and car parking, with levels one to three comprising office/commercial space. Residential development is proposed for levels four to 13. The three basement levels are proposed for vehicle parking. The Architectural Plans (Team 2 Architects Ref 918, Rev 4 dated 17.9.2020)are provided in Appendix A.

3.4 Geology and Hydrogeology

Reference to the Newcastle Coalfield Regional Geology 1:100 000 Geological Series Sheet published by the Department of Mineral Resources indicates that the site is underlain by Quaternary aged alluvium which typically comprises gravel, sand, silt and clay.

Reference to the Newcastle Acid Sulfate Soil Risk Map prepared by the Department of Land & Water Conservation indicates that the site has a high probability of occurrence of ASS between 1 m and 3 m below the ground surface.

The regional groundwater flow regime is believed to be to the east-north-east of the site, towards Throsby Creek, which is approximately 180 m east-north-east of the site, and is considered to be the nearest sensitive receptor. Based on the site topography and previous assessment in the area, the depth to the water table is believed to be within 3 m of the ground surface. It should be noted that groundwater levels are affected by climatic conditions, soil permeability and tidal influences and will therefore vary with time.

4. Assessment of Remediation Options

A number of remediation options were reviewed with reference to the principles and criteria defined in relevant documents, including, the following:

- NEPC, "National Environment Protection (Assessment of Site Contamination) Amendment Measure 2013", 11 April 2013 (Ref 6);
- NSW EPA, Contaminated Site, "Guidelines for the NSW Site Auditor Scheme 2nd Edition", April 2006 (Ref 7).

NEPM 2013 guidelines state that the preferred hierarchy of options for site clean-up and/or management are as follows:

- On-site treatment of the contamination so that it is destroyed or the associated risk is reduced to an acceptable level; and
- Off-site treatment of excavated soil, so that the contamination is destroyed or the associated risk is reduced to an acceptable level, after which soil is returned to the site; or

If the above are not practicable:

- Consolidation and isolation of the soil on site by containment with a properly designed barrier; and
- Removal of contaminated material to an approved site or facility, followed, where necessary, by replacement with appropriate material;

or

- Where the assessment indicates remediation would have no net environmental benefit or would have a net adverse environmental effect, implementation of an appropriate management strategy.

Based on the distribution and depth of contaminated soils, subsurface conditions, the type of contamination (i.e. PAHs, metals, ACM, and hydrocarbons from USTs and infrastructure), the following remediation options were considered as follows:

1. No Action.
2. Off-site disposal of contaminated soils to a licensed landfill.
3. On-site treatment and re-use (volatile hydrocarbon impacted soils only).
4. On-site management (i.e. containment) of the contaminated soils (i.e. asbestos and PAH impacts only).
5. A combination of Options 2 to 4.

No Action

The "No Action" option involves no remediation response to the contamination identified or likely to be present on the subject site. This option was considered not appropriate as it does not provide any means to appropriately address, remediate, alleviate, and/or manage the long and short-term human health and environmental risk of the contamination already identified on-site.

Off-site Disposal of Contaminated Soils

Off-site disposal of the contaminated soils is the most likely remediation option for both localised hydrocarbon-impacted soils and PAH/metals/ACM impacted soils, since the proposed development requires excavation of the majority of impacted soils for basement construction. On-site treatment of hydrocarbon impacts may be required to enable a 'General Solid Waste' classification and disposal.

On-Site Management of Contaminated Soils

On-site management of contaminated soils involves placement/retention of the contaminated soils within the site area such that the proposed development is constructed over the contaminated soils, minimising the potential for access to the contaminated soils. The management of contaminated soils at the site requires the preparation and implementation of a long-term Site Management Plan (SMP) at the site which outlines the procedures used to render the site suitable for the proposed development. The SMP also provides the procedures for managing contaminated soils should access to the soils be required following construction. On-site management of contaminated materials also requires that a notice be on the Section 10.7 Planning Certificate. On-site management is generally considered for non-volatile contaminants which have a low propensity to leach.

On-site management of PAH and asbestos impacted soils is considered to be a suitable remediation strategy for PAH/metals/ACM-impacted soils development given the distribution (i.e. localised and potentially sporadic within fill materials) and characteristics (i.e. low propensity to leach and located above the observed groundwater table) of the impact on site, however, this approach is not considered practical as the majority of impacted soils require removal as part of basement construction.

On-site management is not considered suitable for the identified localised volatile hydrocarbon impact associated with the UST and fuel infrastructure.

On-site Treatment and Re-use of Contaminated Material

In general on-site treatment is most applicable to volatile hydrocarbon contaminants and requires sufficient time and space to allow impacted materials to be treated in thin (approximately 300 mm) layers and turned to allow aeration with reference to the NSW EPA Technical Note on Landfarming (Ref 8). Depending on the contaminant compounds and their concentrations, the time taken to remediate the soils to levels suitable for re-use may vary from weeks to several months. Whilst this option is suitable for short-medium chain length TRH impacted materials on site, it may not be suitable for the longer chain TRH contamination.

Based on the above the adopted remediation approach for the development is as follows:

- Decommissioning and removal of any remnant fuel infrastructure, with on-site treatment via land farming (if required) and off-site disposal of localised volatile hydrocarbon impacted soils;

- Off-site disposal of PAH, metal and asbestos impacted soils;
- Validation of excavations.

On-site treatment of volatile hydrocarbon impacted soils would generally comprise the following:

- Excavation and 'chase out' of impacted soils to the full depth of impact;
- On-site landfarming of impacted soils;
- Validation of the stripped surface/remaining soils to confirm appropriate removal of contaminated soils and validation of remediated soils following appropriate land farming;
- Re-instatement of site soils (where required) to achieve design levels with 'clean' soil (ENM/VENM) or treated and validated soils.

Off-site disposal (Option 2) of contaminated soils would generally comprise the following:

- Excavation of contaminated soils to the full depth of impact;
- Direct disposal of contaminated soils to an appropriately licensed waste disposal facility;
- Validation of the stripped surface/remaining soils to confirm appropriate removal of contaminated soils;
- Re-instatement of site soils (where required) to achieve design levels with 'clean' soil (ENM/VENM).

5. Remediation Goals and Acceptance Criteria

5.1 Remediation Goals

5.1.1 Removal of USTs and Associated Infrastructure

The main objective of this remediation approach will be to appropriately decommission and remove remaining USTs and associated infrastructure and excavate and 'chase out' any localised residual soil contamination for on-site remediation (land farming) and re-use on site or off-site disposal to an appropriate licensed landfill.

The remediation process will minimise potential risks to human health and the environment.

5.1.2 Off-site Disposal of PAH/Metal/ACM-Impacted Soils

The main objective of this remediation approach will be to excavate contaminated PAH, metal and asbestos impacted soils for removal from site, followed by validation of the remaining soils to confirm removal of the identified impacts.

Any materials requiring off-site disposal should be classified with reference to NSW EPA waste classification guidelines (Ref 9), and disposed to a facility which is licensed to receive such materials. It is noted that previous investigation has indicated the majority of fill materials tested are classified as 'General Solid Waste'. It is noted asbestos impacted soils would be classified as 'Special Waste'.

This process of remediation will remove the potential for human contact with materials that are contaminated so that the development site can be made suitable for the proposed medium/high density residential development.

5.2 Remediation Acceptance Criteria

The RAC used to assess/validate the removal of the USTs, associated infrastructure, any residual impacted soils and the PAH/metals/ACM-impacted upper filling have been developed in line with the proposed use of the site for high density residential landuse with minimal access to soils.

The contaminants of concern associated with the USTs are hydrocarbons (TRH, BTEX, VOCs and PAHs) and heavy metals. The contaminants of concern associated with the impacted upper filling are PAH, heavy metals and asbestos.

It is considered that the validation analysis should focus on the identified contaminants of concern in the area of concern. In order to provide for contingency situations, however, RAC are also established for other contaminants (e.g. OCP/OPP, PCB etc.). This should, however, only be used as and when required (i.e. if signs of such contaminants are observed, suspected or found).

The adopted criteria are as follows:

- NEPM 2013 (Ref 6) - Health Investigation Levels (HIL) and Health Screening Levels (HSL) for high density residential landuse with minimal access to soils (HIL B/HSL B);
- NEPM 2013 (Ref 6) - Management Limits for Residential, Parkland and Public Open Space Landuse – Coarse Soil Texture for TRH impact;
- CRC Care 2011 (Ref 10) – Petroleum based HSL for direct contact for high density residential landuse with minimal access to soils (HSL B).

For the purposes of providing a single RAC for each analyte the lowest of the above criteria (i.e. most conservative) has been adopted as the RAC as shown in Table 2 below. It is noted that the use of medium density landuse is consistent with the zoning and proposed landuse at the site.

Table 2: Site RAC for Soil (mg/kg)

Contaminant	NEPM HIL B[b] / HSL B[c]	CRC Care Direct Contact - HSL B[a]	NEPM Management Limits – Residential Landuse / Coarse Soil [d]	Adopted RAC (mg/kg)
Asbestos [e]	0.001% for FA and AF; 0.04% w/w for ACM over the impacted volume; and No visible asbestos for surface soils	NC	NC	Nil (imported fill and excavation validation) OR 0.04% w/w for ACM and No visible asbestos for surface soils for existing filling
Arsenic	500	NC	NC	500
Cadmium	150	NC	NC	150
Chromium	500	NC	NC	500 (Cr VI)
Copper	30,000	NC	NC	30,000
Lead	1200	NC	NC	1200
Mercury	120	NC	NC	120
Nickel	1200	NC	NC	1200
Zinc	60,000	NC	NC	60,000
TRH (C_6-C_{10})-BTEX (F1)	45	5600	700	45
TRH (>C_{10}-C_{16})-Naphthalene (F2)	110	4200	1000	110
TRH (>C_{16}-C_{34})	NC	5800	2500	2500
TRH (>C_{34}-C_{40})	NC	8100	10,000	8100
Benzene	0.5	140	NC	0.5
Toluene	160	21,000	NC	160
Ethylbenzene	55	5900	NC	55
Xylene	40	17,000	NC	40
Total PAH	400	NC	NC	400
Benzo(a)pyrene	NC	NC	NC	NC
Benzo(a)pyrene TEQ	4	NC	NC	4
Naphthalene	3	2200	NC	3
PCBs	1	NC	NC	1

Notes for Table 2:

a CRC Care (2011) – Petroleum based HSL for direct contact – Table B4 (Ref 6)

b NEPC (2013) Health-based investigation levels (HIL) – Table 1A(1) Ref 6

c NEPC (2013) Health-based screening levels for vapour intrusion - medium density residential landuse (Sand 0 to <1 m) – Table 1A(3) Ref 6

d NEPC (2013) Management Limits for TPH – Table 1 B(7) Ref 6

e WA DOH (2009) – Trigger levels for residential landuse with minimal access to soils (Ref 11)

f Adoption of a lower RAC should be considered when the material will be below the water table or potentially in contact with surface water due to the leachable characteristics of Naphthalene.

NC No Criteria

NL Non Limiting

The results of previous groundwater assessment at the site indicated the general absence of gross groundwater contamination across the site. Some localised hydrocarbon impact (i.e. TRH (>C_{10}-C_{16})-Naphthalene (F2)) was encountered in groundwater in the vicinity of the USTs (i.e. Bore 10 and Bore 202). The results of groundwater testing suggest the general absence of gross groundwater impact from the upper PAH and metal-impacted filling within the site. Groundwater hydrocarbon impact is present in the vicinity of the underground fuel infrastructure (i.e. TRH (>C_{10}-C_{16})-Naphthalene (F2)) in Bore 10 and Bore 202). Localised off-site migration of hydrocarbon impact has occurred.

Active groundwater remediation is generally not considered to be necessary within the site based on the results of testing, however, further groundwater testing during and following soil remediation is recommended to assess any residual impacts (if any).

In the event, however that localised groundwater impact remains following UST removal and remediation, groundwater RAC should be adopted for validation purposes. The adopted criteria are as follows:

- Australian Drinking Water Guidelines 2016 (ADWG);
- ANZAST (2018), 'Australian and New Zealand Guidelines for Fresh and Marine Water Quality', August 2018, (Ref 12);
- NEPM 2013 (Ref 6) – Health Screening Levels for Vapour Intrusion in groundwater for medium density residential landuse (HSL-B) for volatile hydrocarbon impact.

For the purposes of providing a single RAC for each analyte the lowest of the above criteria (i.e. most conservative) has been adopted as the RAC as shown in Table 3 below. It is noted that the use of medium density landuse is consistent with the zoning and proposed landuse at the site.

Table 3: Site RAC for Groundwater (µg/L)

Analyte		NEPC (2013) Fresh Waters [2]	NEPC (2013) Marine Waters [2]	NEPC (2013) Drinking Water	NEPC (2013) HSL B Vapour Intrusion	Adopted RAC (µg/L)
Metals	Arsenic (V)	13	2.3	10	NC	Given regional groundwater quality exceeds the adopted criteria, no RAC is provided for heavy metals. If heavy metal testing is conducted concentrations should be compared to previous groundwater testing (Ref 4)
	Barium	NC	NC	2000	NC	
	Cadmium	0.2	0.7	2	NC	
	Chromium (VI)	1	4.4	NC	NC	
	Cobalt	NC	1	NC	NC	
	Copper	1.4	1.3	2000	NC	
	Lead	3.4	4.4	10	NC	
	Manganese	1900	80	500	NC	
	Mercury (total)	0.06	0.1	1	NC	
	Nickel	11	7	20	NC	
	Selenium	5	3	10	NC	
	Zinc	8	15	NC	NC	
PAH	Naphthalene	16	50	NC	NL	16
	Benzo(a)pyrene	0.1	0.1	0.01	NC	0.01
TRH	C6 – C10 (less BTEX) [F1]	NC	NC	NC	1000	1000
	>C10-C16 (less Naphthalene) [F2]	NC	NC	NC	1000	1000
BTEX	Benzene	950	500	1	800	1
	Toluene	180	180	800	NL	180
	Ethylbenzene	80	5	300	NL	5
	Xylene (o)	350	NC	NC	NC	350
	Xylenes (Total)	NC	NC	600	NL	600
VOC[3]	Chloroform	370	NC	NC	NC	370
	Trichloroethene	30	NC	NC	NC	30
	Isopropylbenzene	30	NC	NC	NC	30

Notes to Table 3:

1 In cases where no high reliability trigger values are provided, the low reliability trigger values provided in ANZECC & ARMCANZ (2000) have been used as screening levels

2 Investigation levels apply to typically slightly-moderately disturbed systems

3 Given the exhaustive list of VOC contaminants, only a few have been included in this table.

NL -The solubility limit is defined as the groundwater concentration at which the water cannot dissolve any more of an individual chemical based on a petroleum mixture. The soil vapour which is in equilibrium with the groundwater will be at its maximum. If the derived groundwater HSL exceeds the water solubility limit, a soil-vapour source concentration for a petroleum mixture could not exceed a level that would result in the maximum allowable vapour risk for a given scenario. For these scenarios no HSL is presented for these chemicals. These are denoted as not limiting 'NL'.

It is noted that the generic HSL are not appropriate when the depth to groundwater impact is less than 2m. Under these circumstances a site specific risk assessment may be needed. The adopted HSLs have therefore been used for preliminary assessment purposes only.

NC No Criteria

6. Responsibilities

In order to achieve the goals of the remediation/earthworks programme, the following roles and responsibilities have been identified for the contractor and consultants:

Contractor

The contractor is responsible for on-site operations including:

- Decommissioning and removal of USTs, and associated infrastructure (i.e. fuel lines etc.);
- Handling of fill materials (contaminated or otherwise) including excavations, stockpiles, segregation, placement, compaction, and disposal of unsuitable or excess materials;
- Treatment of contaminated materials (i.e. landfarming of hydrocarbon contaminated materials) if present;
- Disposal of contaminated soil material (hydrocarbon-contaminated material and PAH/metals/asbestos contaminated materials) to a licensed landfill (after classification);
- Safety of all personnel on site;
- Measures to minimise environmental effects;
- Preparation of a site specific construction environmental management plan (CEMP) and WHS plan. The CEMP should reference this RAP and will require review and comment by DP to confirm consistency with the objectives of the RAP prior to commencement of remediation;
- Ensure required licenses and approvals from regulatory authorities are obtained prior to remediation works commencing. It is noted that an appropriately licenced contractor will be required to conduct earthworks within the site due to the presence of asbestos in filling.

Occupational Hygienist (OH)

- Advice on management of asbestos contamination (if required);
- Set-up and maintenance, analysis and reporting of air monitoring for air borne asbestos fibres during construction works resulting in the disturbance of fill materials (i.e. any excavations, stockpiling, placement or transport of fill materials).

General Site Validation (Suitably Qualified Environmental Consultant)

- Full time inspection associated with excavation, treatment and validation of hydrocarbon contaminated soils in the areas of USTs and associated infrastructure (i.e. fuel lines etc.);
- Validation/classification of remediated soils for on-site reuse or off-site disposal;
- Advice on excavation and segregation of contaminated soils;
- Validation of excavations;
- Inspection of remediation and validation works;
- Sampling and classification of imported fill materials (where required);
- Provision of a remediation and validation report;
- Correspondence/liaison with the regulatory authority throughout the remediation works.

Client

- Overall project management;
- Engaging suitably qualified remediation contractor, and Environmental Consultant to conduct the remediation works;
- Ensure necessary approvals and notifications have been obtained prior to remedial works commencing;
- Liaison with the regulator (Newcastle City Council - NCC), environmental consultant, remediation contractor during remediation process;
- Submission of validation reports to NCC.

Prior to the commencement of remediation works, a site meeting between the client, contractor and environmental consultant is recommended to confirm responsibilities and procedures in accordance with the agreed management plan.

7. Regulatory Approvals and Licences

State Environmental Planning Policy No. 55 - Remediation of Land (Ref 12, SEPP 55) aims to provide a state-wide planning approach to the remediation of contaminated land. Under clause 7(1) of SEPP 55 the approval authority is required to consider whether the land is contaminated, and:

a) If the land is contaminated, it is satisfied that the land is suitable in its contaminated state (or will be suitable, after remediation) for the purpose for which the development is proposed to be carried out; and

b) If the land requires remediation to be made suitable for the purpose for which the development is proposed to be carried out, it is satisfied that the land will be remediated before the land is used for that purpose.

This RAP presents the proposed remediation methodologies to address PAH, metals and asbestos contamination on site, and remediation of remnant fuel infrastructure and residual soil contamination. Implementation of the RAP will render the site suitable for the proposed development.

In accordance with Clause 9 of SEPP 55 the definition of Category 1 remediation works which require development consent are as follows:

a) Designated development, or

b) Carried out or to be carried out on land declared to be a critical habitat, or

c) Possibly have a significant effect on a critical habitat or a threatened species, population or ecological community, or

d) Development for which another State environmental planning policy or a regional environmental plan requires development consent, or

e) Carried out or to be carried out in an area or zone to which any classifications to the following effect apply under an environmental planning instrument:

   i) coastal protection,

ii) conservation or heritage conservation,

iii) habitat area, habitat protection area, habitat or wildlife corridor,

iv) environment protection,

v) escarpment, escarpment protection or escarpment preservation,

vi) floodway,

vii) littoral rainforest,

viii) nature reserve,

ix) scenic area or scenic protection,

x) wetland, or

f) Carried out or to be carried out on any land in a manner that does not comply with a policy made under the contaminated land planning guidelines by the council for any local government area in which the land is situated (or if the land is within the unincorporated area, the Western Lands commissioner).

It is understood that site remediation works are considered to be Category 1 under SEPP55 due to the site being within a coastal protection zone and being within flood prone land.

It is noted that the proposed residential development, which is integral to the remediation of the site (i.e. proposed basement excavation to remove impacted soils) will require development consent from Council.

Based on review of Appendix VI of the Guidelines for the NSW Site Auditor Scheme (Ref 7), the following consent, notification or licence requirements are anticipated:

- Any conditions outlined in the DA;
- SafeWork NSW asbestos removal work licence under the Work Health and Safety Regulation 2011 (WHS Regulation) and appropriate notification prior to commencement;
- As remediation works may involve groundwater extraction, a groundwater interference permit through the NSW Office of Water may need to be obtained prior to remediation commencing as per the requirements of the NSW Aquifer Interference Policy September 2012. It is noted that the permit may also be required to facilitate installation of services for the proposed development.

It is noted that previous asbestos testing at the site indicated the presence of asbestos ‘fines’ in fill materials, which should be considered in the work licence application to SafeWork NSW.

It is recommended that the proposed development is staged and conditional upon the submission of a validation report for the site;

8. Remediation Strategy

8.1 Sequence of Remediation

The following staged remediation methodology is recommended to achieve the remediation goals:

Stage 1: Initial Preparation and Site Meeting

- Client/Contractor to obtain all necessary approvals and notifications to allow commencement of the works, including Council approvals and SafeWork NSW permit for friable/non-friable asbestos related works (i.e. excavation, handling and disposal of soils containing asbestos). The contractor should hold the relevant licenses/approvals for asbestos related works;
- Site inception meeting between environmental consultant, the remediation contractor, demolition contractor and the site owner to discuss remediation methodologies and responsibilities, prior to demolition activities.

Stage 2: Demolition

- Contractor to set up environmental controls and secure the site. OH to setup air monitoring stations as required;
- Contractor to demolish and remove existing buildings across the site. It is recommended that concrete slabs/pavements in the vicinity of the remnant fuel infrastructure area are left in place until infrastructure has been decommissioned;
- Following demolition / removal of concrete surface, interim environmental management procedures should be implemented where ACM impacts are identified at the surface. Occupational Hygienist to provide advice on recommended procedures.

Stage 3: Decommissioning of Remnant Fuel Infrastructure

- USTs, fuel lines etc. to be decommissioned and removed by a licensed contractor (full time inspection by environmental consultant) in accordance with regulatory requirements.

Stage 4: Remediation / Validation – Petroleum Hydrocarbon Materials

- Preparation of a soil remediation/stockpiling area for on-site landfarming of hydrocarbon contaminated soil and/or waste classification for off-site disposal (contractor). Ideally, sufficient concrete slabs would be left in place to facilitate this;
- Excavation and ‘chasing out’ of petroleum hydrocarbon affected soils by the contractor (commencing at identified locations) based on visual and olfactory observations and screening with a photoionisation detector (PID) by environmental consultant (full-time inspection);
- Validation of excavated areas (environmental consultant);
- Collection and analysis of groundwater grab samples from water within the excavation during and following soil excavation and validation to assess groundwater conditions;
- Remediation of petroleum hydrocarbon affected soils using landfarming techniques (on-site treatment), or disposal to a licensed landfill i.e. off-site disposal by the contractor, following waste classification sampling and testing by environmental consultant.

Stage 5: Remediation and Validation of PAH, metals and Asbestos Contaminated Soils

- Preparation of a soil stockpiling area for waste classification of contaminated soils for off-site disposal (contractor) where required;
- Excavation and 'chasing out' of impacted soils by the contractor based on visual observations and material types by DP;
- Validation of excavated areas (DP);
- Disposal of affected soils to a licensed landfill i.e. off-site disposal by the contractor, following waste classification sampling and testing by DP.

Stage 6: Validation – Imported Fill Materials (if required)

- Inspection and analysis by environmental consultant of imported fill materials required to re-instate or raise site levels to confirm levels are within RAC as required (i.e. where certificate from supplier not available).

In addition to the above, lower sand filling and underlying natural sand soils will require treatment as acid sulfate soils with reference to an acid sulfate soil management plan.

8.2 Remediation of Petroleum Hydrocarbon-Affected Soils

8.2.1 Methodology

Remnant fuel infrastructure, including a possible former fuel bowser, possible fuel line and presumed USTs, have been identified within the site. The proposed remediation strategy is to remove any remnant fuel infrastructure and to excavate identified hydrocarbon-impacted soils.

The following general procedures are recommended for the remediation and validation of hydrocarbon affected soils:

- Decommissioning and removal of remnant fuel infrastructure by licensed contractor (with full time inspection by the environmental consultant);
- Inspection of areas potentially containing hydrocarbon-impacted soils;
- Contractor to progressively excavate affected soils from former identified impacted areas under full-time inspection by the environmental consultant;
- Contaminated material will be excavated/chased from the walls and base of the tank pits/excavations until visual and olfactory evidence, and the results of PID screening, indicates the absence of such materials;
- The environmental consultant to validate excavated areas as discussed in Section 8.2.3.

Procedures for stockpiling of excavated soil/fill materials and landfarming techniques are discussed below.

Soil/fill material containing visual or olfactory evidence of potential contamination is considered to be contaminated material until classification has found otherwise.

8.2.2 Remediation of Hydrocarbon Contaminated Soils (Landfarming)

The following outlines the basic procedure for landfarming (if required) with reference to NSW EPA (2014) 'Best Practice Note: Landfarming' (Ref 8).

Hydrocarbon contaminated soil should be placed on-site in a specified remediation area, prepared as follows:

- Nominate remediation area on-site, away from the possible excavation of contaminated soil, and as far as practicable from adjacent residences. If possible, the remediation area should be located over a concrete area;
- Provision should be made to allow for expansion of the remediation area should this be required during the course of the works;
- Cover any drainage pits (if present) within the remediation area to minimise leachate from contaminated soils entering the stormwater system;
- Cover the base of the remediation area with plastic sheeting, and surround with straw bales and/or absorbent boom;
- Placement of plastic sheeting around the outside of perimeter bales to minimise the potential for leachate to migrate beneath the bales or absorbent boom;
- Stockpile hydrocarbon contaminated material over plastic sheeting to a depth of up to 0.5 m (temporary stockpiling of wet soils may be required during excavation to allow soils to drain such that decant is directed back into the excavation);
- Barricade the perimeter of the stockpiled material.

The above methods should be employed for both landfarming techniques and for stockpiling for off-site disposal. Material to be disposed off-site, however, could be stockpiled higher than 0.5 m prior to disposal.

The proposed landfarming methodology comprises the following sequence:

- Prepare area to receive hydrocarbon contaminated soil for landfarming (refer to above);
- Excavate hydrocarbon contaminated soil from the impacted area using screening results from a photoionisation detector and visual/olfactory observation by the environmental consultant as a guide to the extent of excavation;
- Stockpile the contaminated soil over the prepared remediation area to a height of less than 0.5 m;
- Validate excavation (environmental consultant);
- Backfill excavation with verified clean fill (VENM or ENM) following validation, or fence/barricade until excavated soil is remediated to a level suitable for re-use on site (i.e. satisfies RAC);
- Periodically "turn" stockpiled material by backhoe/excavator to promote biological activity (at least weekly turning is recommended). More active remediation (i.e. addition of enhancing agent such as BioSolve or additional organic material) may be required if heavier fractions are found in samples analysed during the remediation of excavations;
- Monitor remediation progress of stockpiled material (environmental consultant);
- Validate stockpiled material (environmental consultant);

- Re-use remediated material on site or dispose to landfill (subject to stockpile validation results).

remediated and validated materials could be considered for on-site reuse above the groundwater table to minimise possible impacts of residual hydrocarbons in soil affecting groundwater quality. It is understood that based on the proposed development, there will be limited opportunity for reuse of materials at the site.

The validation and monitoring plan for the stockpiled material involves periodic stockpile sampling, screening and testing as remediation proceeds. The proposed sampling plan is:

- Collection of at least one sample per 25 m^3 of soil or a minimum of three samples per sampling round (whichever greater), once obvious hydrocarbon odours have dissipated;
- Samples would be collected at regular spacing over the stockpile area, at various depths.

8.2.3 Validation of Excavations/Stripped Surfaces

The following procedure is recommended for validation of identified areas of hydrocarbon-contaminated soils following stripping/removal:

- The stripped surface should be inspected by DP to confirm, visually, the absence of potentially contaminated soils;
- As a minimum, validation samples will be collected at the following frequency:
    - Base of Excavation – a minimum of one sample from the base of excavation (per tank), or one sample per 10 m^2 area for larger excavated areas;
    - Side of Excavations – one location per side wall (per tank) or one per 5 m length of wall. Additional samples may be required due to the observed soil profile (e.g. upon signs of contamination and at the depth of groundwater seepage);
    - Fuel Lines/Pipe Lines – a minimum of one sample per 5 m linear metres or at least one sample from beneath each fuel line (if present);
    - Chemical analysis will be conducted by a NATA registered laboratory on samples collected to validate the removal of materials containing hydrocarbon contamination.

The above analysis will be utilised to determine contaminant levels with respect to the RAC in the validated areas.

If validation results exceed the RAC, further removal (additional scraping/excavation) will be required, followed by additional validation sampling and analysis, until the RAC is met. Note that at least seven working days are required for laboratory analysis.

Excess rain water entering tank pit excavations or groundwater will be sampled and analysed to assess the potential for contamination.

8.2.4 Monitoring Procedures

The following monitoring procedures are recommended during remediation activities:

- The contractor/site manager inform nearby occupants of the proposed remediation activities, and provide contact details of the site manager (including after-hours contacts) to report a loss of amenity due to the remediation of hydrocarbon-impacted soils (e.g. hydrocarbon odours);
- Monitoring of volatile hydrocarbon levels using a calibrated photo ionisation detector (PID) as well as olfactory observations should be undertaken as follows:
    - During excavation of hydrocarbon-impacted soils (i.e. adjacent to the excavation);
    - During placement of contaminated soils in the proposed landfarm area;
    - Periodic monitoring during site inspections at site boundaries.

The above monitoring should be undertaken by a suitable qualified contaminated land or WHS consultant. The remediation contractor will be responsible for appropriate WHS and environmental monitoring and management during site remediation.

Detectable levels of volatile hydrocarbons (PID readings above ambient levels at site boundaries) or olfactory evidence of loss of amenity will trigger additional contingency management, as indicated below.

8.2.5 Loading and Transport of Contaminated Materials

Transport of contaminated material off the site shall be via a clearly demarcated haul route and this route exclusively shall be used for entry and egress of vehicles used to haul identified contaminated materials within and away from the site.

Removal of waste materials from the site shall only be carried out by a licensed contractor holding appropriate licences, consents and approvals from NSW EPA and/or other Authorities to transport and dispose the waste materials according to the classification guidelines.

Details of all contaminated materials removed from the site shall be documented by the contractor with copies of weighbridge slips, trip tickets and consignment disposal confirmation (where appropriate). Such information should be provided to DP for reporting purposes. A site log/tracking sheets shall be maintained by the remediation contractor for stockpiles (numbered locations), to enable the tracking of disposed loads against on-site origin and location of the materials and corresponding (validation) sample numbers.

Measures shall be implemented to minimise the potential for contaminated material to be spilled onto public roadways or tracked off-site on vehicle wheels. Such measures could include the deployment of a vehicle washing / cleaning facility, which should be placed at a location before the egress point of the site. The facility shall be able to handle all vehicles and plant operating on site (if required). Residue from the cleaning facility will be deemed contaminated unless shown by validation to be below RAC criteria.

The proposed waste transport route should be notified to the local Council and truck dispatch shall be logged and recorded by the contractor for each load leaving the site. The waste tracking procedure should be confirmed by the environmental consultant.

8.2.6 Limits of Excavation

In the event that significant contamination has occurred, consideration must be given to site boundaries, building infrastructure and infrastructure of the surrounding properties. The stability of the structures and adjacent features must be maintained at all times. If a field assessment or validation data indicate that contamination in the soil extends beyond a point where stability may be threatened, advice should be sought from a qualified geotechnical or structural engineer before any further excavation is undertaken in this direction. Temporary retaining structures may be recommended, however, in any event, excavation will not progress beyond the site boundary or within a reasonable proximity to existing structural elements. Validation samples will be taken at the limit of excavation notwithstanding that there may be residual contamination present.

8.2.7 Contingency Procedures

8.2.7.1 Hydrocarbon Impacts in Soil

Contingency action will be required if elevated PID levels are encountered, olfactory evidence of loss of amenity is observed, or the outcomes of the RAP are not being achieved. Contingency procedures shall comprise the following (in no particular order):

- Postponement of remediation and validation works (including fuel infrastructure decommissioning/removal, excavation, and turning of soils etc.) until such time that the loss of amenity is ameliorated and prevailing conditions are suitable to recommence;
- Covering of excavated soils within the remediation area until loss of amenity is ameliorated and prevailing conditions are suitable to recommence landfarming activities;
- Application of a suppressant, such as BioSolve, to reduce volatiles and odours from hydrocarbon-impacted soils within the excavation or the stockpile area.

8.2.7.2 Seepage/Groundwater

Active groundwater remediation is not proposed based on the results of previous investigations (Refs 2 and 4). As part of the validation process, grab samples of groundwater or seepage water encountered in the remediation excavations will be collected.

Groundwater (or surface water) grab samples will be analysed for TRH, BTEX, PAH, and heavy metals. The results of the groundwater analysis will be incorporated with the validation report and assessed against the criteria in Section 5.2.

If hydrocarbon free product or slick is observed over seepage/groundwater within the excavation, appropriate absorbent materials should be utilised to skim/absorb such materials. Further grab sampling and analysis of remaining waters within the excavation will be conducted to confirm the groundwater conditions and requirements for further remediation and/or management (if any).

8.3 Remediation of PAH, Heavy Metal and Asbestos-Impacted Soils

8.3.1 Methodology

Based on the results of laboratory testing from previous investigations (Refs 1, 2), there was several location containing elevated concentrations of PAH, heavy metals and asbestos in filling. Based on the results of subsurface investigation, the affected filling is likely to be across the whole site. The proposed remediation strategy is to remove the localised affected filling as part of basement construction works.

The following general procedures are recommended for the remediation and validation of PAH/metal/asbestos-impacted soils:

- Contractor to progressively excavate affected soils from across the site areas under full-time inspection by DP;
- Contaminated material will be excavated/chased from the site until visual evidence indicates the absence of such materials;
- DP to validate excavated areas as discussed in Section 8.3.3;
- Contractor to dispose of the excavated soils to an appropriately licensed landfill, following waste classification of the soils.

Procedures for stockpiling of excavated soil/fill materials are discussed in Section 8.3.2 below.

8.3.2 Stockpiling of PAH / Metal / Asbestos Contaminated Soils

PAH/metal/asbestos contaminated soil should be placed on site in a specified area, prepared by the contractor as follows:

- DP to nominate designated stockpile area in consultation with the contractor. The stockpile should be away from the possible excavation of contaminated soil, and as far as practicable from adjacent residences or other sensitive landuses;
- The proposed stockpile area should be inspected to confirm the absence of deleterious or potentially contaminated materials at the surface prior to the placement of materials;
- Provision should be made to allow for expansion of the stockpile area should this be required during the course of the works;
- An impermeable membrane such as plastic sheeting should be provided at the surface by the remediation contractor prior to stockpiling;
- Stockpile areas should be demarcated by the remediation contractor (i.e. fence/pickets and hazard tape) to prevent access, and clearly delineate the stockpiles;
- Stockpiles that are observed to contain or potentially contain asbestos materials should be lightly conditioned by sprinkler and covered by plastic or similar to prevent dust blow (undertaken by the remediation contractor - refer to Section 11.5);
- Measures should be taken by the remediation contractor to prevent the migration of stockpile materials (i.e. perimeter bunds, hay bales, silt fences, etc.);

- A record of stockpile locations, dimensions, descriptions, environmental controls, etc. should be maintained by the contractor.

Excavation, handling, transport etc. of asbestos-impacted materials should be undertaken by the licensed contractor with reference to the appropriate statutory and regulatory guidelines.

8.3.3 Validation of Excavations/Stripped Surfaces

The following procedure is recommended for validation of identified areas of PAH/metal/asbestos contaminated soils following stripping / removal:

- The stripped surface should be inspected by DP to confirm the visual absence of potentially contaminated filling/soils;
- Validation samples for chemical testing will be collected by DP at a sampling density of at least a 10 m x 10 m grid over the stripped area;
- Chemical analysis will be conducted by a NATA registered laboratory on samples collected to validate the removal of impacted materials.

The above analysis will be utilised to determine contaminant levels with respect to the RAC in the validated areas.

If validation results exceed the RAC, further removal (additional scraping/excavation) will be required, followed by additional validation sampling and analysis, until the RAC is met. Note that at least seven working days are required for laboratory analysis. Excavation of contaminated material will be limited to the extent of site boundaries.

8.3.4 Fill Stockpile Classification and Disposal/Reuse Options

Segregated fill stockpiles containing potentially contaminated materials are classified in accordance with the NSW EPA Waste Classification Guidelines (Ref 9) for disposal purposes.

For soils to be disposed off-site, representative samples should be collected by DP from the segregated fill stockpiles (i.e. where waste classification testing has not already been conducted as part of previous investigation), and analysed for the potential chemical contaminants as discussed in Section 9.4. The frequency of samples will depend on the size and composition/characteristics of the stockpile. A minimum frequency of one sample per 25 m^3 should be initially considered.

The results of analysis will be utilised to confirm options for off-site disposal, or re-use at the site, as follows:

- Satisfies RAC:
  - Re-use on site, subject to geotechnical suitability as engineered fill;
  - Dispose off-site to a licensed landfill.
- Satisfies RAC and off-site re-use criteria:
  - Re-use on site, subject to geotechnical suitability as engineered fill;
  - Dispose off-site to a licensed landfill;

- Re-use off-site, subject to geotechnical suitability and classification as VENM or ENM.

- Exceeds RAC but satisfies landfill disposal guidelines (Ref 9):
  - Dispose off-site to a licensed landfill.
- Exceeds RAC and exceeds landfill disposal guidelines:
  - Develop on-site remediation strategy and continue until guidelines are satisfied;
  - Carry out appropriate immobilisation for off-site disposal to licensed landfill (subject to regulatory approvals).

8.3.5 Loading and Transport of Contaminated Materials

The procedures for the loading and transport of contaminated material are detailed in Section 8.2.5.

8.4 Imported Fill

Imported fill used to reinstate site excavations (where required), raise site levels or utilised for the proposed development (i.e. landscape areas, pavement materials etc.) should be classified as Virgin Excavated Natural Material (VENM, Excavated Natural material (ENM) or material classified under an appropriate resource recovery order and should be accompanied by an appropriate certificate from the supplier, otherwise detailed assessment (including analysis of representative samples) will be required prior to use on-site. Imported soils should also meet the adopted RAC. Soil proposed for importation should be confirmed to be VENM / ENM or an approved resource recovery material prior to delivery to the site.

8.5 Geotechnical Considerations

The site stripping, excavation and the placement and compaction of fill materials should be carried out with due consideration of geotechnical requirements for development. Deleterious inclusions such as organics, timber, metal, concrete (>200 mm) should be segregated from filling that may be used as engineered fill (i.e. for support of buildings or pavements).

Fill materials that will support structural loads, pavement, services or form structural backfill, should be placed and compacted to a suitable geotechnical specification that takes account of the intended purpose of the fill. Stability of excavations should also be considered.

The geotechnical specification for earthworks should be prepared as part of the final design.

8.6 Acid Sulfate Soil Management

Based on the results of previous investigations, sand filling and natural sand soils are acid sulfate soils. Disturbance of these materials (i.e. excavation or dewatering) will need to be conducted in accordance with a site specific Acid Sulfate Soil Management Plan (ASSMP) to be prepared by DP.

It is noted that disturbance of potential ASS during remediation works is likely as part of basement excavation.

8.7 Unexpected Finds Protocol

8.7.1 Potentially Contaminated Soils

The results of previous assessments at the site indicate the presence of PAH, heavy metal and asbestos contamination within upper filling at the site, and identified hydrocarbon impacts from USTs and associated infrastructure. Due to the historical use of the site, history of demolition and the presence of uncontrolled filling at the site, there is potential for additional contamination within site soils. Contingency procedures are required should additional potentially contaminated soils be identified during site development.

The following general procedures are suggested for the assessment and management of potentially impacted filling/soils during remediation/earthworks. Based on the results of previous assessment, soils/filling may be potentially impacted by petroleum hydrocarbons, heavy metals, PAH and asbestos:

- Excavation, handling loading and transport of contaminated materials should be undertaken by a licensed contractor in accordance with the appropriate regulatory approvals and legislative requirements;
- The progress of site excavations during construction should be inspected by the contractor during earthworks, and periodically by the contaminated lands consultant (i.e. DP). Potential soil contamination may include stained soils, odorous soils, soils containing fibro fragments, soils containing building rubble (i.e. bricks, tiles, concrete, timber etc.) and slag/ash products;
- If additional/unknown potentially contaminated soils are encountered (i.e. visual or olfactory indication of contamination), excavation of filling should cease, and the extent of the affected filling should be assessed by DP;
- The affected soils may need to be segregated based on visual/olfactory observations, and stockpiled for further assessment;
- If the assessment of impacted materials indicates that the materials are not suitable to remain on-site, the materials should be classified for disposal to an appropriately licensed landfill with reference to the NSW EPA waste classification guidelines (Ref 9);
- The affected area should be stripped and validated by DP;
- Excavation in the affected area cannot recommence until the validation testing indicates the absence of gross impact and no visual or olfactory indicators of contamination;
- Licensed contractor to load classified materials directly into appropriate trucks for transport and disposal to a licensed facility (Note: waste classification is required prior to off-site disposal).

The occupational hygienist should provide work health and safety advice to the contractor during site works.

8.7.2 Migration along Preferential Pathways

In the event that contamination is found to be migrating along preferential pathways (such as service trenches and conduits) in the vicinity of the identified hydrocarbon contamination, the following contingency procedure will be adopted:

- Remediation excavations will be continued in the direction of migration to the practical extent possible (without causing damage to infrastructure) as directed by the structural engineer (it is anticipated that the extent to which impacted materials can be chased-out along service conduits would be limited due to structural elements and services) and site boundaries;
- If impacted materials are present at the practical limits of the remedial excavation, validation samples will be collected and analysed per the requirements of Section 9.3 to determine the degree of residual contamination present;
- If concentrations of residual contaminants at the practical extent of the remedial excavation exceed the adopted RAC then the following additional contingencies may be adopted:
    - Site specific risk assessment will be undertaken to determine the actual level of risk to human health;
    - Additional groundwater monitoring wells/soil bores will be considered (if feasible) hydraulically down gradient of the observed impacted material/preferential pathway to attempt to define extent and degree of preferential migration;
    - Consideration of vapour intrusion risks to the proposed development; and
    - Based on the results of the above, additional management controls and/or groundwater remediation measures may be required.

9. Sample Collection and Analysis

9.1 Sample Collection and Handling

9.1.1 Soil

Soil sampling will be directly from the exposed surface of excavation, or, in the case of remediation stockpiles, from various depths between the surface and the base. Sampling data shall be recorded to comply with routine Chain of Custody (COC) requirements.

The general sampling, handling, transport and tracking procedures comprises:

- The use of stainless steel sampling equipment;
- The use of disposable gloves for each sampling event;
- Washing of all sampling equipment in contact with the sample, in a 3% solution of phosphate free detergent (Decon 90) then rinsing with distilled water prior to each sample being collected;
- Transfer of the sample immediately into new glass jars;
- Collection of 10% replicate samples for QA/QC purposes;
- Collection of replicate soil samples in zip-lock plastic bags for PID screening;

- Labelling of the sample containers with individual and unique identification including Project Number and Sample Number;
- Placement of the containers into a chilled, enclosed and secure container for transport to the laboratory; and
- Use of chain of custody documentation so that sample tracking and custody can be cross-checked at any point in the transfer of samples from the field to hand-over to the laboratory.

9.1.2 Seepage / Groundwater

The general sampling, handling, transport and tracking procedures for the collection and analysis of a seepage/groundwater sample from water within the excavation comprises:

- Collection of seepage/groundwater 'grab' sample using a long-handled 'swing-sampler' fitted with new laboratory prepared containers for analysis;
- The use of disposable gloves for each sampling event;
- Collection of 10% replicate samples for QA/QC purposes;
- Collection of replicate water samples in a laboratory prepared jar for field screening of the groundwater with a PID;
- Labelling of the sample containers with individual and unique identification including Project Number and Sample Number;
- Placement of the containers into a chilled, enclosed and secure container for transport to the laboratory; and
- Use of COC documentation so that sample tracking and custody can be cross-checked at any point in the transfer of samples from the field to hand-over to the laboratory.

9.2 Sample Holding Times

The maximum sample holding times are as follows:

Soil

- Metals – 6 months (if required);
- TRH/BTEX – 14 days;
- PAH – 14 days, and 40 days following extraction (if required);
- OCP/OPP – 14 days, and 40 days following extraction (if required);
- Asbestos – no holding time

Groundwater

- Metals – 6 months (if required);
- TRH/BTEX – 14 days;
- PAH – 14 days, and 40 days following extraction (if required).

All samples must be collected in appropriate containers and stored at 4°C or below.

9.3 Analysis – Hydrocarbon Impacted Soils

Analysis for the validation of excavated hydrocarbon impacted soils should comprise the following:

- Total Recoverable hydrocarbons (TRH);
- Benzene, Toluene, Ethylbenzene and Xylene (BTEX);
- Polycyclic Aromatic Hydrocarbons (PAHs).

Stockpiled materials should also be analysed for asbestos to classify the material prior to off-site disposal.

The analytical programme will be reviewed following excavation, segregation and sampling to confirm analysis for testing. Leachability (TCLP) analysis may be required for stockpile samples if total contaminant levels are found to exceed 'General Solid Waste' Criteria.

9.4 Analysis – PAH/Metals/Asbestos-Impacted Soils

Analysis for the validation of excavated PAH/metals/asbestos impacted soils should comprise the following:

- Total Recoverable hydrocarbons (TRH);
- Polycyclic Aromatic Hydrocarbons (PAHs);
- Heavy metals (As, Cd, Cr, Cu, Pb, Hg, Ni, Zn);
- Asbestos identification.

Stockpiled materials should also be analysed for asbestos to classify the material prior to off-site disposal.

The analytical programme will be reviewed following excavation, segregation and sampling to confirm analysis for testing. Leachability (TCLP) analysis may be required for stockpile samples if total contaminant levels are found to exceed 'General Solid Waste' Criteria.

9.5 Imported Fill

Any materials which are imported onto the site (e.g. to backfill excavations) should be classified as Virgin Excavated Natural Materials (VENM), Excavated Natural Material (ENM) or under an appropriate resource recovery order and an appropriate report must be made available to the environmental consultant prior to the importation of the material.

If the source or suitability of use for imported fill has not been confirmed, the material should be assessed with reference to appropriate resource recovery Exemptions/Orders and analysed for the following at a minimum:

- Total Recoverable hydrocarbons (TRH);
- Benzene, Toluene, Ethylbenzene and Xylene (BTEX);
- Polycyclic Aromatic Hydrocarbons (PAHs);
- Heavy Metals (Arsenic, Cadmium, Chromium, Copper, Lead, Nickel, Mercury, and Zinc);
- pH, Electrical Conductivity;
- Percentage Foreign Material (NSW RTA Test Method T276).

10. Quality Assurance Plan

10.1 Field Quality Assurance

Sampling accuracy and precision should be maintained through the analysis of:

- Minimum 10% field duplicate/replicate samples;
- Field/trip spikes/blanks to be analysed at a rate of one per day of validation sampling;
- Rinsate samples are collected and analysed at a rate of one per day of validation sampling;
- Trip spike/blank samples during storage/transport of samples to the laboratory;

Appropriate sampling procedures should be undertaken to minimise potential for cross contamination, for example:

- Standard operating procedures are followed;
- Site safety plans are developed prior to commencement of works;
- Duplicate or replicate field samples are collected and analysed;
- Equipment rinsate samples are analysed as part of the QA/QC programme;
- Samples are stored under secure, temperature controlled conditions;
- Chain of custody documentation is employed for the handling, transport and delivery of samples to the selected laboratory.

10.2 Laboratory Quality Assurance and Quality Control

DP's preferred laboratory routinely undertakes in-house QA/QC procedures involving the routine testing of:

- Reagent blanks;
- Spike recovery analysis;
- Laboratory duplicate analysis;
- Analysis of control standards;
- Calibration standards and blanks;
- Statistical analysis of QC data.

10.3 Data Quality Indicators

Based on the analysis of quality control samples i.e. duplicates/replicates and in-house laboratory QA/QC procedures, the following data quality indicators have been assigned for the validation testing:

- Conformance with specified holding times;
- Accuracy of spiked samples within the laboratory's acceptable range (typically 70% to 130% for inorganic contaminants and greater for some organic contaminants);
- Field and laboratory duplicates and replicates samples will have a precision average of +/- 50% relative per cent difference (RPD). Elevated RPDs may be present due to heterogeneity of materials;
- Rinsate samples will show that the sampling equipment is free of introduced contaminants (i.e. the analytes within the normal range for deionised water);
- Field duplicates/replicates will be collected at a frequency of 10% of all samples, and rinsate samples of field equipment will be collected at one per day of sampling.

An assessment of the overall data quality will be presented in the final validation report.

10.4 Validation Reporting

A validation report will be prepared by the environmental consultant with reference to the NSW EPA Contaminated Sites Guidelines for Consultants Reporting on Contaminated Sites (Ref 5) and other appropriate guidance documentation.

The report shall be submitted to Council at the completion of the remediation works program. The validation report shall confirm that the site has been remediated to a suitable standard for the proposed high density residential development.

With respect to the remediation and validation of excavations (if required), backfilling and subsequent construction should only commence following validation of the excavations.

The validation report shall include (where required) details of the total volume of contaminated materials excavated, present detailed analytical results, confirm that excavation areas and remediated soils re-used on site are validated and indicate the final disposal destination of the materials removed from site.

11. Environmental Management Plan (during construction)

11.1 Introduction

The contractor should undertake the work with due regard to the minimisation of environmental effects and to meet all statutory and regulatory requirements.

The contractor shall have in place a Construction Environmental Management Plan (CEMP) so that work on the site complies with, but not limited to, the requirements of the following legislation:

- Protection of the Environment Operations Act;
- Contaminated Land Management Act;
- Dangerous Goods Act;
- Construction Safety Act;
- Work Health and Safety Act (SafeWork NSW);
- Council Development Approval Conditions.

The contractor shall also be responsible that the site works comply with the following conditions:

- Wastes generated at the site are disposed in an appropriate manner;
- Fugitive dust leaving the confines of the site is minimised;
- No water containing any suspended matter or contaminants leaves the site in a manner which could pollute the environment;
- Vehicles shall be cleaned and secured so that no mud, soil or water are deposited on any public roadways or adjacent areas;
- Noise and vibration levels at the site boundaries comply with the legislative requirements.

Asbestos materials have been associated with various human respiratory diseases. The risk of contracting these diseases from contact with asbestos depends entirely on the fibres becoming airborne. It is important during disturbance of asbestos impacted soils that the potential for generating airborne asbestos fibres should be minimised. Moreover, levels of airborne asbestos fibres immediately outside the works area should be maintained to within the acceptable background level (i.e. <0.01 fibre/mL). Appropriate air monitoring should be conducted by the OH during remediation of upper asbestos-impacted filling.

In order to achieve a minimisation of environmental effects, the following measures are recommended, and should be adopted by the appointed contractor.

The contractor's CEMP is to include:

- Contingency plans to respond to site incidents;
- Site management plan for the operation phase of remediation works;
- A remediation schedule and hours of operation (which will be subject to development consent conditions);
- Details of relevant contacts;
- Requirements outlined in Newcastle City Council Technical Manual: Contaminated Land Management (June 2012);
- Procedure(s) for dealing with deleterious materials that may affect use as fill;
- Incident management/emergency response procedures;
- Any community consultation requirements.

At the commencement of site works and following demolition and removal of concrete slabs, interim measures should be adopted to manage possible human-health and environmental impacts from ACM observed at the surface (i.e. prior to full scale construction). Such measures could include use of spray / sprinklers to prevent dust blow or temporary covers. Requirements for interim control measures should be confirmed following demolition with the OH.

11.2 Traffic Management

All vehicular traffic shall use only routes approved by Council, to and from the selected landfill where off-site disposal is undertaken. All loads shall be tarpaulin covered and lightly wetted to minimise the potential for materials or dust are dropped or deposited outside or within the site. The proposed landfill should be consulted for any additional requirements.

Each vehicle that has trafficked potentially impacted site soils within the site shall be inspected for cleanliness before being logged out as clean (wheels and chassis), or hosed down into a wheel wash or wash down bay until designated as clean when exiting the site (if required).

Wheel wash silt residues should be collected periodically and either returned to the excavation area or included in the remediation stockpile. Such material will be treated as contaminated unless analysis proves otherwise.

Removal of waste materials from the site shall only be carried out by a licensed contractor holding appropriate licence, consent or approvals to dispose the waste materials according to the waste classification.

Waste tracking should be conducted by the licensed contractor in accordance with regulatory requirements. Details of all materials removed from the site shall be documented by a contractor with copies of weighbridge slips, trip tickets and consignment disposal confirmation (where appropriate) provided to the environmental consultant responsible for site validation. A site log shall be maintained by the contractor to track disposed loads against on-site origin and location of the materials.

Truck dispatch shall be logged and recorded by the contractor for each load leaving the site. A record of the truck dispatch should be provided to the environmental consultant responsible for site validation by the contractor.

Similarly tracking and documentation of all on-site movements of material should be maintained by the contractor.

11.3 Excavations

Records of all excavations and stockpile locations should be maintained. A site diary should also be maintained by the contractor to record daily progress, abnormal occurrences, incidents, and truck movements.

Contaminated material should be stockpiled at suitable locations within the site. All temporary stockpiles of contaminated material shall be secured and demarcated to clearly delineate their boundaries.

All excavations shall be made with due regard to the stability of adjacent footings and structures. It will be the contractor's responsibility to provide adequate battering, shoring and/or underpinning to protect adjacent structures (if required).

No person shall be permitted to enter an unsupported excavation where it is more than 1.5 m deep or where it is considered to be unstable, irrespective of depth.

Records of all imported filling and placement should also be maintained by the contractor.

11.4 Stormwater Management and Control

Appropriate measures shall be taken to minimise the potential for potentially contaminated water or sediments to leave the site. Such measures could include:

- Construction of diversion bunds to divert stormwater from contaminated areas and contaminated soil stockpiles;
- Provision of sediment traps including geotextiles or hay bales. This would be required for contaminated soil stockpiles to prevent losses by surface erosion; and
- Construction of sediment control basins (if required).

Discharge of any waters should meet the consent conditions from the appropriate authority. This should be verified by sampling and analyses undertaken by the contractor. For example, if excavations fill with water during validation works (i.e. due to rainfall), the water will require analysis to determine appropriate options for discharge (i.e. disposal to stormwater, sewer or collection by a licensed contractor).

11.5 Control of Dust and Odour

Control of dust and odour during the course of the remediation works shall be maintained by the contractor and may include, but not necessarily be limited to, the following:

- The use of a water cart, as and when appropriate, to eliminate wind-blown dust;
- Use of sprays/sprinklers to prevent dust blow from stockpiles;
- Covering of stockpiles with plastic sheeting or geotextile membranes;
- Restriction of stockpile heights to 2 m above surrounding site level;
- Ceasing works during periods of inclement weather such as high winds or heavy rain;
- Regular checking of the fugitive dust and odour issues. Undertake immediate remediation measures to rectify any cases of excessive dust or odour;
- Provision of temporary capping over site soils;

11.6 Noise Control

Noise and vibration will be restricted to reasonable levels. All plant and machinery used on site should not breach statutory noise levels. Working hours will be restricted to those specified by Council.

12. Work Health and Safety

All site work must be undertaken in a controlled and safe manner with due regard to potential hazards, training and safe work practices. The practices outlined should generally comply with the WHS policies specified by the relevant Authorities.

All personnel on site should be required to wear the following protection as a minimum:

- Steel-capped boots;
- Safety glasses or safety goggles with side shields meeting AS1337 requirements (as necessary);
- Hard hat meeting AS1801 requirements;
- Hearing protection meeting AS1270 requirements when working around machinery or plant equipment if noise levels exceed exposure standards.

In the event that personnel are required to work in areas of potential contact with asbestos containing materials, the following protection will be required in accordance with the Worksafe Australia: Asbestos – Code of Practice and Guidelines Notes:

- Disposable coveralls to prevent contact with asbestos materials if large volumes of asbestos material are present;
- Breathing apparatus fitted with a Class P2 filter;
- Steel-capped boots;
- nitrile work gloves meeting AS 2161 requirements or heavy duty gauntlet gloves;
- Safety glasses or safety goggles with side shields meeting AS 1337 requirements (as necessary);
- Hard hat meeting AS 1801 requirements;
- Hearing protection meeting AS 1270 requirements when working around machinery or plant equipment if noise levels exceed exposure standards.

Excavation, handling, stockpiling, transport etc. of materials containing asbestos should be undertaken by a licenced contractor in accordance with regulatory requirements including the Work Safe Australia: Asbestos – Code of Practice and Guidelines Notes, and the relevant statutory requirements such as Section 29 of the Protection of the Environment Operations (Waste) Regulation 2014. Based on the results of the previous investigations, the presence of asbestos materials comprises mainly asbestos fines (i.e. small fibro fragments and fibre bundles). Asbestos in the form of larger fibro fragments may also be present given the history of demolition and fill importation at the site.

The contractor shall prepare a project-specific environmental management and WHS plans to supplement measures presented in this RAP.

13. Conclusion

This RAP provides the clean-up objectives, remediation acceptance criteria (RAC), principles, methods and procedures by which the remediation and validation of the site will be achieved.

Prior to commencement of remediation and construction works, it is recommended that a site inception meeting is held between the developer, remediation contractor and consultant to discuss the remediation and validation process and to identify the tasks and responsibilities for the remediation of the site to a condition suitable for the proposed high density residential development.

14. References

1. Douglas Partners Pty Ltd, “Report on Preliminary Contamination and Geotechnical Assessment, Proposed Multi-Storey Commercial Development, 10 Dangar Street, Wickham, prepared for Valad Property Management, Project 39961, September 2008.
2. Douglas Partners Pty Ltd, ‘Report on Additional Contamination Assessment, Proposed Multi-storey Commercial Development, 10 Dangar Street Wickham’, prepared for Valad Property Management, Project 39961.01, November 2008.
3. Douglas Partners Pty Ltd, ‘Report on Preliminary Site Investigation, Desktop Geotechnical and Acid Sulfate Soil Assessment, Proposed Apartment Development, 10 Dangar Street Wickham’, prepared for Dangar Street Wickham Pty Ltd, Project 39961.02 dated 18 October 2018.
4. Douglas Partners Pty Ltd, ‘Report on Detailed Site Investigation, Proposed Apartment Development, 10 Dangar Street Wickham’, prepared for Dangar Street Wickham Pty Ltd, Project 39961.02 dated 23 November 2018.
5. NSW EPA Contaminated Sites (2011), ‘Guidelines for Consultants Reporting on Contaminated Sites’, August 2011.
6. National Environment Protection Council (2013), ‘National Environment Protection (Assessment of Site Contamination) Amendment Measure 2013’, 11 April 2013.
7. NSW EPA, Contaminated Site, “Guidelines for the NSW Site Auditor Scheme 2nd Edition”, April 2006.
8. NSW EPA, “Best Practice Note: Landfarming”, April 2014.
9. NSW EPA, “Waste Classification Guidelines: Part 1 – Classifying Waste”, November 2014;
10. Cooperative Research Centre for Contamination Assessment and Remediation of the Environment (CRC CARE) Technical Report no.10 (2011), ‘Health screening levels for petroleum hydrocarbons in soil and groundwater’ September 2011.ANZECC (2000) “Australian and New Zealand Guidelines for Fresh and Marine Water Quality”, October 2000.
11. Western Australia Department of Health (2009), ‘Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia’, May 2009.
12. ANZAST (2018), 'Australian and New Zealand Guidelines for Fresh and Marine Water Quality', August 2018

13. NSW EPA, “Managing Land Contamination, Planning Guidelines, SEPP55 – Remediation of Land”, 1998.

15. Limitations

Douglas Partners (DP) has prepared this report for this project at 10 Dangar Street with reference to DP’s proposal dated 5 July 2018 and acceptance received from David Goldman of Dangar Street Wickham Pty Ltd dated 20 September 2018. The work was carried out under DP’s Conditions of Engagement. This report is provided for the exclusive use of Dangar Street Wickham Pty Ltd 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 the previous investigations. 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.

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.

Asbestos was previously detected by laboratory analysis in filling materials at the test locations sampled and analysed. Building demolition materials, such as concrete, brick and tile were also located in previous below-ground filling and these are considered as indicative of the possible presence of hazardous building materials (HBM), including asbestos.

Although the sampling plan adopted for this investigation is considered appropriate to achieve the stated project objectives, there are necessarily parts of the site that have not been sampled and analysed. This is either due to undetected variations in ground conditions or to budget constraints (as discussed above), or to parts of the site being inaccessible and not available for inspection/sampling. It is therefore considered possible that additional HBM, including asbestos, may be present in unobserved or untested parts of the site, between and beyond sampling locations, and hence no warranty can be given that additional asbestos is not present.

The contents of this report do not constitute formal design components such as are required, by the Health and Safety Legislation and Regulations, to be included in a Safety Report specifying the hazards likely to be encountered during construction and the controls required to mitigate risk. This design process requires risk assessment to be undertaken, with such assessment being dependent upon factors relating to likelihood of occurrence and consequences of damage to property and to life. This, in turn, requires project data and analysis presently beyond the knowledge and project role respectively of DP. DP may be able, however, to assist the client in carrying out a risk assessment of potential hazards contained in the Comments section of this report, as an extension to the current scope of works, if so requested, and provided that suitable additional information is made available to DP. Any such risk assessment would, however, be necessarily restricted to the environmental components set out in this report and to their application by the project designers to project design, construction, maintenance and demolition.

Douglas Partners Pty Ltd

Appendix A

About This Report
Drawing 1- Test Location Plan
Architectural Plans (Team 2 Architects Ref 918, Rev 4 dated 17.9.2020)

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

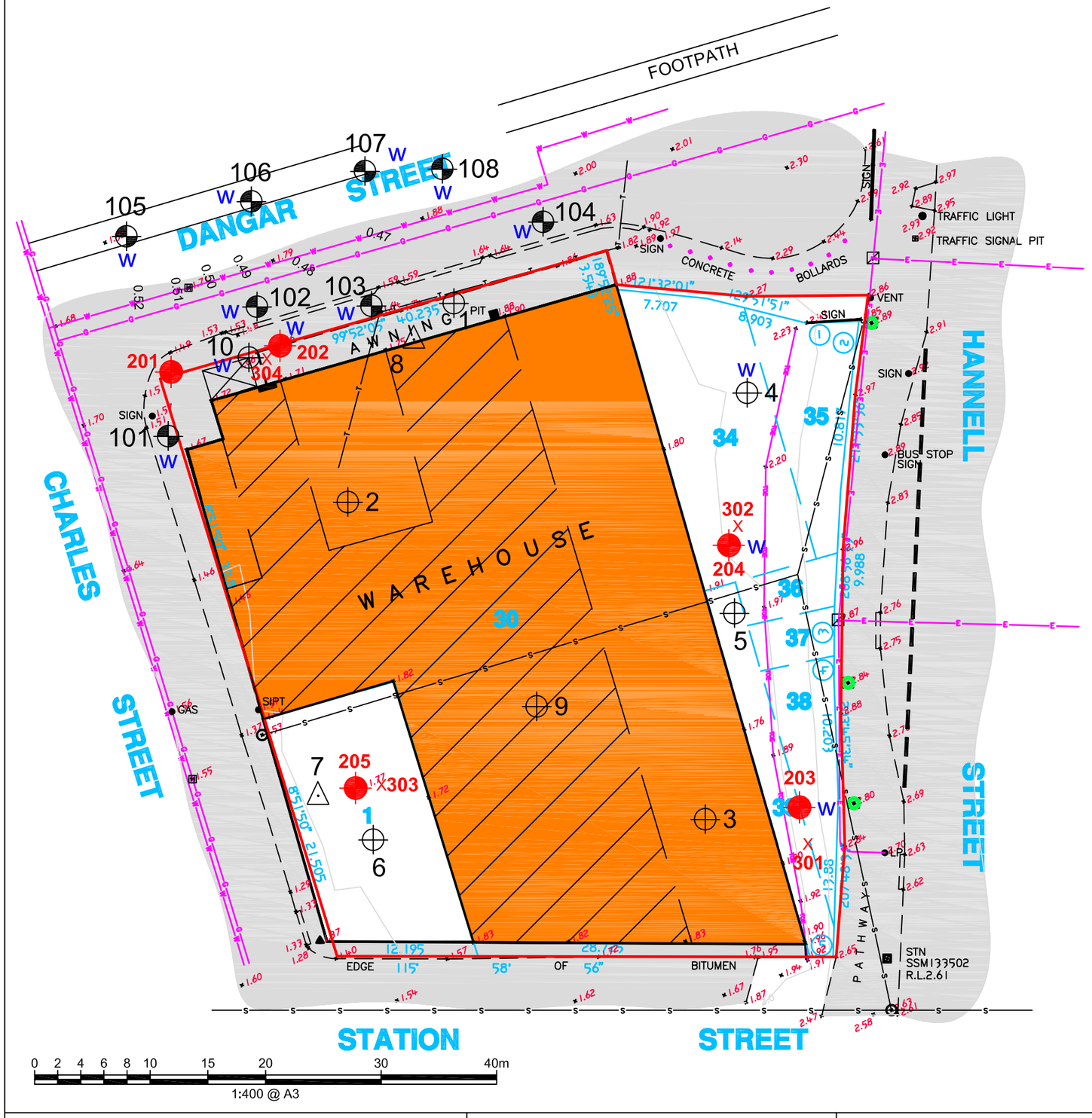
In the event that conditions encountered on site during construction appear to vary from those which were expected from the information contained in the report, DP requests that it be immediately notified. Most problems are much more readily resolved when conditions are exposed rather than at some later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

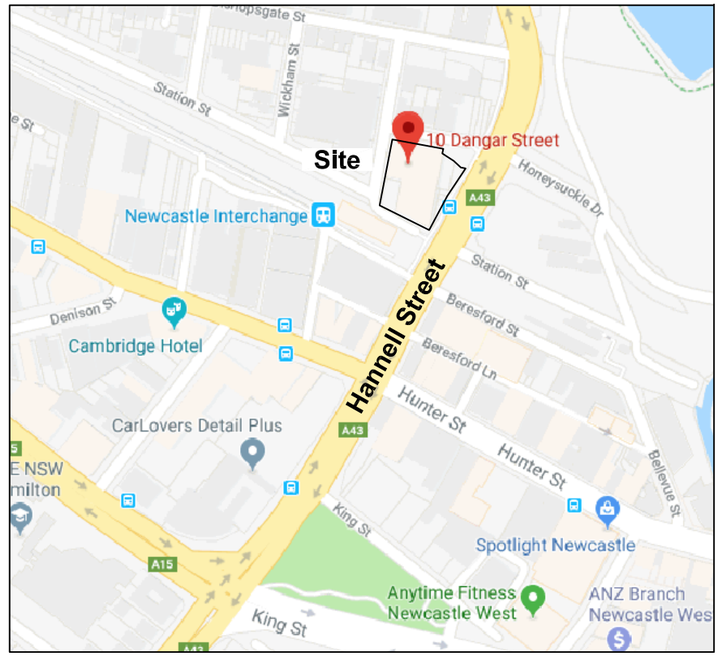
Information for Contractual Purposes

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.





Locality Plan

NOTES

1. Drawing adapted from survey plan by Parker Scanlon Pty Ltd, Ref B122 dated 25.1.08.

LEGEND

- Approximate Borehole Location (current investigation)
- Approximate CPT Location (current investigation)
- Approximate Borehole Location (previous investigation 39961.01, Nov 2008)
- Approximate Borehole Location (previous investigation 39961, Sept 2008)
- Approximate Location of Raised Concrete Floor
- Approximate Surface / Near Surface Sampling Location (previous investigation 39961, Sept 2008)
- Approximate Location of Possible Former Bowser(s)
- Approximate of Possible Underground Storage Tank(s)
- W Groundwater Monitoring Well
- Site Boundary

Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT: Dangar Street Wickham Pty Ltd		TITLE: **Test Location Plan** **Proposed Apartment Development** **10 Dangar Street, Wickham**
OFFICE: Newcastle	DRAWN BY: PLH	
SCALE: 1:400@A3 Sheet	DATE: 23.11.2018	

PROJECT No:	39961.02
DRAWING No:	1
REVISION:	0

Sheet List_S4.55			
Sheet Number	Sheet Name	Current Revision	Current Revision Date
S4.55			
1000-General Arrangement Plans			
DA-1000	Basement 3 GA	5	17.09.20
DA-1001	Basement 2 GA	5	17.09.20
DA-1002	Basement 1 GA	5	17.09.20
DA-1003	Ground Floor GA	5	17.09.20
DA-1004	Level 1-3 Typical GA	4	17.09.20
2000-Building Elevations			
DA-2000	North Elevation	4	17.09.20
DA-2001	West Elevation	4	17.09.20
DA-2002	South Elevation	4	17.09.20
DA-2003	East Elevation	4	17.09.20
3000-Building Sections			
DA-3000	Building Section AA	4	17.09.20
DA-3001	Building Section BB	4	17.09.20
DA-Supporting Documents			
DA-4000	Materials Schedule	4	17.09.20
DA-4001	Visual Impact Analysis 01	4	17.09.20
DA-4002	Visual Impact Analysis 02	4	17.09.20
DA-5000	GFA Diagram 01	4	17.09.20

DRAWING STATUS:

S4.55 APPLICATION

Rev	Revision Description	Date
1	Draft S4.55 Issue	18.08.20
2	Draft S4.55 Issue	28.08.20
3	Draft S4.55 Issue	11.09.20
4	S4.55 Submission	17.09.20

DRAWING LEGEND:

1. Architectural drawings shall be read in conjunction with other consultant drawings and specifications. Any discrepancies shall be referred to team 2 architects before proceeding with work.
2. All dimensions and levels are in millimeters unless noted otherwise. No dimension shall be obtained by scaling the drawing.
3. All dimensions to be checked on site with any discrepancies referred to team 2 architects before proceeding with work.
4. All work to be carried out in accordance with the requirements of the principal certifying authority, current ncc & australian standards.

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Project:
BOWLINE

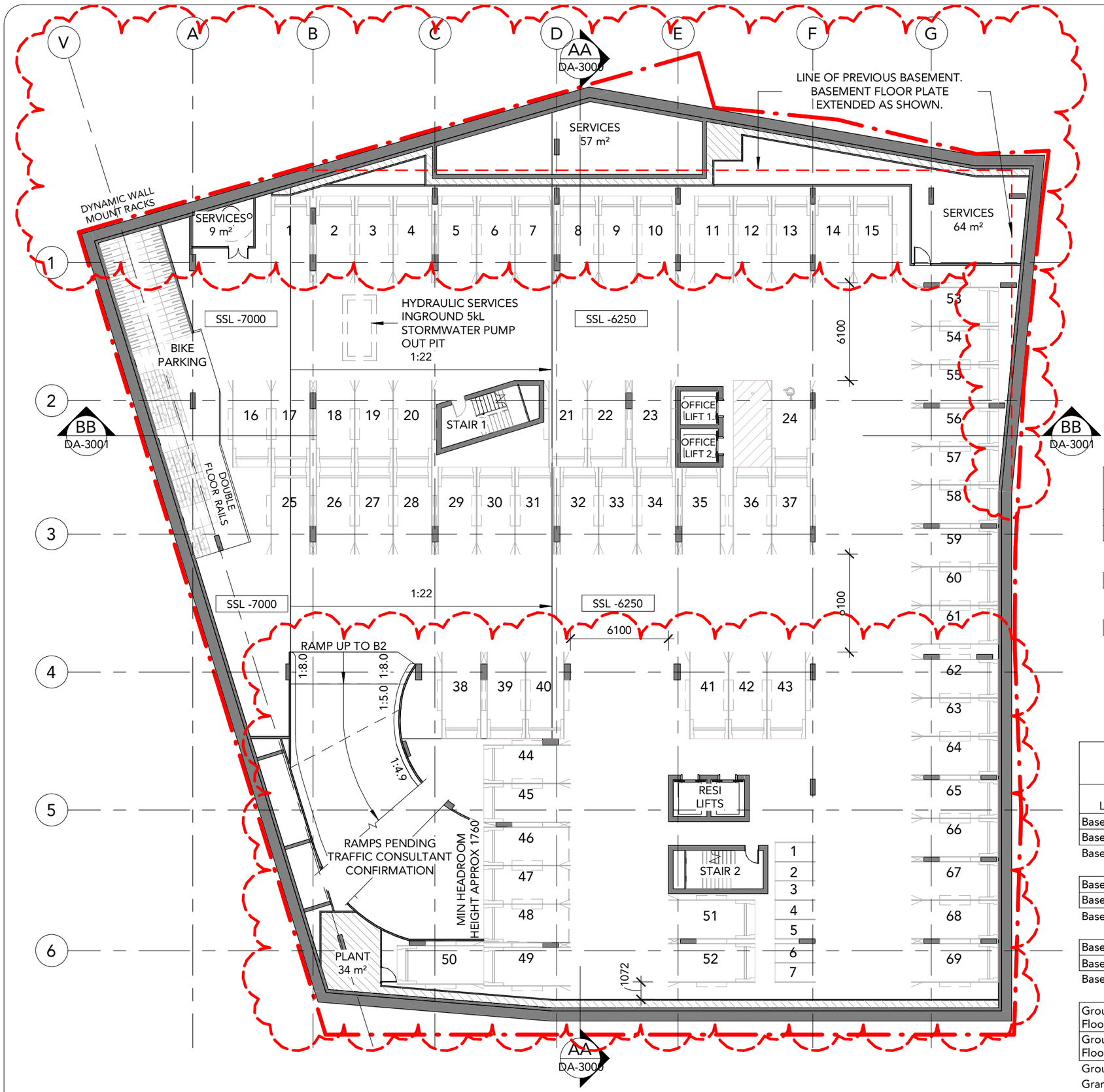
10 Dangar Street
Wickham NSW 2293

Title:
Cover Sheet

Project #:	Scale:	Drw:	Ckd:
918		LR	ML

Drawing #: DA-0001

Rev: 4



Overall Vehicle Parking Schedule

Level	Type	Count
Basement 3	Tandem	2
Basement 3	Standard	66
Basement 3	Accessible	1
Basement 3		69
Basement 2	Tandem	2
Basement 2	Standard	57
Basement 2	Accessible- SDA	4
Basement 2		63
Basement 1	Tandem	2
Basement 1	Standard	60
Basement 1	Accessible	2
Basement 1		64
Ground Floor Upper	Standard	7
Ground Floor Upper	Loading Bay	2
Ground Floor Upper		9
Grand total		205

Overall Motorcycle Parking Schedule

Level	Description	Count
Basement 3	Motorbike Bay	7
Basement 3		7
Basement 2	Motorbike Bay	5
Basement 2		5
Basement 1	Motorbike Bay	7
Basement 1		7
Grand total		19

Overall Bicycle Parking Schedule

Level	Type	Count	No. of Spaces
Basement 3	Floor Rail Double	9	18
Basement 3	Wall Mount Single DYN	34	34
Basement 3		43	52
Basement 2	Floor Rail Double	14	28
Basement 2	Wall Mount Single DYN	10	10
Basement 2		24	38
Basement 1	Floor Rail Double	5	10
Basement 1	Wall Mount Single DYN	58	58
Basement 1		63	68
Ground Floor Upper	Floor Rail Double	3	6
Ground Floor Upper	Wall Mount Single DYN	15	15
Ground Floor Upper		18	21
Grand total		148	179

DRAWING STATUS:

S4.55 APPLICATION

Rev	Revision Description	Date
1	Draft S4.55 Issue	14.08.20
2	Draft S4.55 Issue	28.08.20
3	Issue for Information	08.09.20
4	Draft S4.55 Issue	11.09.20
5	S4.55 Submission	17.09.20

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Reg NSW: 9940
MELBOURNE
313/737 Burwood Road,
Hawthorn East VIC 3123
ABN: 72 104 833 507
Reg Vic: 19340

Project:
BOWLINE

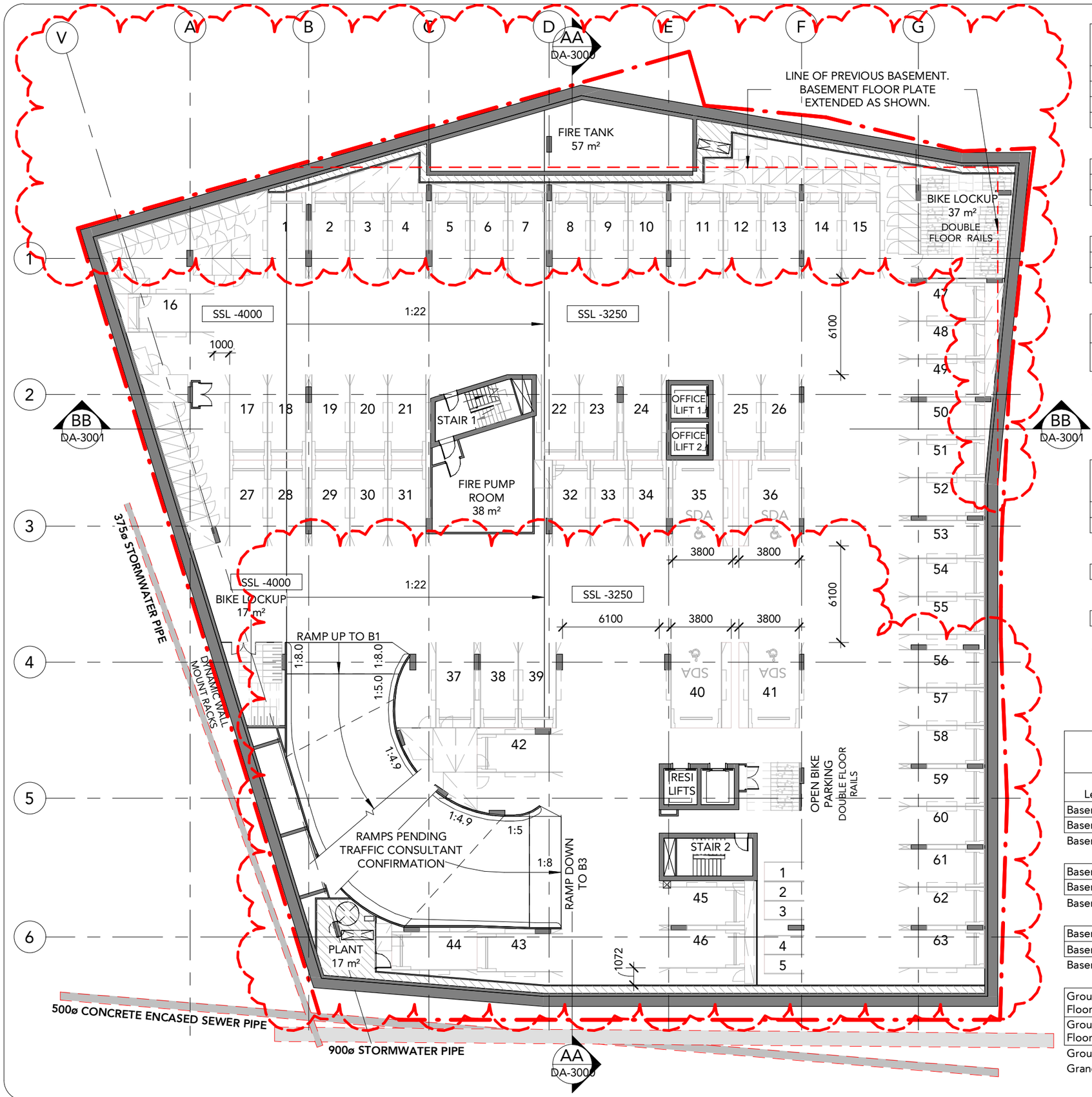
10 Dangar Street
Wickham NSW 2293

Title:
Basement 3 GA

Project #:	Scale:	Drw:	Ckd:
918	1 : 250 @A3	LR	ML

Drawing #: DA-1000

Rev: 5



Overall Vehicle Parking Schedule

Level	Type	Count
Basement 3	Tandem	2
Basement 3	Standard	66
Basement 3	Accessible	1
Basement 3		69
Basement 2	Tandem	2
Basement 2	Standard	57
Basement 2	Accessible- SDA	4
Basement 2		63
Basement 1	Tandem	2
Basement 1	Standard	60
Basement 1	Accessible	2
Basement 1		64
Ground Floor Upper	Standard	7
Ground Floor Upper	Loading Bay	2
Ground Floor Upper		9
Grand total		205

Overall Motorcycle Parking Schedule

Level	Description	Count
Basement 3	Motorbike Bay	7
Basement 3		7
Basement 2	Motorbike Bay	5
Basement 2		5
Basement 1	Motorbike Bay	7
Basement 1		7
Grand total		19

Overall Bicycle Parking Schedule

Level	Type	Count	No. of Spaces
Basement 3	Floor Rail Double	9	18
Basement 3	Wall Mount Single DYN	34	34
Basement 3		43	52
Basement 2	Floor Rail Double	14	28
Basement 2	Wall Mount Single DYN	10	10
Basement 2		24	38
Basement 1	Floor Rail Double	5	10
Basement 1	Wall Mount Single DYN	58	58
Basement 1		63	68
Ground Floor Upper	Floor Rail Double	3	6
Ground Floor Upper	Wall Mount Single DYN	15	15
Ground Floor Upper		18	21
Grand total		148	179

DRAWING STATUS:

S4.55 APPLICATION

Rev	Revision Description	Date
1	Draft S4.55 Issue	14.08.20
2	Draft S4.55 Issue	28.08.20
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ABN: 72 104 833 507
Reg Vic: 19340

Project:
BOWLINE

10 Dangar Street
Wickham NSW 2293

Title:
Basement 2 GA

Project #:	Scale:	Drw:	Ckd:
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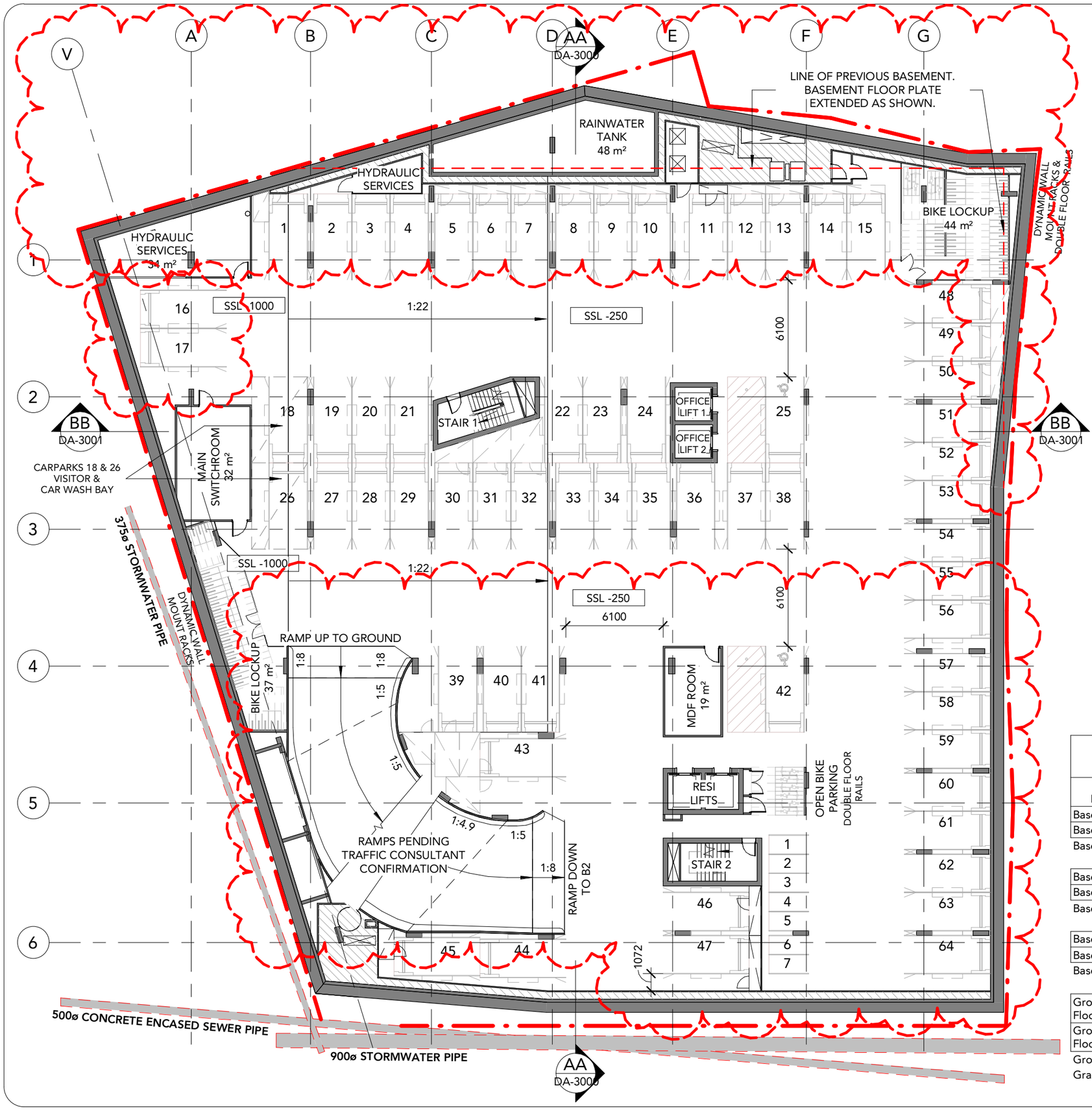
Drawing #: DA-1001

Rev: 5



Overall Vehicle Parking Schedule

Level	Type	Count
Basement 3	Tandem	2
Basement 3	Standard	66
Basement 3	Accessible	1
Basement 3		69
Basement 2	Tandem	2
Basement 2	Standard	57
Basement 2	Accessible- SDA	4
Basement 2		63
Basement 1	Tandem	2
Basement 1	Standard	60
Basement 1	Accessible	2
Basement 1		64
Ground Floor Upper	Standard	7
Ground Floor Upper	Loading Bay	2
Ground Floor Upper		9
Grand total		205

Overall Motorcycle Parking Schedule

Level	Description	Count
Basement 3	Motorbike Bay	7
Basement 3		7
Basement 2	Motorbike Bay	5
Basement 2		5
Basement 1	Motorbike Bay	7
Basement 1		7
Grand total		19

Overall Bicycle Parking Schedule

Level	Type	Count	No. of Spaces
Basement 3	Floor Rail Double	9	18
Basement 3	Wall Mount Single DYN	34	34
Basement 3		43	52
Basement 2	Floor Rail Double	14	28
Basement 2	Wall Mount Single DYN	10	10
Basement 2		24	38
Basement 1	Floor Rail Double	5	10
Basement 1	Wall Mount Single DYN	58	58
Basement 1		63	68
Ground Floor Upper	Floor Rail Double	3	6
Ground Floor Upper	Wall Mount Single DYN	15	15
Ground Floor Upper		18	21
Grand total		148	179

DRAWING STATUS:

S4.55 APPLICATION

Rev	Revision Description	Date
1	Draft S4.55 Issue	14.08.20
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Reg Vic: 19340

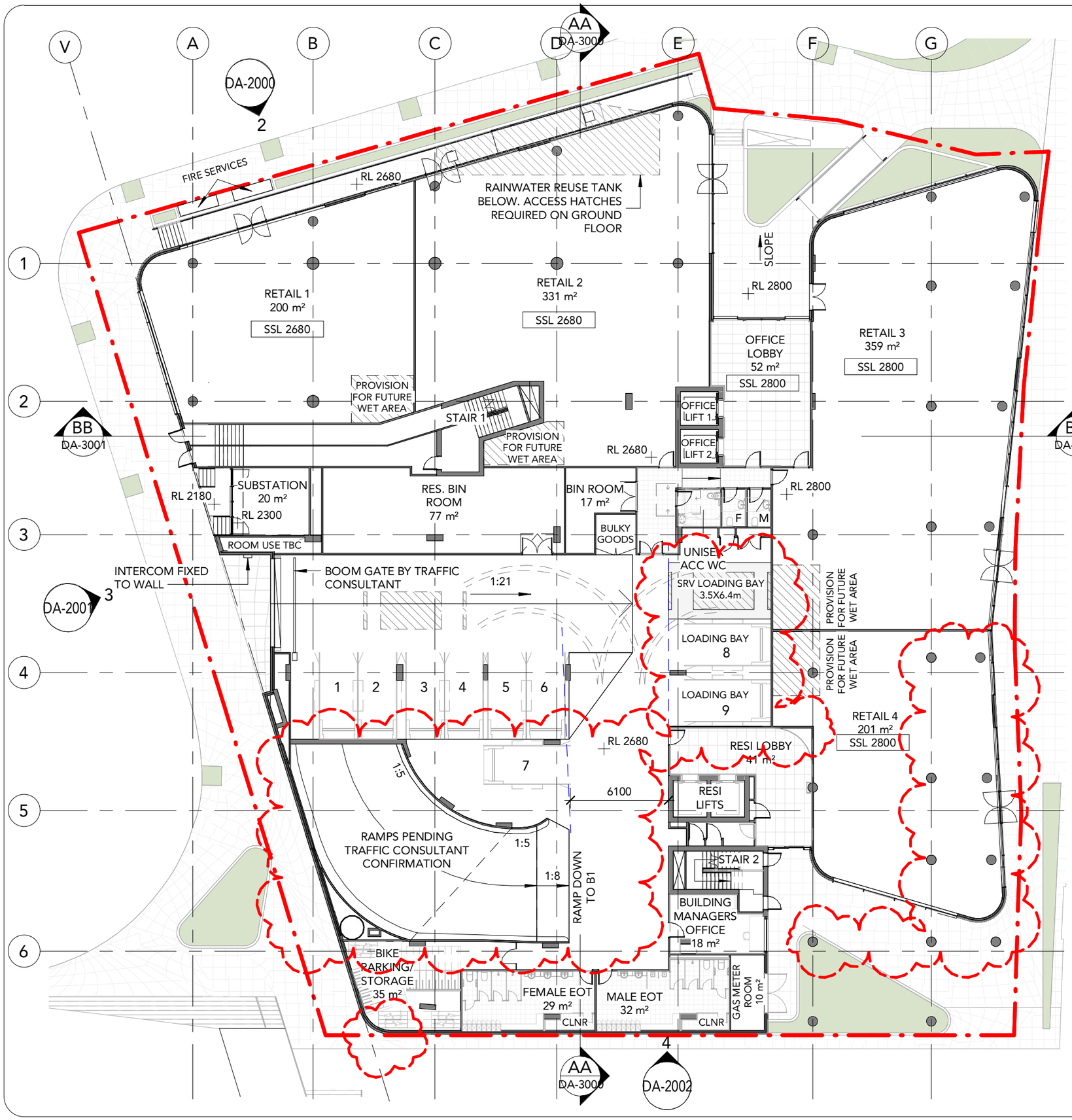
Project:
BOWLINE

10 Dangar Street
Wickham NSW 2293

Title:
Basement 1 GA

Project #:	Scale:	Drw:	Ckd:
918	1 : 250 @A3	LR	ML

Drawing #: DA-1002
Rev: 5



Overall Vehicle Parking Schedule

Level	Type	Count
Basement 3	Tandem	2
Basement 3	Standard	66
Basement 3	Accessible	1
Basement 3		69
Basement 2	Tandem	2
Basement 2	Standard	57
Basement 2	Accessible- SDA	4
Basement 2		63
Basement 1	Tandem	2
Basement 1	Standard	60
Basement 1	Accessible	2
Basement 1		64
Ground Floor Upper	Standard	7
Ground Floor Upper	Loading Bay	2
Ground Floor Upper		9
Grand total		205

Overall Motorcycle Parking Schedule

Level	Description	Count
Basement 3	Motorbike Bay	7
Basement 3		7
Basement 2	Motorbike Bay	5
Basement 2		5
Basement 1	Motorbike Bay	7
Basement 1		7
Grand total		19

Overall Bicycle Parking Schedule

Level	Type	Count	No. of Spaces
Basement 3	Floor Rail Double	9	18
Basement 3	Wall Mount Single DYN	34	34
Basement 3		43	52
Basement 2	Floor Rail Double	14	28
Basement 2	Wall Mount Single DYN	10	10
Basement 2		24	38
Basement 1	Floor Rail Double	5	10
Basement 1	Wall Mount Single DYN	58	58
Basement 1		63	68
Ground Floor Upper	Floor Rail Double	3	6
Ground Floor Upper	Wall Mount Single DYN	15	15
Ground Floor Upper		18	21
Grand total		148	179

DRAWING STATUS:

S4.55 APPLICATION

Rev	Revision Description	Date
1	Draft S4.55 Issue	14.08.20
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Reg Vic: 19340

Project:
BOWLINE

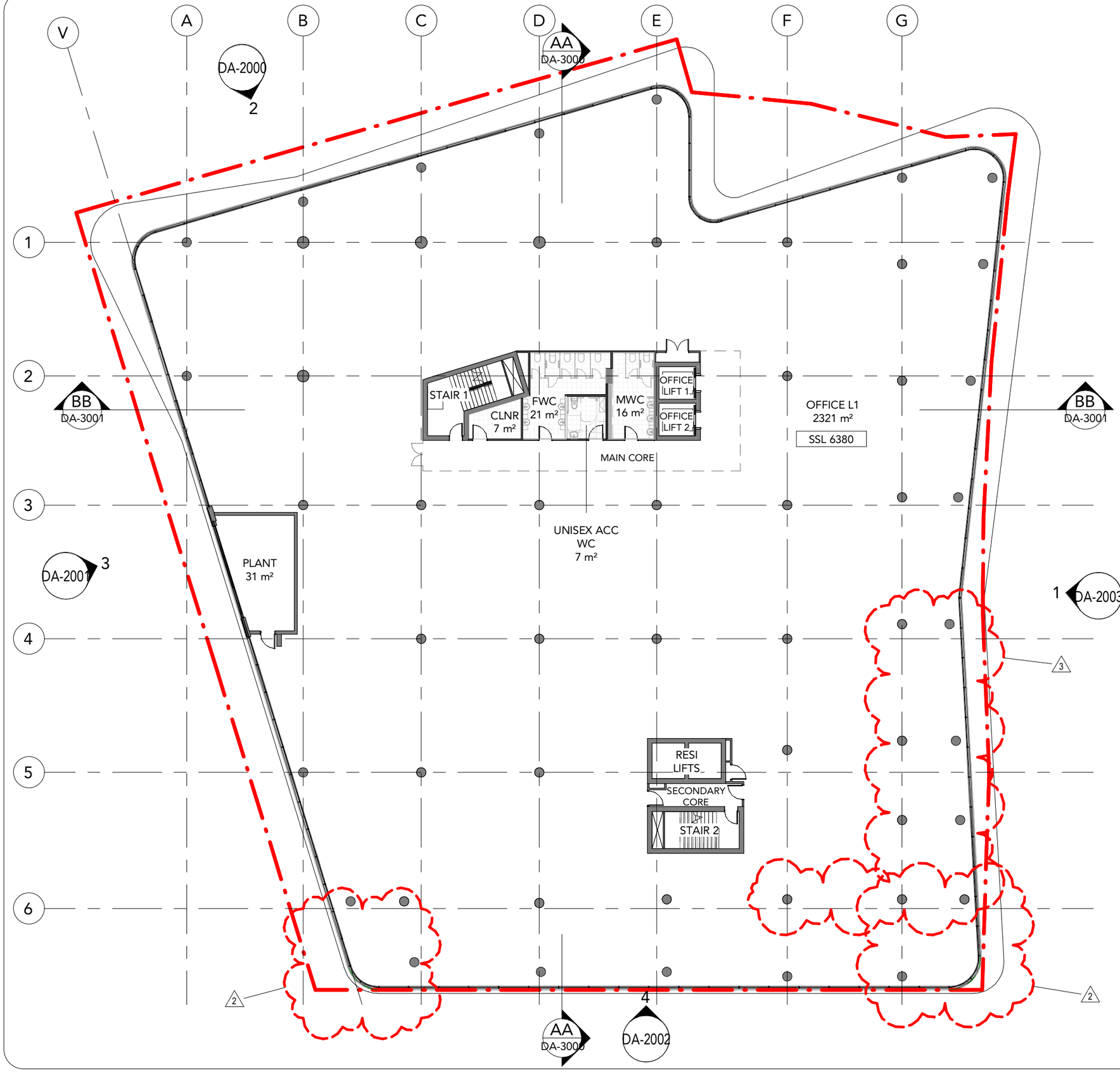
10 Dangar Street
Wickham NSW 2293

Title:
Ground Floor GA

Project #:	Scale:	Drw:	Ckd:
918	1 : 250 @A3	LR	ML

Drawing #: DA-1003

Rev: 5



DRAWING STATUS:

S4.55 APPLICATION

Rev	Revision Description	Date
1	Draft S4.55 Issue	14.08.20
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3	Draft S4.55 Issue	11.09.20
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Reg Vic: 19340

Project:
BOWLINE

10 Dangar Street
Wickham NSW 2293

Title:
Level 1-3 Typical GA

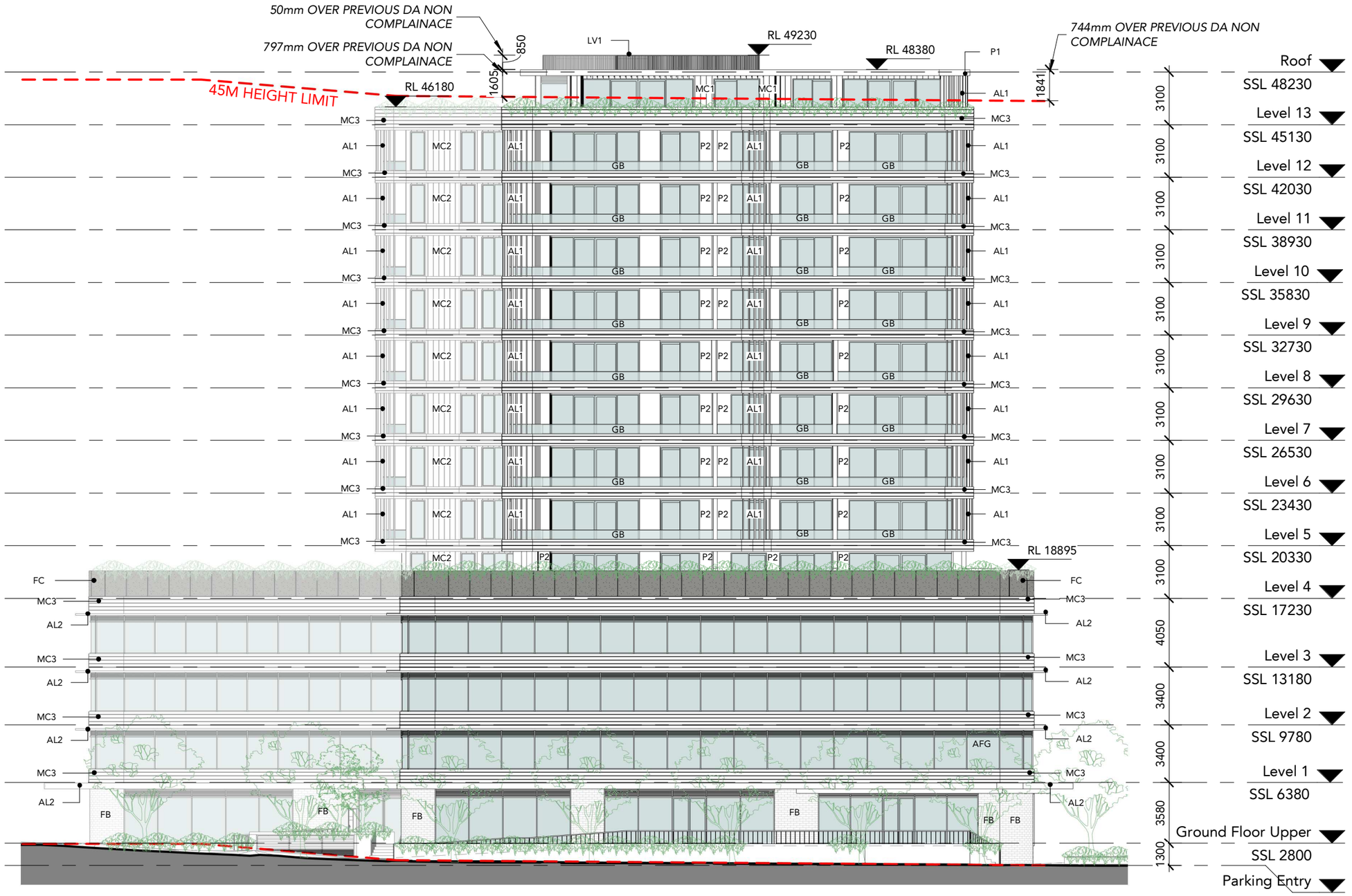
Project #:	Scale:	Drw:	Ckd:
918	1 : 250 @A3	LR	ML

Drawing #: DA-1004

Rev: 4

FINISHES KEY

AFG	ALUMINIUM FRAMED GLAZING
AL1	ALUMINIUM LOUVRE
AL2	HORIZONTAL ALUMINIUM SUNSHADE
FB	AUSTRAL FACE BRICK
FC	EQUITONE NATURA/LINES FIBRE CEMENT CLADDING
GB	FRAMELESS GLASS BALUSTRADE
LV1	VERTICAL SERVICES LOUVRE
MC1	METAL CLADDING
MC2	METAL CLADDING
MC3	METAL CLADDING
P1	PAINT DULUX ZEUS BLACK MATT
P2	PAINT MILTON MOON 94



DRAWING STATUS:

S4.55 APPLICATION

Rev	Revision Description	Date
1	Draft S4.55 Issue	14.08.20
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Hawthorn East VIC 3123
ABN: 72 104 833 507
Reg Vic: 19340

Project:
BOWLINE

10 Dangar Street
Wickham NSW 2293

Title:
North Elevation

Project #:	Scale:	Drw:	Ckd:
918	1 : 250 @A3	LR	ML

Drawing #: DA-2000

Rev: 4

FINISHES KEY

AFG	ALUMINIUM FRAMED GLAZING
AL1	ALUMINIUM LOUVRE
AL2	HORIZONTAL ALUMINIUM SUNSHADE
FB	AUSTRAL FACE BRICK
FC	EQUITONE NATURA/LINES FIBRE CEMENT CLADDING
GB	FRAMELESS GLASS BALUSTRADE
LV1	VERTICAL SERVICES LOUVRE
MC1	METAL CLADDING
MC3	METAL CLADDING
P1	PAINT DULUX ZEUS BLACK MATT
P2	PAINT MILTON MOON 94
P3	PAINT DULUX NATURAL WHITE

DRAWING STATUS:

S4.55 APPLICATION

Rev	Revision Description	Date
1	Draft S4.55 Issue	14.08.20
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Reg Vic: 19340

Project:
BOWLINE

10 Dangar Street
Wickham NSW 2293

Title:
West Elevation

Project #:	Scale:	Drw:	Ckd:
918	1 : 250 @A3	LR	ML

Drawing #: DA-2001

Rev: 4

FINISHES KEY

AFG	ALUMINIUM FRAMED GLAZING
AL1	ALUMINIUM LOUVRE
AL2	HORIZONTAL ALUMINIUM SUNSHADE
FB	AUSTRAL FACE BRICK
FC	EQUITONE NATURA/LINES FIBRE CEMENT CLADDING
GB	FRAMELESS GLASS BALUSTRADE
LV1	VERTICAL SERVICES LOUVRE
MC1	METAL CLADDING
MC3	METAL CLADDING
P1	PAINT DULUX ZEUS BLACK MATT

DRAWING STATUS:

S4.55 APPLICATION

Rev	Revision Description	Date
1	Draft S4.55 Issue	14.08.20
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ABN: 72 104 833 507
Reg Vic: 19340

Project:
BOWLINE
10 Dangar Street
Wickham NSW 2293

Title:
South Elevation

Project #:	Scale:	Drw:	Ckd:
918	1 : 250 @A3	LR	ML

Drawing #: DA-2002

Rev: 4

FINISHES KEY

AFG	ALUMINIUM FRAMED GLAZING
AL1	ALUMINIUM LOUVRE
AL2	HORIZONTAL ALUMINIUM SUNSHADE
FB	AUSTRAL FACE BRICK
FC	EQUITONE NATURA/LINES FIBRE CEMENT CLADDING
GB	FRAMELESS GLASS BALUSTRADE
LV1	VERTICAL SERVICES LOUVRE
MC1	METAL CLADDING
MC2	METAL CLADDING
MC3	METAL CLADDING
P1	PAINT DULUX ZEUS BLACK MATT
P2	PAINT MILTON MOON 94

DRAWING STATUS:

S4.55 APPLICATION

Rev	Revision Description	Date
1	Draft S4.55 Issue	14.08.20
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313/737 Burwood Road,
Hawthorn East VIC 3123
ABN: 72 104 833 507
Reg Vic: 19340

Project:
BOWLINE

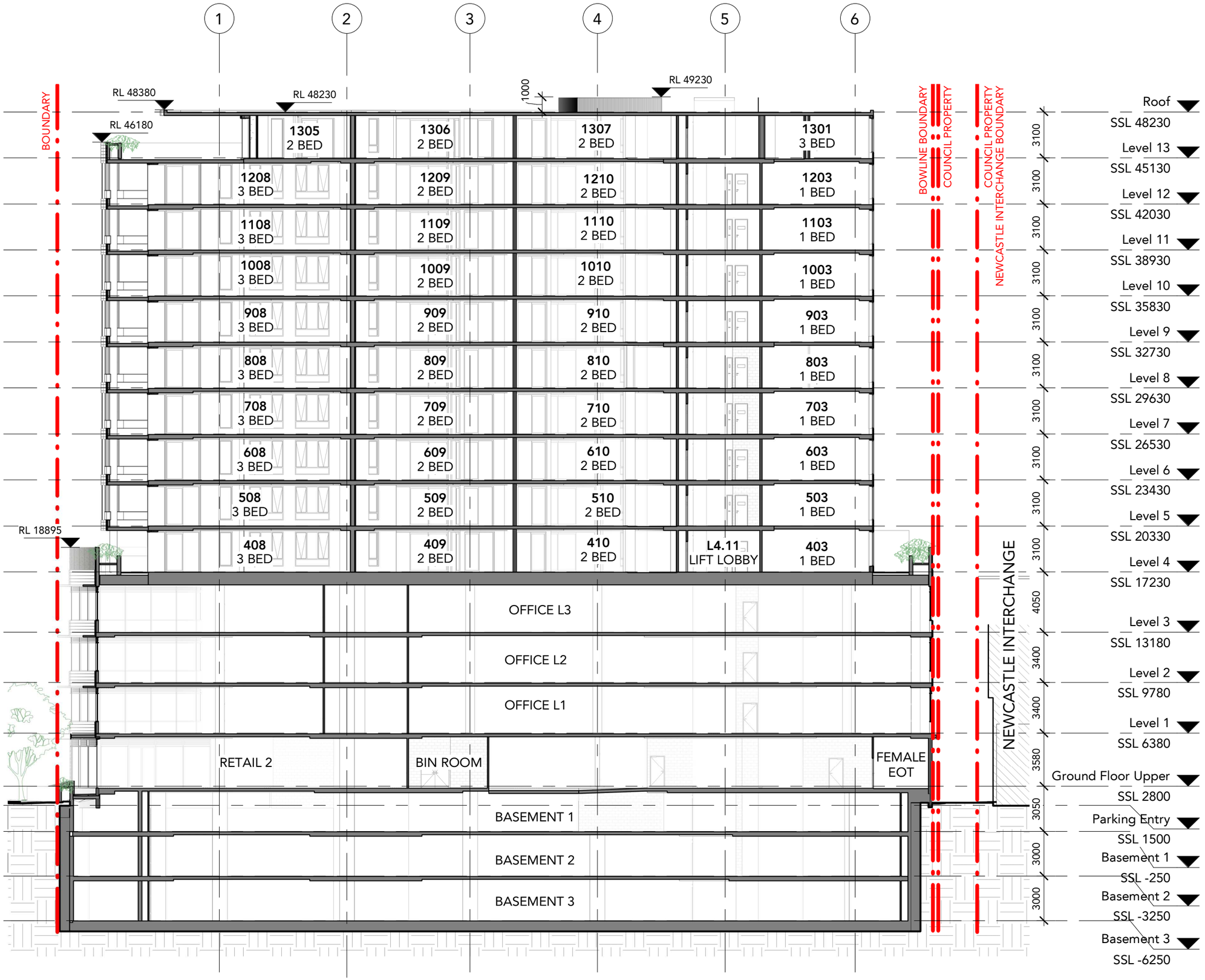
10 Dangar Street
Wickham NSW 2293

Title:
East Elevation

Project #:	Scale:	Drw:	Ckd:
918	1 : 250 @A3	LR	ML

Drawing #: DA-2003

Rev: 4



DRAWING STATUS:

S4.55 APPLICATION

Rev	Revision Description	Date
1	Draft S4.55 Issue	14.08.20
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313/737 Burwood Road,
Hawthorn East VIC 3123
ABN: 72 104 833 507
Reg Vic: 19340

Project:
BOWLINE

10 Dangar Street
Wickham NSW 2293

Title:
Building Section AA

Project #:	Scale:	Drw:	Ckd:
918	1 : 250 @A3	LR	ML

Drawing #: DA-3000

Rev: 4

DRAWING STATUS:

S4.55 APPLICATION

Rev	Revision Description	Date
1	Draft S4.55 Issue	14.08.20
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ABN: 72 104 833 507
Reg Vic: 19340

Project:
BOWLINE

10 Dangar Street
Wickham NSW 2293

Title:
Building Section BB

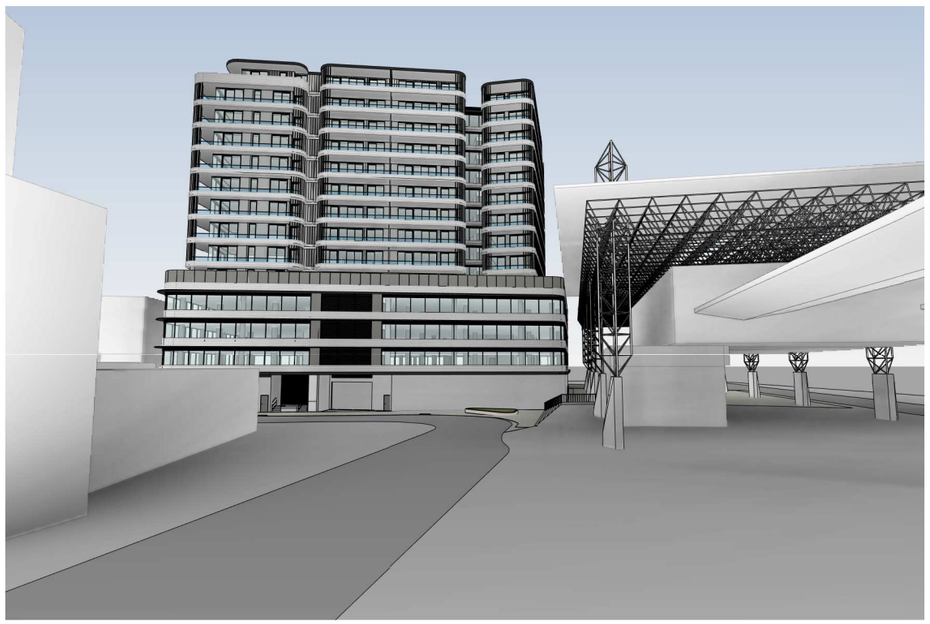
Project #:	Scale:	Drw:	Ckd:
918	1 : 250 @A3	LR	ML

Drawing #: DA-3001

Rev: 4

1 North View (Charles Street)
Scale:

2 East View (Hannell Street)
Scale:



3 West View (Station Street)
Scale:

DRAWING STATUS:

S4.55 APPLICATION

Rev	Revision Description	Date
1	Draft S4.55 Issue	18.08.20
2	Draft S4.55 Issue	28.08.20
3	Draft S4.55 Issue	11.09.20
4	S4.55 Submission	17.09.20

DRAWING LEGEND:

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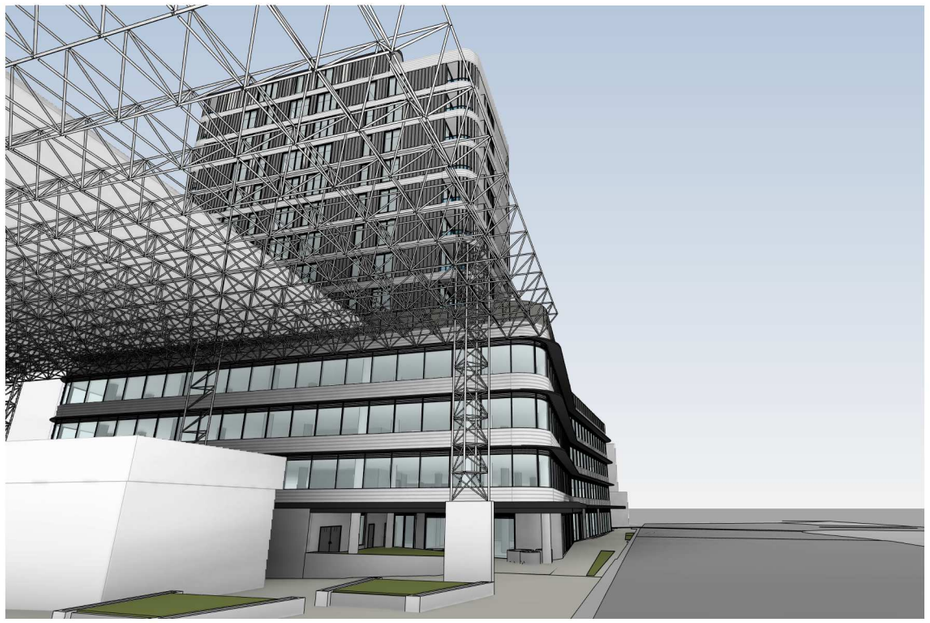
Project:
BOWLINE

10 Dangar Street
Wickham NSW 2293

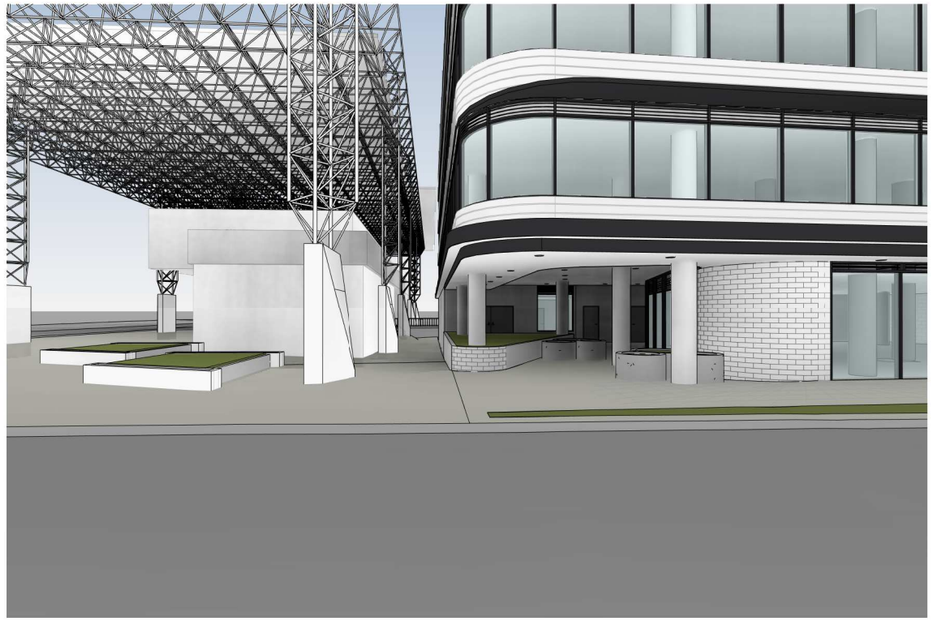
Title:
Visual Impact Analysis 01

Project #:	Scale:	Drw:	Ckd:
918	NTS	LR	ML

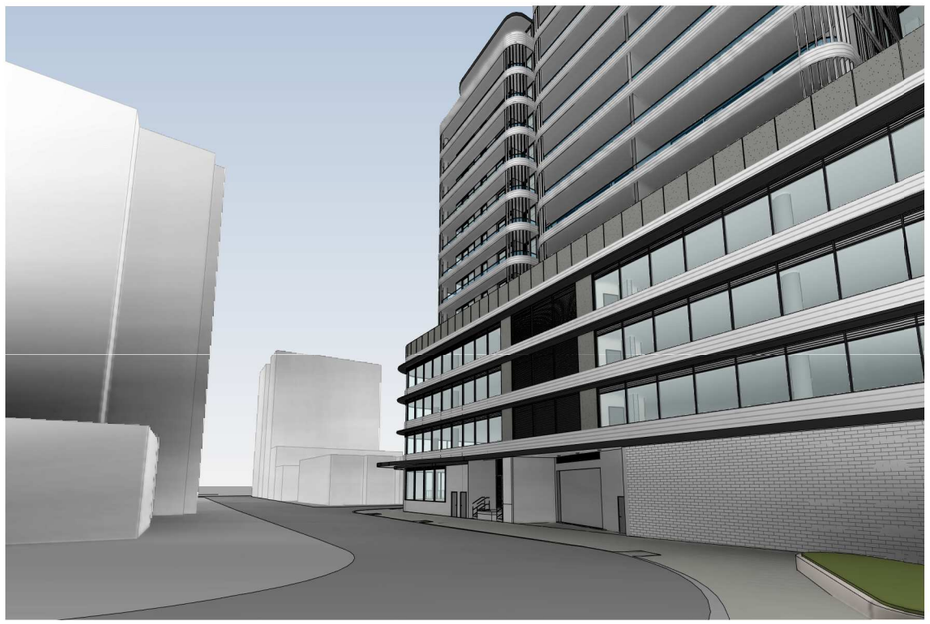
Drawing #: DA-4001
Rev: 4



4 South View (Hannell Street)
Scale:



5 South-East View (Hannell Street)
Scale:



6 South View (Charles Street)
Scale:

DRAWING STATUS:

S4.55 APPLICATION

Rev	Revision Description	Date
1	Draft S4.55 Issue	18.08.20
2	Draft S4.55 Issue	28.08.20
3	Draft S4.55 Issue	11.09.20
4	S4.55 Submission	17.09.20

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Project:
BOWLINE

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Wickham NSW 2293

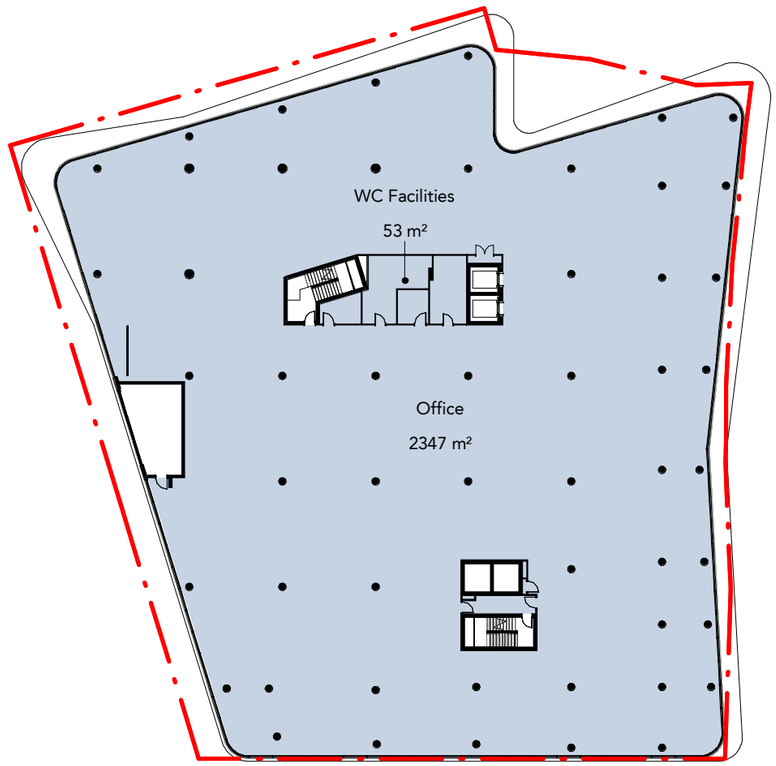
Title:
Visual Impact Analysis 02

Project #:	Scale:	Drw:	Ckd:
918	NTS	LR	ML

Drawing #: DA-4002
Rev: 4

1 Ground Floor GFA
Scale: 1 : 500

ROOM	AREA
RETAIL 1	202m²
RETAIL 2	333m²
RETAIL 3	366m²
RETAIL 4	206m²
OFFICE LOBBY	53m²
RESI LOBBY	43m²
WC'S+LOBBY	33m²
EOT+LOBBY	114m²
BM OFFICE	20m²
TOTAL	1370m²



2 Levels 1-3 TYPICAL GFA
Scale: 1 : 500

ROOM	AREA
OFFICE	2347m²
WC FACILITIES	53m²
TOTAL	2400m²

Podium Levels GFA

Level	Area
Ground Floor Upper	1368.79 m²
Level 1	2400.62 m²
Level 2	2400.62 m²
Level 3	2400.62 m²
Total Podium Gross Floor Area	8570.65 m²

Newcastle Local Environmental Plan 2012

Gross floor area means the sum of the floor area of each floor of a building measured from the internal face of external walls, or from the internal face of walls separating the building from any other building, measured at a height of 1.4 metres above the floor, and includes:

(a) the area of a mezzanine, and
(b) habitable rooms in a basement or an attic, and
(c) any shop, auditorium, cinema, and the like, in a basement or attic,

but excludes:

(d) any area for common vertical circulation, such as lifts and stairs, and
(e) any basement:
(i) storage, and
(ii) vehicular access, loading areas, garbage and services, and
(f) plant rooms, lift towers and other areas used exclusively for mechanical services or ducting, and
(g) car parking to meet any requirements of the consent authority (including access to that car parking), and
(h) any space used for the loading or unloading of goods (including access to it), and
(i) terraces and balconies with outer walls less than 1.4 metres high, and
(j) voids above a floor at the level of a storey or storey above.

DRAWING STATUS:

S4.55 APPLICATION

Rev	Revision Description	Date
1	Draft S4.55 Issue	14.08.20
2	Draft S4.55 Issue	28.08.20
3	Draft S4.55 Issue	11.09.20
4	S4.55 Submission	17.09.20

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SCALE 1:500

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Title:
GFA Diagram 01

Project #:	Scale:	Drw:	Ckd:
918	1 : 500 @A3	LR	ML

Drawing #: DA-5000
Rev: 4