INITIA

GEOTECHNICAL SPECIALISTS

PRECINCT PROPERTIES LTD

DOMINION & VALLEY ROAD APARTMENTS

GEOTECHNICAL INTERPRETATIVE REPORT FOR RESOURCE CONSENT

INITIA REF P-002422 REV B

AUGUST 2024

Your Report Summary

This summary outlines the principal geotechnical issues, design considerations and advice for the proposed apartment buildings on the corner of Valley and Dominion Roads and is intended for our client, Precinct Properties. It is important that all designers and constructors refer to relevant sections in the main body of the report for further detail.

Geotechnical Consideration	Summary Advice/Recommendations
Ground Conditions & Geology	The site is underlain by a capping layer of fill comprising pavement (hardfill) and minor cohesive fill overlying natural, Auckland Volcanic Field (AVF) geology. The AVF consists of an upper layer of basalt rubble and heavily fractured basalt rock over intact, slightly weathered basalt rock. The basalt is approximately 20 m thick.
Groundwater	Groundwater at the site is depressed in the permeable basalt rock aquifer, at a depth of approximately 20 m below current ground level. Groundwater is well below the proposed depth range of excavation and construction. A groundwater consent (for take or diversion) is not required for this project.
Site seismicity & liquefaction susceptibility	The site subsoil class should be taken as Class B ("rock site") under NZS1170.5. This is on the basis that there is less than 3 m of soil beneath the building foundations. Any soils below the basalt rock at 20 m depth, are expected to be thin and highly over-consolidated with ECBF rock underlying. Given the presence of basalt rock to depths of 20 m or more, there is no risk of liquefaction at the site and no specific design or detailing is required in relation to liquefaction effects.
Slope stability	The site is located on flat to gently sloping land, dominated by near surface Auckland Volcanic Field Basalt rock geology. Therefore, there is no risk of global instability in the natural ground formations. However, it will be necessary to ensure that all excavations required to construct the Level 0 (partial basement level) are stable or otherwise structurally supported to avoid adverse effects to surrounding land, buildings and infrastructure.
Earthworks	Minor earthworks will be required to construct the proposed lower (Level 0) floor. In general, these earthworks are expected to comprise minor cuts (less than 1 m deep) to form a design subgrade level of approximately RL 51.35 m (500 mm below design FFL of 51.85 m). The excavations are therefore likely to extend mainly through the surface fill and basalt rubble/heavily fractured basalt rock. Locally deeper excavations may be required in the northern extent of the site where natural ground levels are higher. Excavation in basalt rock could be completed either using heavy plant (35t-50t diggers) with rock ripper buckets, or alternatively using pneumatic rock breakers. It is recommended that contingent allowance be made for a limited volume of rock excavation using pneumatic breakers.
Retaining walls	Permanent retaining walls will be required to support cuts of up to 3.5 m in the north-western most corner of the site where the cut depth is deepest. The walls are expected to comprise cast in situ, or reinforced masonry walls constructed on footings. Temporary retention may be locally required in the northern most part of the site, where the basement extends close to the boundary with 184-196 Dominion Road. Temporary retention could comprise fibre reinforced shotcrete facing (for solid/blocky basalt rock), batter slopes of 1.5V : 1H in basalt rubble or short rock bolts (1-2 m long, which do not extend beyond the boundary) where necessary. The existing building retaining walls at 198 and 202 Dominion Road should be left in situ following demolition to provide continued support to the boundary during construction.

Geotechnical Consideration	Summary Advice/Recommendations
Foundations	The building can be supported on shallow foundations comprising pad and strip footings bearing on competent, intact basalt rock. To reduce the requirement for extensive QA during construction, it is recommended that modest bearing pressures be considered for foundation design. Higher bearing capacities could however be adopted provided that foundation locations are proof-drilled to confirm continuity of rock and rock quality during construction. Uplift loads can be resisted using strand or bar anchors embedded into the basalt rock. Anchors are expected to comprise 150 to 200 mm diam, pneumatically drilled boreholes extending to depths of approximately 10-12 m below ground level, with tendons grouted into place.
Subgrade conditions – Floor slab and pavements	The building subgrade conditions are likely to comprise high strength basalt rock or basalt rubble. Such conditions will provide very high subgrade CBR values (> 10%) for design of the floor slab. Notwithstanding the subgrade strengths, it is recommended that a min. 100 mm thickness of subbase be assumed beneath the slab.
Geotechnical risk mitigation	The key geotechnical risks for this project include: - The possible presence of high quality, intact basalt rock in the northern part of the site and the potential requirement for localised excavation using pneumatic rock breakers. - Temporary support or retaining requirements for the excavation on the northern boundary. - The possible presence of poor quality basalt rock or voids/tomos at foundation locations. Risk mitigation options are presented in Section 7.

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1. Introduction

1.1 Purpose

This report has been prepared to provide geotechnical advice and recommendations for the proposed apartment building development at 198-222 Dominion Road and 113-117 Valley Road, Mt Eden, Auckland. The report is intended to be suitable for preliminary design purposes and resource consent application. Additional geotechnical inputs may be required for detailed design and building consent stages of the project.

1.2 Background

Geotechnical investigations were previously completed by others for a former development scheme which was to occupy the same site. The investigations were undertaken in March 2015 and comprised fully cored machine boreholes. This historical information has been used to develop a subsurface model for the site and to provide specific geotechnical design advice and recommendations for the proposed revised development.

1.3 Proposed Development

The proposed development at the site is presented in the latest Aston Mitchell architectural drawings dated 13/06/2024[1]. The development involves demolition of all existing structures across the project site and construction of three apartments buildings (Carrick Building, Valley Rd Building, Dominion Rd Building), each five storeys high, with three storey retail/residential buildings on the Valley Road and Dominion Road frontages. A single level basement car park (Level 0) is proposed beneath most of the site. The buildings will be interconnected at basement level and Level 1 (ground floor level). Below ground, stormwater detention tanks may also be required in two locations.

Vehicle access to the Level 0 car park will be via a ramp off Valley Road at the south eastern corner of the site.

The proposed basement car park will have a finished floor level at RL 51.850 m. Excavation depths to form the basement level (Level 0) and foundation systems for the building structure, are expected to vary between approximately 0.5 m and 1 m typically, with localised excavation of up to 4 m in the north western corner of the site, where natural ground levels are higher. Figure 1 below presents a cross section running west-east through the northern end of the building.

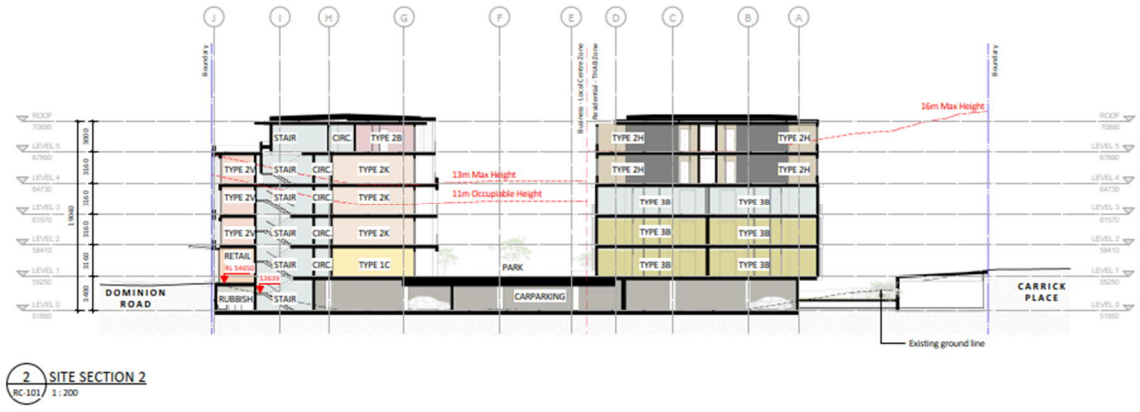

Figure 1: Section through proposed apartment building (west-east) – northern end of site (Aston Mitchell Section 2 (Drawing RC-401, Rev A).

[1] Aston Mitchell drawings entitled "Dominion & Valley Roads Apartments, issued 'For Information' dated 13-06-24, Ref 202328, Valley Road and Dominion Road, Work in Progress.

2. Site Conditions

The site is located on the north-eastern corner of Dominion and Valley Roads, Mt Eden and is comprised of the 113-117 Valley Road, 198-202 Dominion Road, and 214-222 Dominion Road properties, with a combined area of 5,173 m^2. The site is mostly covered by existing buildings, asphalt and occasionally concrete pavements.

The overall site topography is generally flat with localised moderately sloping ground in the north western and north eastern corners. The existing ground surface levels vary between about RL 55.5 m and RL 51.3 m. The two northern most buildings at 198 Dominion Road and 202 Dominion Road both have basement levels fronting the Dominion Road boundary, with finished floor levels of RL 51.7 and RL51.5 m respectively. The basements extend to the western boundary of the site.

Surrounding development includes retail/commercial buildings and Dominion Road on the western boundary, commercial and residential development on the northern boundary and residential buildings on the eastern boundary. Valley Road is on the southern side of the site. The building situated immediately to the north of the site (184-196 Dominion Road) includes a basement with a finished floor level of RL 53.5 m, and an estimated footing level of RL 53.050 m.

Historical aerial photography from 1940 and 1959 indicates the site was previously occupied by residential dwellings. The present structures that occupy the site were constructed between 1959 and 1996.

Two public wastewater lines run through the middle of the site; one in a north-south alignment and the other in an east-west alignment, connecting to the former. According to the Auckland Council GIS, both pipes are 150-225 mm diameter, vitreous clay. An existing soakpit chamber is located near the centre of the site.

A site plan showing the properties and an aerial photograph of the site is presented as Figure 2-1 below.

Figure 2-1: Site location, aerial photo and boundaries (in red), showing basement extents and levels

3. Published Geology

The published geology indicates the site is underlain by basalt lava of the Auckland Volcanic Field consisting of grey to very dark grey, dense, fine grained olivine basalt or basanite lava flows (dark red colour on Figure 3-1). The basalt was sourced from the nearby Mount Eden Volcano, positioned approximately 1km to the east of the site.

East Coast Bays Formation geology (orange on Figure 3-1 below) is mapped to the north and south of the site, indicating this unit is likely to underlie the volcanically derived materials.

The published geology with the location of the site is presented on Figure 3-1 below.

The results of the site specific investigations are consistent with the published geological data.

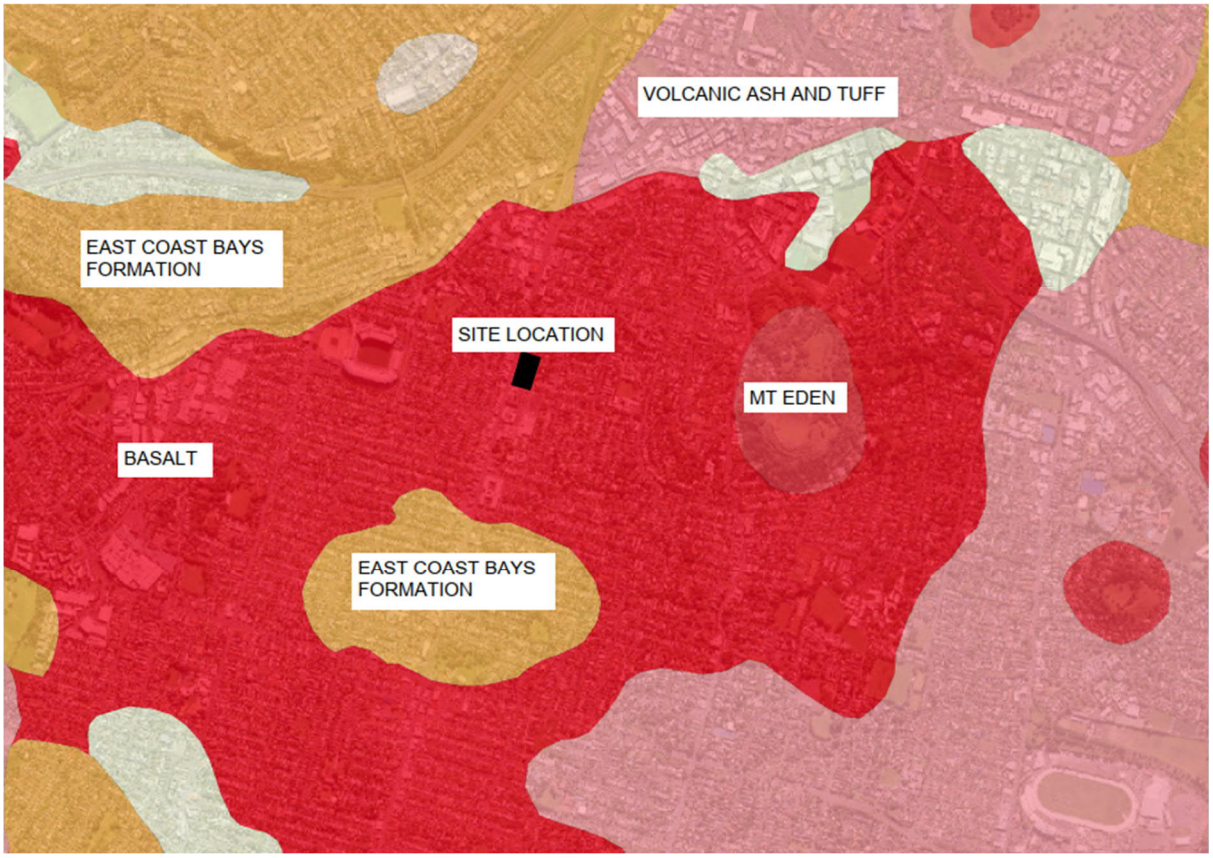

Figure 3-1: Published geology for the Auckland Urban Area with location of the site shown

4. Geotechnical Investigations

4.1 NZGD Investigations

A review of publicly available geotechnical information on the New Zealand Geotechnical Database (NZGD) indicates there is a single borehole (NZGD reference BH_65060) available within proximity to the site (9 Carrick Place, Mt Eden, approximately 60m north). The log was drilled for investigation of groundwater and extends to approximately 20 m depth. A copy of the borehole log is attached in Appendix B.

4.2 Historical Investigations

Historical geotechnical investigations were undertaken by Tonkin & Taylor Ltd (T+T) between the 26th and 30th March 2015 and comprised of 8 No. fully cored machine boreholes. The boreholes were drilled by DCN Drilling Ltd using a GeoProbe tractor. The drilling was terminated after penetrating a minimum of 3m into the solid basalt rock. The maximum depth of the boreholes was 8.5m below ground level.

Groundwater was not encountered during and after completion of the drilling of any of the boreholes. Notwithstanding this, standpipe piezometers were installed in boreholes BH1, BH2, BH3 and BH8. These consisted of slotted PVC pipes extending 3m below ground level with sealed pipe over the top 1.5m of the hole. The boreholes were backfilled with gravel/sand over the screened length and a bentonite cap over the upper 1m to seal the borehole from surface water infiltration.

The historical T+T borehole logs are attached in Appendix B and locations are presented on Figure 2422-G01 in Appendix A.

Table 5-1: Summary of Historical Investigations.

Investigation ID	Investigation Type	Co-ordinates (Mt Eden Circuit)		Ground Surface Elevation (m RL)	Termination Depth (m BGL)
		Easting (mE)	Northing (mN)		
NZGD BH_65060	Cored Machine Hole	1756146 (NZTM)	5917595 (NZTM)	58.7	24.0
T+T BH1	Cored Machine Hole	398935.4	800475.9	55.7	3.5
T+T BH2	Cored Machine Hole	398877.4	800444.3	52.4	6.1
T+T BH3	Cored Machine Hole	398905.2	800416.5	52.5	7.0
T+T BH4	Cored Machine Hole	398916.7	800440.2	52.3	6.5
T+T BH5	Cored Machine Hole	398875.7	800414.3	52.4	5.0
T+T BH6	Cored Machine Hole	398894.1	800455.7	52.4	6.5
T+T BH7	Cored Machine Hole	398892.2	800500.6	52.6	4.5
T+T BH8	Cored Machine Hole	398875.4	800480.1	51.5	8.5

5. Subsurface Conditions

5.1 Stratigraphy

Subsurface conditions presented in this report are based on the results of historical geotechnical investigations completed by others at point locations across the site. Inferences have been made in relation to the nature and continuity of the ground conditions between test locations; however, it is important to note that actual conditions may vary from the assumed model.

The T+T geotechnical investigation results indicate that the site is mostly covered by pavements, over a layer of fill, overlying rubbly and intact basalt rock as summarised below:

Pavement materials

Asphalt or concrete with basecourse comprising an asphalt surface (or occasionally concrete) overlying a 100mm to 300mm thick layer of basecourse. The basecourse generally comprises angular gravel.

Fill

The pavement and basecourse are occasionally underlain by a layer of fill consisting of a dark brown, stiff gravelly silt, with fragments of bricks and red scoria. The fill layer, where encountered, ranges in thickness between 0.8 and 1.8m.

Rubbly or heavily fractured Basalt

A thin layer of rubbly or heavily fractured basalt typically overlies the solid/intact (less fractured), competent Basalt rock. The 'Rubbly/fractured Basalt' comprises highly to moderately weathered, vesicular, dark grey basalt gravels intermixed with a dark reddish brown, non-plastic silt. This layer varies between 0 and 3.5m in thickness.

Competent/Intact basalt rock

Competent (intact) basalt rock is encountered beneath the rubbly basalt and is described as a **slightly weathered, dark grey, highly to slightly vesicular, strong basalt**. The depth to competent basalt rock is irregular, varying from 0.15m to 5.2m below existing ground level. Occasional zones of weaker rock and rock with a closer fracture spacing were logged within the competent basalt rock layer.

A rock surface elevation contour plan has been developed based on the available investigation data and is presented as Figure 2422-G100 in Appendix A. This plan presents the inferred surface elevation of the intact/competent basalt rock; however, it is important to recognise that volcanically derived deposits are extremely variable in composition and surface elevation, therefore it is inevitable that there will be variation from the levels presented.

With reference to available NZGD boreholes, the basalt rock layer is inferred to be approximately 20m thick at the site. The basalt is expected to be underlain by East Coast Bays Formation rock, though this has not been confirmed.

Geological cross sections depicting the layering and types of soil/rock units beneath the site are attached in Appendix A as Figures 2422-G10, G11, G12 and G13.

5.2 Groundwater

Groundwater was not encountered in any of the project specific geotechnical investigations to the full depth of the boreholes (up to 8.5 m below ground level).

Measurements of the installed piezometers were carried out on 21 April 2015, approximately three weeks after drilling. All piezometers were found to be dry. In addition, the two soakage test boreholes, drilled to 23.5m and 25.5m depth, were found to be dry upon completion of the holes.

A soakpit chamber located between BH8 and BH6 was found on the site with standing water at approximately 20.75m below ground level.

Based on the above, the groundwater level is significantly below the proposed basement level and well below the range of any construction works proposed as part of the development.

6. Geotechnical Considerations

6.1 General

The recommendations and opinions in this report are based on data from the site investigation described above. The nature and continuity of subsoil away from the investigation locations are inferred but it must be appreciated that actual conditions could vary from the assumed model.

6.2 Site Subsoil Class and Seismicity

Rock with an unconfined compressive strength of more than 1 MPa is present beneath the building platform at a depth of less than 3 m below platform level. On this basis, the site can be classified as site subsoil Class B in accordance with NZS1170.5

Since the site is underlain by rubbly basalt and solid basalt rock at least 20m thick there is no risk of liquefaction. No specific design or detailing is required to address liquefaction related effects.

Peak ground acceleration (PGA) and associated effective magnitude (M_w) to be adopted for the seismic geotechnical design of temporary and permanent structures are calculated in accordance with the MBIE Geotechnical Guidelines – Module 1. The design seismic parameters are presented in Table below.

Table 6-1: Design Seismic Loading

Design Seismic Loading		
Site Subsoil Class	B	
Importance Level	IL2 (to be confirmed by structural engineer)	
Design life	50 years	
Design Seismic Event	SLS	ULS
Return Period	1/25	1/500
Peak Ground Acceleration PGA	0.05 g	0.19 g
Effective Earthquake Magnitude M_w	5.9	6.5

6.3 Earthworks

6.3.1 Excavations

With reference to the architectural drawings prepared by Aston Mitchell, the proposed development includes a basement car park with a finished floor level at RL 51.850 m. Excavation depths to form the basement level (Level 0) and foundation systems for the building structure, are expected to extend 300-400 mm below the finished floor level, i.e. RL 51.55 to RL 51.35 m to allow for the floor slab and subbase materials

The existing ground level around the perimeter of the basement footprint varies between RL 52.2 m over the southern half of the site to a maximum of RL 55.2 m at the north western corner of the site, where the existing vehicle ramp connects to Dominion Road. The ground surface elevation along the eastern site boundary is typically RL 52.2 to RL 52.5 m.

Therefore, in general, excavation depths are likely to vary between approximately 0.5 m and 1 m, however, localised excavation of up to 4 m depth will be required in the north westerner most corner of the site, where natural ground levels are higher.

Excavations are likely to extend mainly through the surface pavements, fill and rubbly/heavily fractured basalt rock, with a combined layer thickness of about 0.5 to 1.5 m typically. This material can likely be excavated with standard earthmoving plant (e.g. a 20t digger). However, with reference to Figure 2422-G100, some of the excavation is likely to encounter the competent/intact basalt rock (slightly weathered solid basalt rock). Figure 6-1 below presents the area of excavation where intact/competent basalt rock may be encountered above an assumed subgrade level of RL 51.5 m (approx.). The majority of this excavation area is expected to involve cuts of no more than 0.5 m into solid rock, with only very localised areas in the north west corner and north eastern corners of the basement footprint requiring cuts of between 1 and 2.5 m into solid basalt rock. The approximate extents of the inferred solid basalt rock excavation are shown hatched red in Figure 6-1 below. The estimated total volume of solid basalt rock requiring excavation to subgrade level is inferred to be between 750 to 1,250 $m^{3.}$ This volume estimate is based on the available borehole data and could vary by +/- 50%.

Figure 6-1: Estimated area of solid basalt rock excavation required (shaded red) with approximate cut depth contours in solid rock shown in black (0 to -2.5 m). Orange contours are inferred basalt rock surface elevations contours (refer Figure 2422-G100).

Excavation of the competent/intact basalt could either be completed using heavy plant (30-50t diggers) with rock ripper buckets or single tyne ripping. Where possible, the excavation should be completed from an 'open face,' rather than top-down using a heavy excavator; this is the preferred method of excavation. Excavation difficulty will depend on the fracture spacing/frequency within the

rock. Rock which has infrequent rock fractures may require pneumatic breaking to fracture or dislodge the rock before being excavated by heavy plant.

Blasting is not recommended due to the proximity of residential dwellings and commercial buildings. If blasting is used we would expect this to be undertaken using small charges to loosen the rock and blast blankets to dampen noise and flyrock effects, with the blast designed and executed by a specialist sub-contractor.

Chemical expansion cracking could also be considered as an alternative method to remove the solid basalt where it is greater than 1 m thick.

Excavation into basalt using a rock bucket in combination with a ripping tyne can generally be undertaken within the residential noise and vibration limits. However, the use of pneumatic rock breakers or blasting will require assessment and monitoring. Mitigation measures, such as the use of acoustic blankets, can be employed to reduce the disturbance.

Where excavation of solid basalt rock is required within 1m of existing (neighbouring), as is proposed adjacent to the northern boundary with 184-196 Dominion Road, the following methodology is recommended to mitigate noise and vibration effects to neighbouring properties and building occupants:

- Drill 100 mm diameter percussion boreholes at approximately 200-250 mm centres to a depth of approximately 3.5 m along the edge of the proposed cut, preferably offset at least 200 mm inside the boundary. It is anticipated that approximately 30 No. percussion boreholes will be required between Gridlines I and G approximately.
- Excavate the basalt by ripping or heavy excavation from an open face, at least 3-4 m south of the boundary. Where the excavation extends close to the existing building, smaller plant can be used to ‘un-pick’ the rock along the alignment of the percussion boreholes, creating a more even cut surface than would otherwise be possible.

Figure 6-2 below presents the proposed extent of the above recommended works.

It is expected that the excavation works will likely require a Construction Noise and Vibration Management Plan (CNVMP). It is recommended that a specialist be engaged to work with the contractor in developing a construction methodology which mitigates noise/vibration effects to neighbouring properties/residents that a pre-condition survey of surrounding properties is completed prior to excavation.

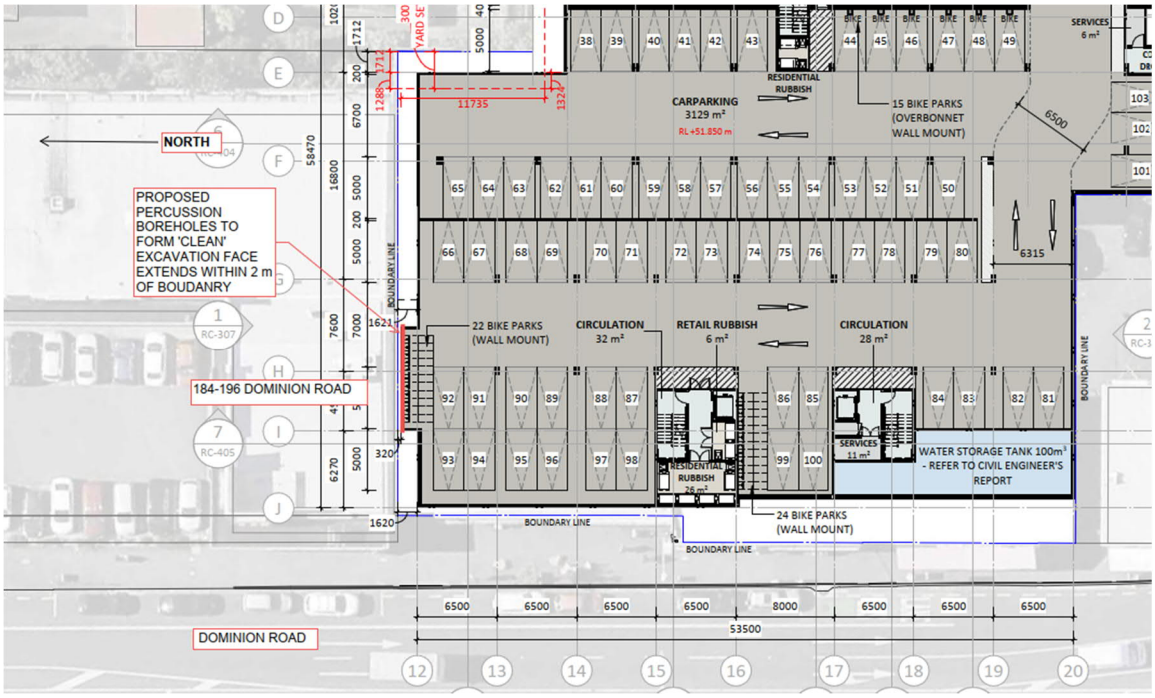

Figure 6-2: Proposed basalt excavation within 1 m of adjacent building.

6.3.2 Filling

Engineered fill may be required locally to backfill over-excavations in the basalt rock, backfill behind retaining walls or to fill where subgrade levels are lower than design levels. All new fill should comprise imported GAP40 or GAP65 hardfill sourced from a quarry. The hardfill should be placed and compacted in layers of maximum 250 mm (loose thickness) to achieve the following compaction criterion:

Clegg Hammer Test

- Minimum Average Clegg Impact Value (CIV): 28 (5 consecutive tests)
- Minimum single Clegg Impact Value (CIV): 25

Testing should be performed on a maximum of 500 mm lift intervals.

6.4 Groundwater Considerations

As outlined above, there is no evidence of any static or perched groundwater present within 20 m of current ground level. Groundwater is therefore unlikely to be encountered during excavation and construction of the Level 0, proposed partial basement level. Furthermore, design for groundwater pressures will not be required.

A groundwater take and diversion consent will not be required under the Auckland Unitary Plan (AUP).

Notwithstanding the above, drainage is recommended behind all permanent retention structures to collect transient seepage flows from rainfall events. The drains should be conveyed to either the public stormwater system (through a gravity feed) or alternatively discharged to ground via a formalised soakpit or soakhole. The surface of any backfill placed behind basement/retaining walls should be sealed with a minimum 0.3m thick cohesive fill cap to restrict infiltration of surface water.

The existing soakpit chamber is located within the footprint of the proposed basement level and will therefore be decommissioned during construction of the basement.

6.5 Retention

6.5.1 General

In general, retaining requirements are expected to be limited to the northern boundary and the northern ends of the western and eastern sides of the basement level where ground levels are locally higher compared with the remainder of the site. Permanent retaining walls, providing long term support to the ground outside the perimeter of the basement, are expected to comprise either reinforced masonry or reinforced concrete walls, integral with the building structure. Temporary retention may also be required where excavations for the basement are required close to the property boundaries.

6.5.2 Temporary Retention

Temporary retention may be required to support excavations during construction. Where excavation depths and offsets from property boundaries permit, cuts can be managed with temporary batter slopes. This is expected to be achievable around most of the basement perimeter and part of the northern boundary, as shown on Figure 6-3 below (green line), where the basement is offset at least 2 m from the boundary. Temporary batter slopes will also be appropriate along the eastern side of the Level 0 footprint as this is offset several metres from the eastern property boundary.

Existing basement retaining walls for the buildings at 198 and 202 Dominion Road can be left in situ following demolition of the buildings (subject to review of stability by the structural engineer) to maintain support to the Dominion Road frontage. New structural walls can be constructed in front these walls to support the new basement. These existing walls are shown in purple on Figure 6-3 below.

Where the Level 0 footprint extends to the site boundaries, the excavation could be cut sub-vertically and self-supporting (no structural retaining required) if ground conditions through the cut comprise solid/intact basalt rock, with favourable rock mass defects. This is expected to be feasible along the northern boundary as solid basalt rock conditions are inferred here and the neighbouring building foundation bears at approximately RL 53.0 m or lower, i.e. cuts in basalt rock would be less than 2m below the neighbouring building foundation level. Fibre reinforced shotcrete could be applied to the face progressively to stabilise the rock (if it is fractured). This would need to be confirmed by a geologist or geotechnical engineer during excavation.

Rock bolting – either in a grid pattern or in 'spot' locations where unfavourable rock mass defects prevail can also be considered. The rock bolting may be required in combination with reinforcing mesh and shotcrete facing, depending on the nature and quality of the rock. Rock bolts would likely need to extend at least 2m beyond the cut face; therefore, permission would need to be granted from neighbouring property owners at 184-196 Dominion Road on the northern boundary. If permission from the neighbouring property owners is unlikely to be granted, and unfavourable ground conditions are present (e.g. soils, or highly fractured/unstable rock), one of the following two options can be considered at the northern boundary:

1. Installation of some form of embedded pile retaining wall which would necessitate drilling of rock using a percussion, down the hole hammer drilling rig. This is likely to be both expensive and potentially disturbing (noise/vibration) to and is therefore not recommended.
2. Sequenced, hit and miss excavation with temporary, internally propped support to the cut face. This option is likely to constrain the construction programme and comes with some risk.

Given the limited cut depth (1 m or less) along the shared boundary with 228 Dominion Road, structural retention is unlikely to be required. Notwithstanding this, a minimum 500 mm offset is recommended between the boundary and the Level 0 wall.

It is recommended that the boundary excavation be sequenced/staged in max 1 m cut depths with face conditions continually assessed by an experienced engineer or geologist to address any local stability issues likely to affect adjacent roads or neighbouring properties.

The excavated face should be scaled of any loose rock and mapped to identify any potential wedges or blocks that require an increased level of support.

Provided that the excavated faces are either formed in stable, solid basalt rock or appropriately stabilised as outlined above, effects of the proposed works on neighbouring properties are expected to be minor to negligible (less than 5-10 mm).

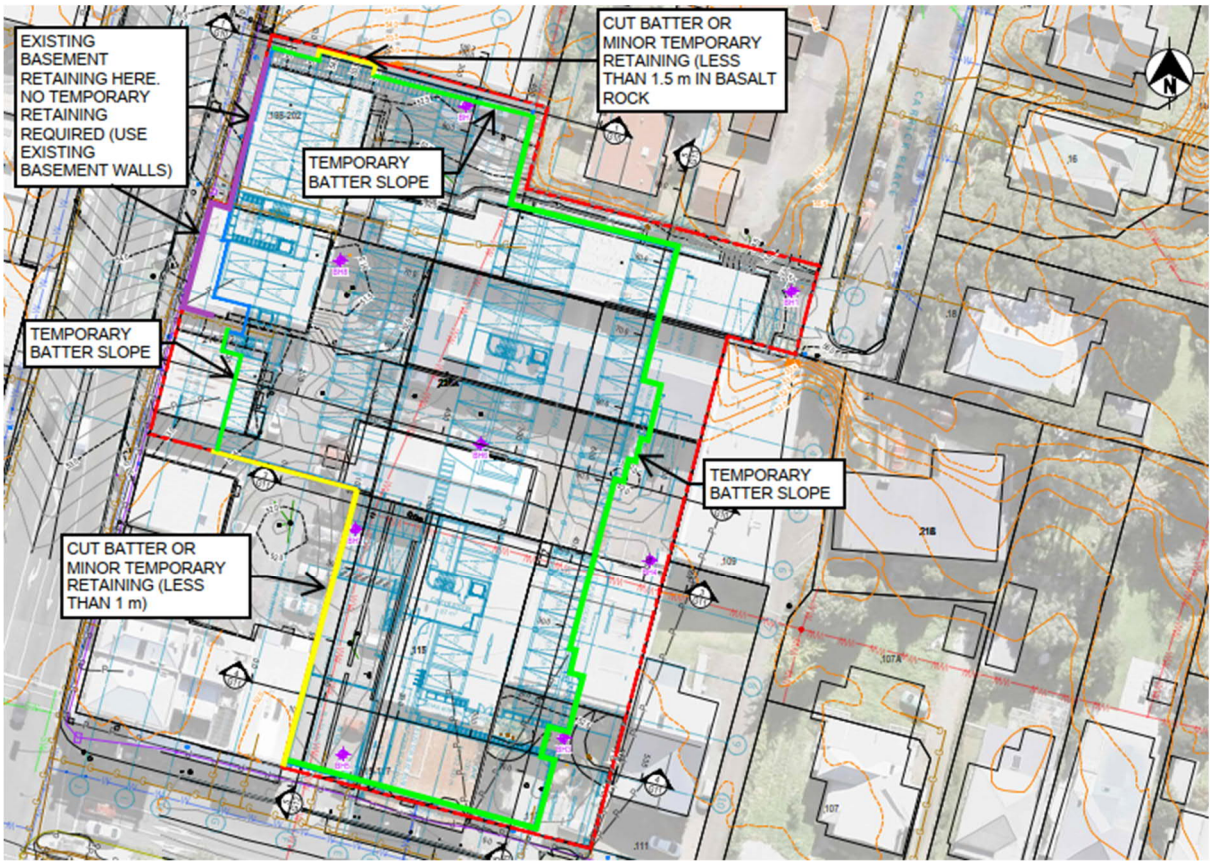

Figure 6-3: Concept retaining types/extents. Green line denotes open batter slopes, yellow line denotes areas that may require structural retention for minor retained heights

6.5.3 Permanent Retention

As outlined above, permanent retention of the Level 0 excavation will be permanently supported by reinforced concrete walls (e.g masonry block, precast panel or cast in-situ) bearing on shallow foundations. Consideration will need to be given to safety in design for construction staging particularly for the installation of any waterproofing membranes on the back of the permanent walls. Personnel should not be permitted to enter the void space between unretained/unsupported cut faces greater than 1 m in height and structural retaining walls.

Retention parameters are presented in Table 6-2 for design of retaining structures. Earth pressure coefficients are based on the flat ground and will need to be modified, as appropriate for retaining structures on sloping ground. Surcharges for building loads, trafficking and construction activities will also need to be considered.

Recommendations for design of retaining wall foundations are provided in Section 6.6 below.

Table 6-2 Geotechnical parameters for retaining structures

Material type	Unit weight, γ (kN/m³)	Effective friction angle, ϕ' (°)	Earth pressure coefficients			Deformation modulus E [kPa]
			K_0	K_a	K_p	
Fill	18	28	0.54	0.38	2.7	5,000
Rubbly basalt	18	35	0.43	0.27	3.7	50,000

The basement walls below solid rock level can be designed to withstand silo "earth" pressures based upon the thickness of granular fill placed between the rock face and the permanent basement walls. A uniform horizontal pressure of 15 kPa horizontal load acting over the full height of the wall should be assumed as a minimum. This assumes a maximum backfill thickness of 1m between the cut face and the retaining wall.

6.6 Foundations

6.6.1 General

As outlined above, the proposed development will involve the construction of three apartments buildings (Carrick Building, Valley Rd Building, Dominion Rd Building), each five storeys high, with three storey retail/residential buildings on the Valley Road and Dominion Road frontages. A single level basement car park (Level 0) is proposed beneath most of the site. The buildings will be interconnected at basement level and Level 1 (ground floor level). Shallow foundations are considered appropriate for support of the proposed buildings, subject to recommendations provided below.

6.6.2 Shallow foundations

The building structures and retaining walls can be designed to bear on shallow pad and strip footings bearing directly onto the solid/intact basalt rock, or alternatively, rubbly/heavily fractured basalt if this material is inspected and approved. Where present, any non-engineered fill should be excavated and replaced with compacted hardfill.

A geotechnical ultimate bearing capacity of 2 MPa is appropriate for design of footings bearing on the rubbly basalt. Increased bearing capacities of up to 10 MPa can be utilised for footings bearing on solid/intact basalt rock; however, this will be subject to confirmation/validation during construction (or once all buildings have been demolished and detailed design is complete) involving proof drilling at every heavily loaded pad and strip footing location. The proof drilling will need to confirm that the thickness of competent basalt below the footing is at least two and a half times the width of the footing or a minimum of 2.5 m, and that there are no voids present within the same depth range.

The available geotechnical investigation data indicates that the basalt rock is of a high quality; however, the potential for cavities to be present in the basalt cannot be discounted. If small voids or cavities are encountered within 2.5m of founding level where a bearing capacity of 10 MPa has been specified, localised infill grouting of the voids will be required.

It is recommended that the lower bound geotechnical ultimate bearing capacity of 2 MPa be adopted for foundation design at this site, to reduce QA requirements during construction and to minimise the risk/extent of foundation ground improvement works that may be required. However, if higher compressive load capacities are required, then higher bearing capacities can be adopted locally subject to additional QA and construction oversight as detailed.

A geotechnical strength reduction factor of 0.5 should be applied to these design pressures for comparison with ULS design.

Basalt flows are by nature highly variable, and this can result in rapid changes in material characteristics and surface elevations over very short distances, both in plan and elevation. It is recommended that provision for some contingency in budget and programme be allowed for addressing issues associated with basalt rock variability at foundation locations.

6.6.3 Design for Uplift

Where shallow foundations are employed for support of the structure, tie-down rock anchors may be required to provide seismic uplift resistance to the building. Rock anchors typically comprise steel tendons (bar/strand) installed in 150 -200 mm diameter drilled and grouted holes into the basalt rock.

The design of the ground anchors to resist uplift should be carried out in accordance with BS8081 '*Code of Practice for Grouted Anchors'* and should include:

(a) Overall rock mass stability where an inverted cone of rock is engaged
(b) Failure in shear along the grout/rock interface
(c) Failure in shear along the anchor tendon/grout interface

A factor of safety for overall rock mass stability of 2.0 is recommended.

To mitigate any risks related to the ground model uncertainties, a conservative approach is to be adopted when estimating design parameters. It is therefore recommended that a geotechnical ultimate bond strength of 1,000 kPa is assumed for design. A higher value could be adopted only if massive/competent basalt can be proven along the full bond length of the anchor. Anchor "cone" pullout would also need to be considered when designing and sizing anchors.

A strength reduction factor of 0.5 should be applied to the geotechnical ultimate bond capacity for ULS/factored load design.

The ground conditions along the anchors' length should be logged and recorded during drilling of the holes to confirm rock thickness and quality to validate the design assumptions.

Grout loss can occur where anchors extend through fractured rock. Grout socks can be used to mitigate the risk of excessive grout loss through fractured basalt rock if such conditions are logged during drilling.

Every tie-down rock anchor should be load tested to 100% of the seismic (ULS) load to verify load capacity and load deformation behaviour prior to being put into service. If required, testing and acceptance criteria to evaluate acceptance or rejection of the rock anchors will be provided at detailed design stage. It is essential that the sizing of the steel elements of the anchors be appropriately detailed to enable the anchor to be tested to the maximum test load.

6.7 Floor slabs and Pavement Design

The subgrade at Level 0 is expected to comprise rubbly/heavily fractured basalt or solid basalt rock, potentially with up to 300 mm of hardfill due to excavation "overbreak". Provided that the subgrade is inspected by a geotechnical engineer and proof rolled under supervision, a CBR of 10% could be easily achieved for the inferred subgrade conditions.

Away from the Level 0 footprint, where the depth of excavation is less, it is recommended that a more conservative subgrade CBR of 5% be adopted for design of the Level 1 slab and any external pavements. This assumes that the car park and accessways are formed on a granular subgrade that has been well prepared by proof rolling (under observation by a geotechnical engineer) and compaction of any new hardfill material to an engineered specification.

Floor slabs should be bear on a minimum of 100mm thick hardfill layer, even if basalt is exposed at the subgrade level, to reduce the risk of floor slab cracking where they span both basalt rock and rubbly/fill subgrades.

6.8 Further Work

The following additional work and geotechnical analysis may be required prior to detailed design and building consent:

Supplementary Investigations

Whilst the existing geotechnical investigation data is appropriate for resource consent stage, additional investigations should be considered to locally assess the ground conditions, where required, to refine retaining designs. This could be completed by test pitting to depths of 2-4 m, at approximately 10 centres along the existing vehicle access ramp at the northern boundary and elsewhere if necessary. This information could be used to determine safe batter slopes and/or confirmation of temporary stabilisation methodologies for excavations extending within 2 m of existing buildings.

Machine boreholes should be considered for confirmation of ground conditions for retaining design. Two further machine drilled boreholes, extending to depths of approximately 6-8m below ground level, are recommended for detailed design.

Geotechnical Assessment/Analysis

The following additional geotechnical design support and/or analysis may be required for detailed design:

- Support with permanent retention design for the basement walls.
- If tie-down rock anchors are required, geotechnical design of the rock anchors may be needed. This work is expected to include review of load and anchors layout, geotechnical analysis and design (i.e. cone pull-out, rock/grout, tendon/grout stability) and testing requirements and acceptance criteria.

Prior to submission for building consents (or at an earlier stage, if appropriate), it is recommended that the civil and structural drawing sets be provided to us for review. This is to confirm that the advice and recommendations outlined in this report and future design reports and specifications have been appropriately interpreted and detailed for consent and construction.

7. Geotechnical Risks and Mitigation

Identified geotechnical risks and mitigation options for design and construction of the Dominion Road apartment development are presented on Table 7-1 below.

Table 7-1: Geotechnical risks and mitigation

Geotechnical consideration	Risk/issue	Mitigation options
Excavation of basalt rock	Basalt rock encountered during excavation is high quality, wide fracture spacing, requiring rock breaking or other removal methods. Results in increased cost, time and possible disturbance to surrounding building occupants.	Allow contingency for pneumatic rock breaking, and plan for mitigating noise disturbance (e.g. shrouds installed around rock breaking plant). Employ heavy excavators (50t or greater) for rock removal.
Excavation and retention close to site boundaries	Excavations of up to 2m depth may be required close to the northern property boundary. Temporary batters or vertical cuts in solid basalt rock are the preferred temporary retention option. However, some form of temporary structural retention may be required if the exposed cut conditions comprise rubbly/heavily fractured rock or rock with unfavourable rock mass defects.	Confirmation of excavation methodology and preferred temporary retention type with the contractor is required prior to commencement. Safe working methodologies should be developed between the contractor and geotechnical engineer.
Safety during excavation and construction	Water proofing membranes may be required for a 'dry-wall' for the Level 0 car park. Manned access between permanent walls and temporary, unsupported batter slopes (not structurally supported) for installation of water-proofing membranes is a safety risk. In addition, it may be necessary to place and compact fill to a high standard behind permanent walls (particularly if ground level terraces are proposed around the Level 0 perimeter). Suitable access will be required for manual compaction plant.	Ensure contractor has suitable methodology for placing and compacting backfill behind the permanent walls. Alternatively, flowable fill could be used, however this is likely to be expensive. Allow for permanent basement walls to be constructed using masonry so that water-proofing membrane can be progressively applied to the back face of the wall from the outside face of the wall.
Foundation excavations and floor slab subgrade preparation	Rubbly rock/scoria/volcanic ash soils encountered at founding or subgrade level where basalt is anticipated and assumed for design purposes (foundation bearing capacity and subgrade strength)	Carry construction contingency for undercutting and replacement at isolated locations in the building platform. Recommended that lower bound geotechnical ultimate bearing capacity is assumed for foundation design.
Drilling of anchors and grouting of anchors	150-200 diam holes drilled though fractured/jointed basalt rock and potential loss of grout.	Allow contingency for casing anchor holes during drilling. Use grout socks for containment of grout.

8. Conclusions

A summary of the conclusions of this report is outlined below:

Ground Conditions

1. The geotechnical investigation results indicate that the site is mostly covered by a surface layer of pavement materials (asphalt or concrete with basecourse), underlain by rubbly basalt and solid basalt rock. Occasional depressions were encountered in the basalt rock surface, and these were filled with a dark brown, gravelly silt.
2. Groundwater is depressed at least 20 m below current site levels and is well below the depth range of any excavation or construction proposed as part of this development.

Seismic Considerations

3. A site subsoil Class B – Rock should be considered for seismic design purposes in accordance with NZS1170.5.
4. There is no risk of liquefaction or liquefaction related effects at this site.

Earthworks

5. Construction of the Level 0 floor will necessitate excavation through fill, rubbly basalt, and competent basalt rock. Excavation of the fill and rubbly/heavily fractured rock can be completed with conventional earthworks plant.
6. Excavation through competent/solid basalt rock may require heavy plant (35t to 50t excavators) with rock ripper buckets or a single tyne pick. Contingent allowance is also recommended for pneumatic rock breaking.
7. The excavation can generally be formed in safe batters cut at approximately 1.5V:1H profiles in rubbly basalt rock. Alternatively, spot rock bolts (2-3 m length) could be used to support cuts. Where the proposed cut extends within 2 m of the northern boundary, these could be formed sub-vertically in solid basalt rock; or alternatively some form of temporary structural retention will be required, e.g. rock bolts, embedded pile walls, or staged, hit and miss excavation/construction with internally propped walls. Embedded pile walls can also be employed but are not recommended, where possible.
8. The existing building basement retaining walls at 198 and 202 Dominion Road should be left in situ during demolition of the buildings. These walls can be used to support the western boundary during excavation and construction of the basement (L0) structure.
9. Permanent retaining walls are expected to comprise reinforced masonry or RC concrete walls, bearing on strip foundations.
10. Consideration should be given to safe construction staging particularly the installation of water proofing membranes on the back face of retaining walls.
11. All filling should be completed using imported, quarry graded GAP40 or GAP65 hardfill compacted to the standards recommended in this report.

Groundwater Considerations

12. The groundwater level is approximately 20 m below the finished level of the building. Therefore, groundwater is not likely to be encountered during excavation and construction. A groundwater consent is not required.

Foundations

13. The buildings can be supported on shallow footings bearing directly on to the basalt rock, or rubbly basalt when inspected and approved. All non-engineered fill below foundations should be excavated and replaced with compacted hardfill.

14. Lower bound geotechnical ultimate bearing capacity values of 2MPa are recommended for foundation design, where possible, though considerably higher values are available if required, subject to QA and validation during construction.
15. Uplift loads should be resisted by grouted anchors embedded into basalt rock.

Floor Slabs and Pavements

16. It is recommended that the building platform (Level 0) subgrade subgrades be over-excavated by 100-200 mm where rock is present at design level. This is to account for the irregularity of the excavated rock surface and to ensure floor slabs bear on a minimum of 100mm thick hardfill layer, even where basalt is exposed at subgrade level.

17. A subgrade CBR of 10% can be assumed for design of the floor slabs bearing on hardfill over rubbly basalt or solid basalt rock subgrades.

18. All surficial material should be stripped and any loose spots and fill encountered during excavation should be removed and replaced with the compacted hardfill. Proof rolling should be undertaken and observed by a geotechnical engineer.

Further Work

19. Further geotechnical inputs and design support are required for building consent/detailed design and prior to commencement of excavations.

Geotechnical Risks and Mitigation

20. A summary of identified geotechnical risks for design and construction of the buildings, and associated mitigation measures, are presented in Table 7.1.

9. Applicability

This report has been prepared for our client, Precinct Properties Ltd, with respect to the brief provided to us. The advice and recommendations presented in this report should not be applied to any other project or used in any other context without prior written approval from Initia Limited.

Report prepared by:

Nick Speight
Senior Geotechnical Engineer

Report reviewed by:

Matthew Wansbone
Senior Geotechnical Engineer

Document Control Record

Report Title		Dominion & Valley Road Apartments Geotechnical Interpretative Report For Resource Consent			
Initia Project Reference		P-002422			
Client		Precinct Properties Ltd			
Revision	Date	Revision Detail	Author	Reviewer	Approved By
-	31-07-2024	First Issue	N. Speight	M. Wansbone	N. Speight
B	30-08-2024	RC Issue	N. Speight	M. Wansbone	N. Speight
Current Revision		B			

Appendix A Figures

LEGEND

HISTORICAL INVESTIGATIONS

MACHINE BOREHOLE (T+T - MAR 2015)

SITE BOUNDARY

PROPOSED BUILDING EXTENT

AC LIDAR 2017 (0.5m INTERVAL)

EXISTING GROUND CONTOUR (0.5m INTERVAL)

EXISTING BASEMENT FL = 51.5mRL

EXISTING BASEMENT FL = 51.7mRL

BH1 BH2 BH3 BH4 BH5 BH6 BH7 BH8

DOMINION ROAD

VALLEY ROAD

CARRICK PLACE

191-217 197 211 217 219-225 229B 14A 16 16A 18 21 21B 109 107A 107 105

NOTES

1. ALL DIMENSIONS ARE IN METRES UNLESS NOTED OTHERWISE.
2. COORDINATE DATUM: MT EDEN 2000
3. AERIAL IMAGE, PROPERTY BOUNDARY, LIDAR CONTOUR AND EXISTING SERVICES TAKEN FROM AUCKLAND COUNCIL DATE 2017.
4. PROPOSED LAYOUT SUPPLIED BY "ASHTONMITCHELL RESIDENTIAL LTD" REFERENCED "RC-101 - PROPOSED PLAN - LEVEL 0.dwg" DATED 2024.08.27
5. EXISTING GROUND CONTOUR SUPPLIED BY "YEOMANS SURVEY SOLUTIONS LTD" REFERENCED "8902-Precinct Properties-Dominion Rd-Site Survey-April 24.pdf" DATED APRIL 2024.
6. ORIGIN OF LEVELS M12 SO 48562 WITH REDUCED LEVEL 58.28 METERS AUCKLAND VERTICAL DATUM 1946.

SCALE A1 1:250
SCALE A3 1:500

0 5 10 15 20 25m

INFORMATION ONLY

Rev	Revision Description	Designed	Drawn	Checked
B	REVISED BASEMENT LAYOUT PLAN (28/08/2024)	NS	JG	NS
A	FIRST ISSUE (15/07/2024)	NS	GG	NS

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PRECINCT PROPERTIES

DOMINION & VALLEY ROAD APARTMENTS

GEOTECHNICAL INVESTIGATION LOCATION PLAN

Initia Project ref: P002422

Figure Number 2422-G01

Revision B

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- AUCKLAND VOLCANIC FIELD
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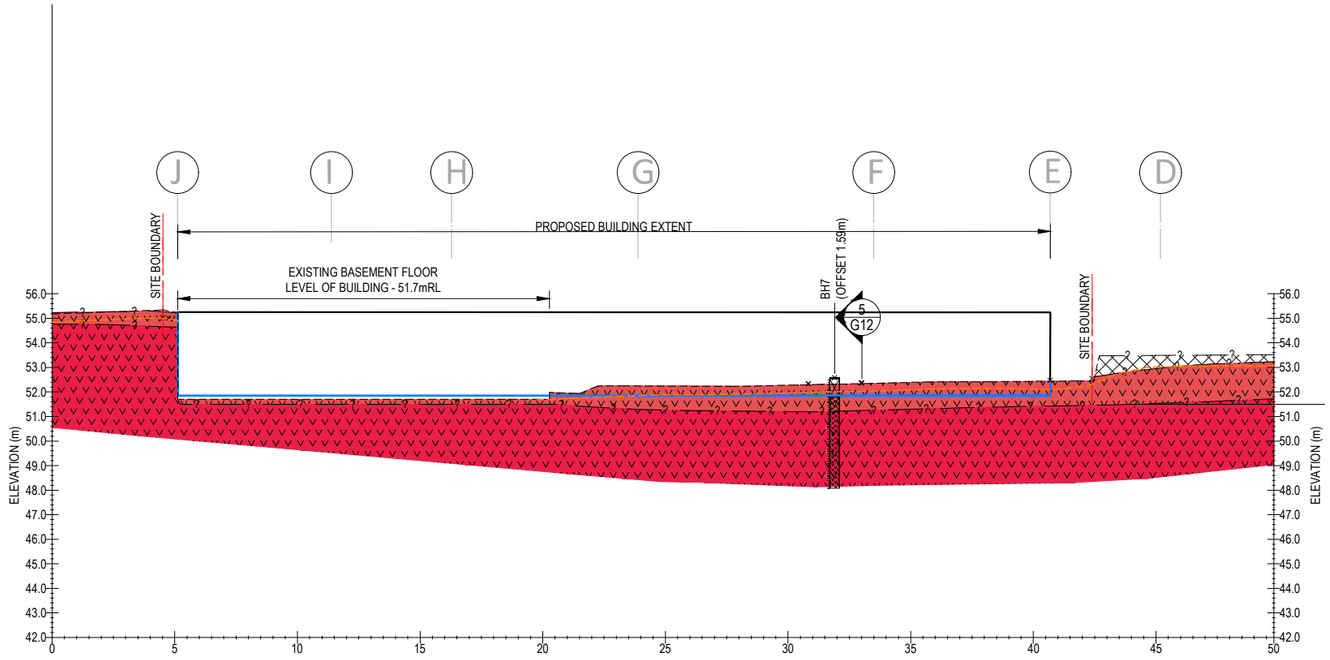
- AUCKLAND VOLCANIC FIELD
  -DARK GREY, SLIGHTLY WEATHERED, BASALT
- AC LIDAR GROUND 2017
- EXISTING GROUND (SURVEY - APR2024)
- PROPOSED FINISHED FLOOR LEVEL 1
- PROPOSED BASEMENT LEVEL
- INFERRED GEOLOGICAL BOUNDARY



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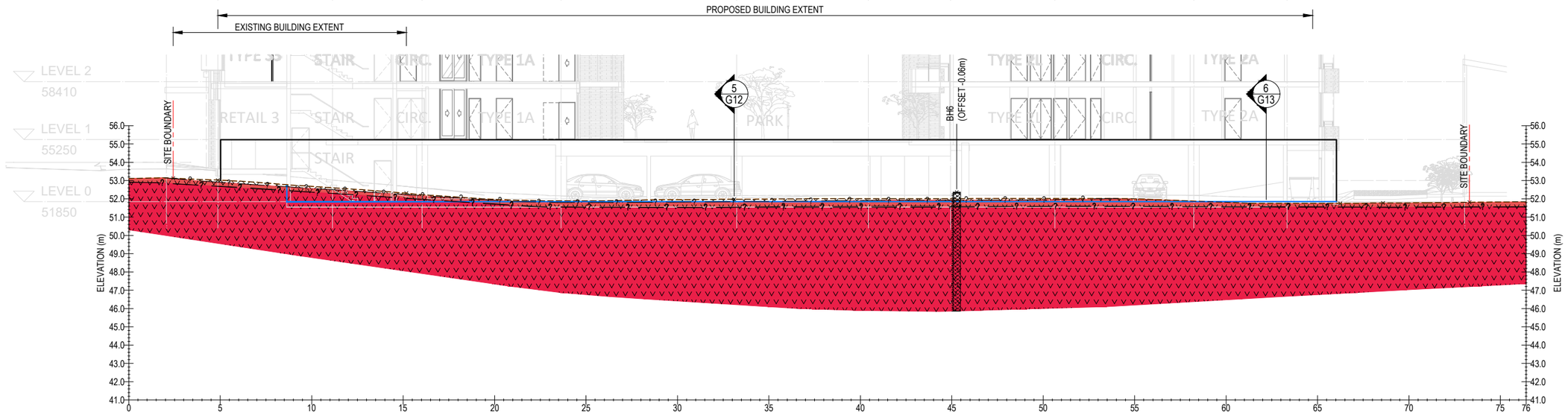

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INFORMATION ONLY

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A	FIRST ISSUE (16/07/2024)	TO	GG	NS

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DOMINION & VALLEY ROAD APARTMENTS

GEOTECHNICAL INVESTIGATION
GEOLOGICAL SECTION 1 AND 2

Initia Project ref: P002422

Figure Number 2422-G10

Revision B

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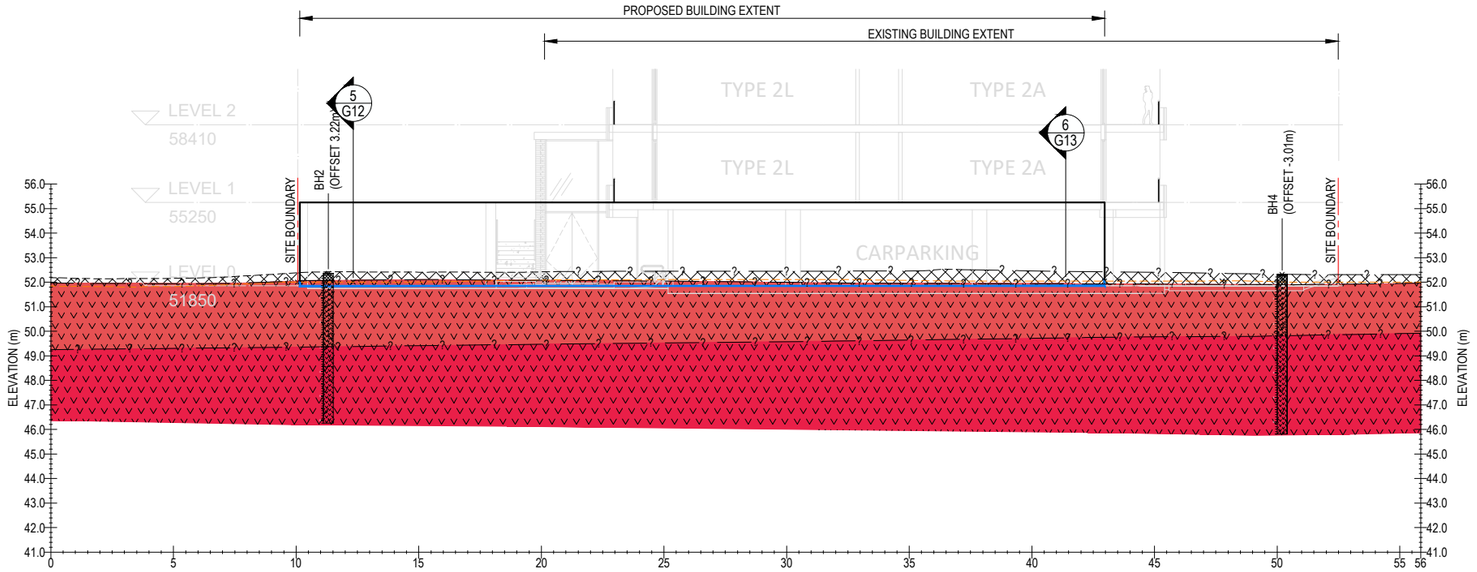
- AUCKLAND VOLCANIC FIELD
  -DARK GREY, SLIGHTLY WEATHERED, BASALT
- AC LIDAR GROUND 2017
- EXISTING GROUND (SURVEY - APR2024)
- PROPOSED FINISHED FLOOR LEVEL 1
- PROPOSED BASEMENT LEVEL
- ——?——?—— INFERRED GEOLOGICAL BOUNDARY



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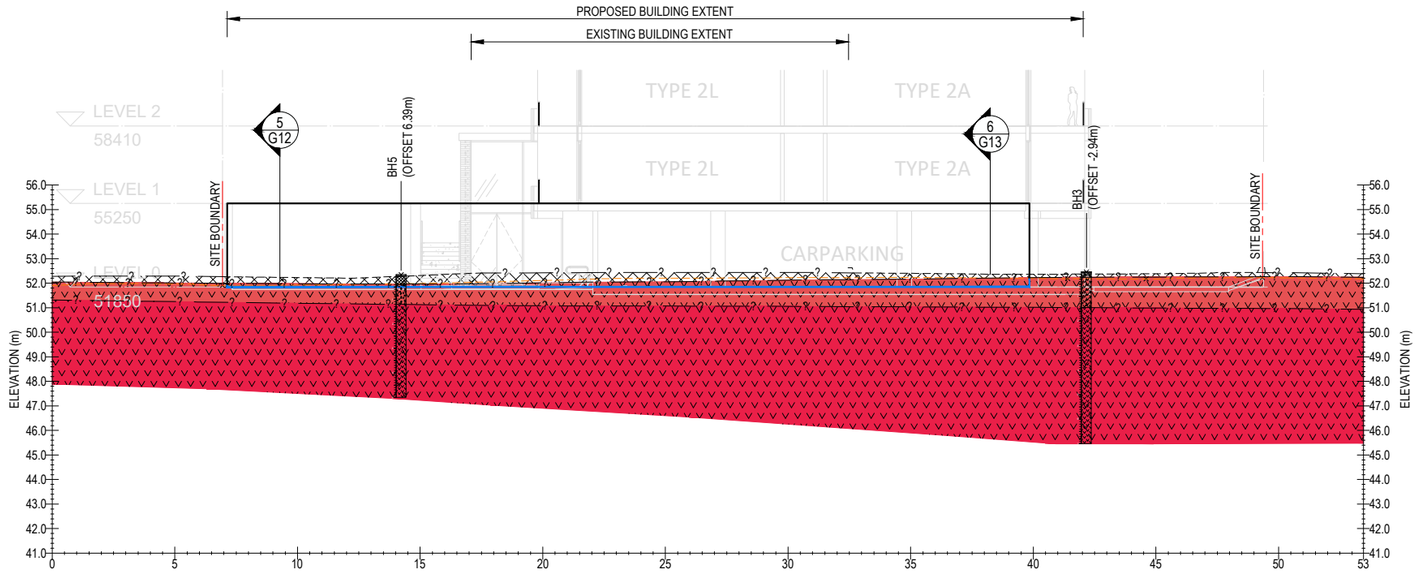

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PRECINCT PROPERTIES

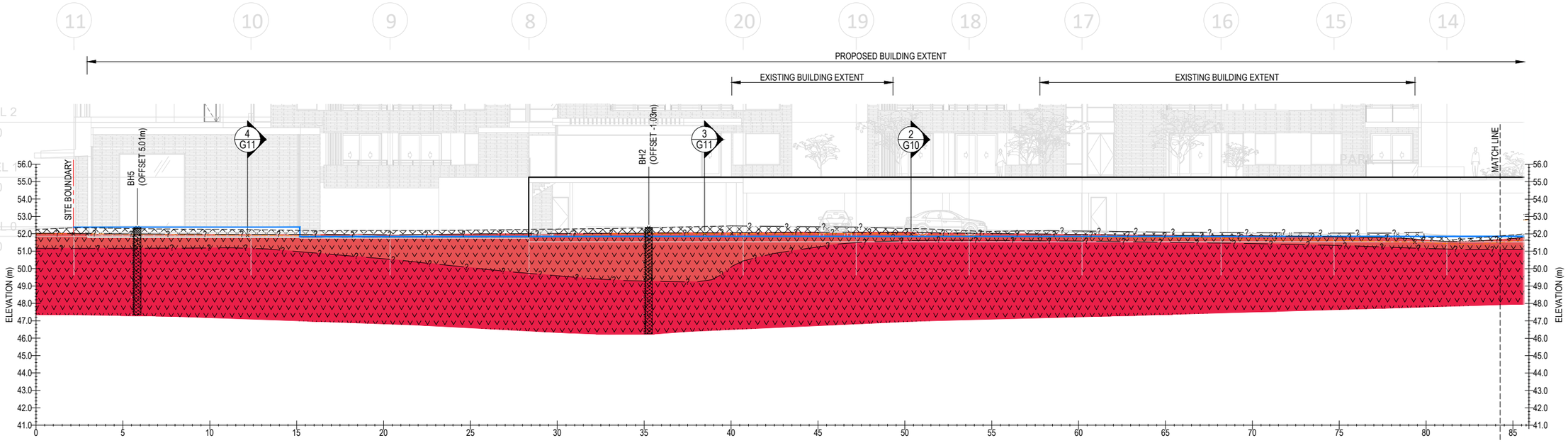
DOMINION & VALLEY ROAD APARTMENTS

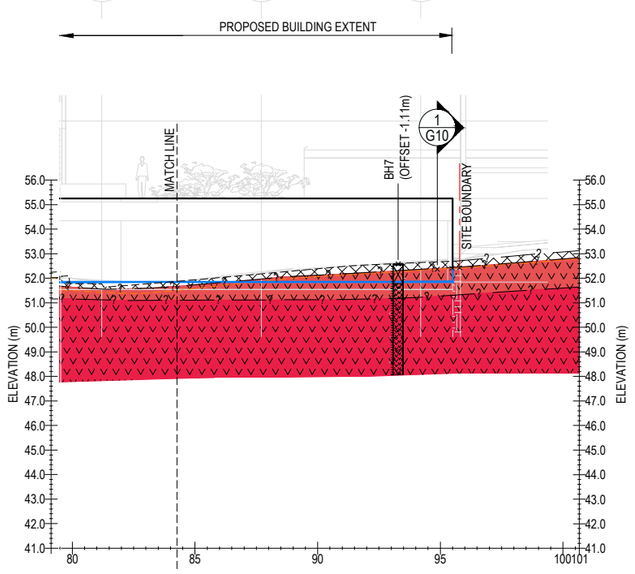
GEOTECHNICAL INVESTIGATION
GEOLOGICAL SECTION 3 AND 4

Initia Project ref: P002422

Figure Number 2422-G11

Revision A





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- AUCKLAND VOLCANIC FIELD -DARK GREY, SLIGHTLY WEATHERED, BASALT
- AC LIDAR GROUND 2017
- EXISTING GROUND (SURVEY - APR2024)
- PROPOSED FINISHED FLOOR LEVEL 1
- PROPOSED BASEMENT LEVEL
- INFERRED GEOLOGICAL BOUNDARY

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DOMINION & VALLEY ROAD APARTMENTS

GEOTECHNICAL INVESTIGATION
GEOLOGICAL SECTION 5

Initia Project ref: P002422
Figure Number 2422-G12
Revision A

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- AUCKLAND VOLCANIC FIELD
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- AUCKLAND VOLCANIC FIELD
  -DARK GREY, SLIGHTLY WEATHERED, BASALT
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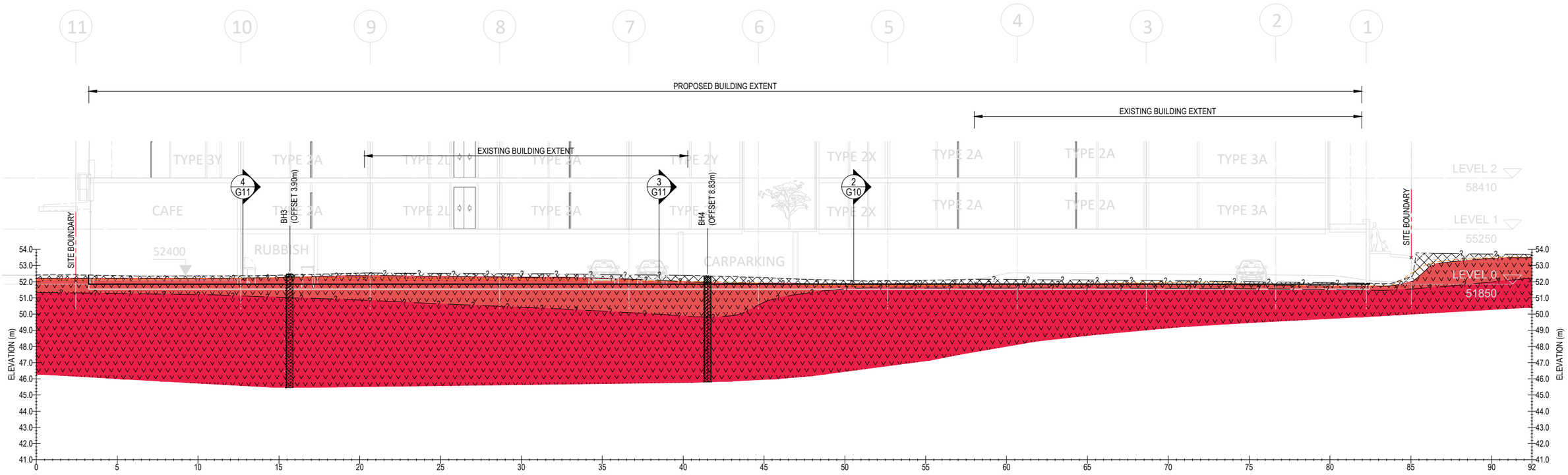
- EXISTING GROUND (SURVEY - APR2024)
- PROPOSED FINISHED FLOOR LEVEL 1
- PROPOSED BASEMENT LEVEL
- INFERRED GEOLOGICAL BOUNDARY



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PRECINCT PROPERTIES

DOMINION & VALLEY ROAD APARTMENTS

GEOTECHNICAL INVESTIGATION
GEOLOGICAL SECTION 6

Initia Project ref: P002422
Figure Number 2422-G13
Revision A

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LEGEND

HISTORICAL INVESTIGATIONS

- MACHINE BOREHOLE (T+T - MAR 2015) — BH1
- SITE BOUNDARY
- PROPOSED BUILDING EXTENT
- 0.5 EXISTING GROUND CONTOUR (0.5m INTERVAL)
- 1.0 ? 1.0 INFERRED ROCK CONTOUR (1m INTERVAL)
- (49.4mRL) ROCK LEVEL

EXISTING BASEMENT FL = 51.5mRL

EXISTING BASEMENT FL = 51.7mRL

BH1 (55.5mRL)
BH2 (48.6mRL)
BH3 (51.0mRL)
BH4 (49.8mRL)
BH5 (51.2mRL)
BH6 (51.6mRL)
BH7 (51.1mRL)
BH8 (49.4mRL)

DOMINION ROAD

VALLEY ROAD

CARRICK PLACE

N

NOTES
1. ALL DIMENSIONS ARE IN METRES UNLESS NOTED OTHERWISE.
2. COORDINATE DATUM: MT EDEN 2000
3. AERIAL IMAGE, PROPERTY BOUNDARY, LIDAR CONTOUR AND EXISTING SERVICES TAKEN FROM AUCKLAND COUNCIL DATE 2017.
4. PROPOSED LAYOUT SUPPLIED BY "ASHTONMITCHELL RESIDENTIAL LTD" REFERENCED "RC-101 - PROPOSED PLAN - LEVEL 0.dwg" DATED 2024.08.27
5. EXISTING GROUND CONTOUR SUPPLIED BY "YEOMANS SURVEY SOLUTIONS LTD" REFERENCED "8902-Precinct Properties-Dominion Rd-Site Survey-April 24.pdf" DATED APRIL 2024.
6. ORIGIN OF LEVELS M12 SO 48562 WITH REDUCED LEVEL 58.28 METERS AUCKLAND VERTICAL DATUM 1946.

SCALE A1 1:250
SCALE A3 1:500
0 5 10 15 20 25m

NOTES:
THE ROCK SURFACE CONTOUR ELEVATIONS PRESENTED ON THIS DRAWING ARE INFERRED BETWEEN BOREHOLES AND CPT'S AT POINT LOCATIONS. SOME LOCALISED VARIABILITY IN ROCK SURFACE LEVELS MAY OCCUR BETWEEN TEST LOCATIONS. CONTINGENT ALLOWANCE SHOULD BE CARRIED FOR DEEPER THAN ANTICIPATED ROCK LEVELS

INFORMATION ONLY

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B	REVISED BASEMENT LAYOUT PLAN (28/08/2024)	NS	JG	NS
A	FIRST ISSUE (19/07/2024)	TO	GG	NS

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PRECINCT PROPERTIES

DOMINION & VALLEY ROAD APARTMENTS

INFERRED INTACT BASALT ROCK SURFACE ELEVATION CONTOURS

Initia Project ref: P002422

Figure Number 2422-G100

Revision B

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Appendix B Historical Borehole Logs

TONKIN & TAYLOR LTD

BORE HOLE LOG

BOREHOLE No: **BH1**

SHEET 1 OF 1

PROJECT: 214 - 222 Dominion Rd	CO-ORDINATES: 800475.91 mN 398935.46 mE	R.L. GROUND: 55.68m	DRILLED BY:
JOB No: 30717		R.L. COLLAR:	LOGGED BY: RBE
LOCATION: Refer to site plan	DIRECTION: 0.00°	DATUM: NZGD2000	CHECKED: RGK
	ANGLE FROM HORIZ.: -90.00°	SURVEY:	START DATE: 30/3/15
			FINISH DATE: 30/3/15
			CONTRACTOR: DCN Drilling Ltd

GEOLOGICAL UNIT	DESCRIPTION OF CORE	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (cm)	RQD %	Description	Water Loss (%)	Water Level	Casing	Installation	Core Box
	SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	UW SW MW HW CW	ES VS S MS W VW EW								50 10 1		Type, Orientation, Spacing, Shape, Persistence, Roughness, Aperture, Weathering, Infill	25 50 75				
	Asphalt																	
	No core recovered																	
Auckland Volcanic Field (*Basalt*)	Slightly weathered, dark grey, highly vesicular, BASALT; strong. Vesicles are irregular in shape, <1 mm to 8 mm, irregular voids <40 mm. Random joint sets are generally rough, Iron stained, with firm red brown clay coating on joint surfaces.			HQ3	88		55	1				61						
	-grades; moderately vesicular			HQ3	100		54	2				94						
	-grades; sligthly vesicular			HQ3	100		53	3				100						Box 1
	-grades; non-vesicular																	Box 2
	END OF BOREHOLE 3.5m (target depth) Piezometer installed: Pipe plain 0-1.5m, slotted 1.5-3.0m Bentonite 0-0.6m, sand 0.6--3.3m Backfill 3.3-6.1m						52 51 50 49 48 47 46	4 5 6 7 8 9 10										

COMMENTS:

T+T DATATEMPLATE.GDT crg

TONKIN & TAYLOR LTD

BORE HOLE LOG

BOREHOLE No: **BH2**

SHEET 1 OF 1

PROJECT: 214 - 222 Dominion Rd
JOB No: 30717
LOCATION: Refer to site plan

CO-ORDINATES: 800444.33 mN 398877.42 mE
DIRECTION: 0.00°
ANGLE FROM HORIZ.: -90.00°

R.L. GROUND: 52.36m
R.L. COLLAR:
DATUM: NZGD2000
SURVEY:

DRILLED BY:
LOGGED BY: RBE
CHECKED: RGK
START DATE: 26/3/15
FINISH DATE: 26/3/15
CONTRACTOR: DCN Drilling Ltd

GEOLOGICAL UNIT	DESCRIPTION OF CORE	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (cm)	RQD %	Description	Water Loss (%)	Water Level	Casing	Installation	Core Box
	Asphalt, angular gravel				100		52	0										
Auckland Volcanic Field (*Basalt*)	Highly to moderately weathered, highly vesicular, dark grey, BASALT, with dark reddish brown silt; moderately strong. [Recovered as: silty GRAVEL, dark grey mottled red brown. Tightly packed. silt is non-plastic.]				17			1										
					40		51											
					33			2										
					20		50											
	-grades; moderately to slightly weathered, slightly vesicular, no voids			HQ3	50			3										
					33		49											
					90			4				67						
	Slightly weathered, dark grey, highly vesicular, BASALT; strong. Vesicles are irregular in shape, <1 mm to 8 mm, irregular voids <40 mm. Random joint sets are generally rough, Iron stained, with firm red brown clay coating on joint surfaces.				100		48					100						Box 1
					100			5				50						
					100		47					100						
					100			6				100						Box 2
	END OF BOREHOLE 6.1m (target lithology) Piezometer installed: Pipe plain 0-1.5m, slotted 1.5-3.0m Bentonite 0-1.0m, sand 1.0--3.3m Backfill 3.3-6.1m						46	7										
							45											
								8										
							44											
								9										
							43											
								10										

COMMENTS:

T+T DATATEMPLATE.GDT crg

Log Scale 1:50

GENERAL LOG 30717.GPJ 8-May-2015

TONKIN & TAYLOR LTD

BORE HOLE LOG

BOREHOLE No: **BH3**

SHEET 1 OF 1

PROJECT: 214 - 222 Dominion Rd
JOB No: 30717
LOCATION: Refer to site plan

CO-ORDINATES: 800416.53 mN 398905.19 mE
DIRECTION: 0.00°
ANGLE FROM HORIZ.: -90.00°

R.L. GROUND: 52.46m
R.L. COLLAR:
DATUM: NZGD2000
SURVEY:

DRILLED BY:
LOGGED BY: RBE
CHECKED: RGK
START DATE: 26/3/15
FINISH DATE: 26/3/15
CONTRACTOR: DCN Drilling Ltd

GEOLOGICAL UNIT	DESCRIPTION OF CORE	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (cm)	RQD %	Description	Water Loss (%)	Water Level	Casing	Installation	Core Box
	Concrete																	
Auckland Volcanic Field (*Basalt*)	Highly to moderately weathered, highly vesicular, dark grey, BASALT, with dark reddish brown silt; very weak. [Recovered as: silty GRAVEL, dark grey mottled red brown. Tightly packed. silt is non-plastic.]	UW SW MW HW CW	EW VS MS W EW	HQ3	30 67 10 100		52	0										
	Slightly weathered, dark grey, moderately vesicular, BASALT; strong. Vesicles are irregular in shape, <1 mm to 8 mm, irregular voids <40 mm. Random joint sets are generally rough, Iron stained, with firm red brown clay coating on joint surfaces.				47		51	1				15						
					50		50	2				33						
					60							0						
	-grades; slightly vesicular				75 100		49	3				0 100						
	-grades; moderately vesicular																	
	-grades; slightly vesicular				100		48	4				100						Box 1
					90		47	5				90						
					100		46	6				100						Box 2
	END OF BOREHOLE 7m (target lithology) Piezometer installed: Pipe plain 0-1.5m, slotted 1.5-3.0m Bentonite 0-1.0m, sand 1.0--3.3m Backfill 3.3-7m						45	7										
							44	8										
							43	9										
								10										

COMMENTS:

T+T DATATEMPLATE.GDT crg

Log Scale 1:50

GENERAL LOG 30717.GPJ 8-May-2015

TONKIN & TAYLOR LTD

BORE HOLE LOG

BOREHOLE No: **BH4**

SHEET 1 OF 1

PROJECT: 214 - 222 Dominion Rd	CO-ORDINATES: 800440.17 mN 398916.72 mE	R.L. GROUND: 52.31m	DRILLED BY:
JOB No: 30717		R.L. COLLAR:	LOGGED BY: RBE
LOCATION: Refer to site plan	DIRECTION: 0.00°	DATUM: NZGD2000	CHECKED: RGK
	ANGLE FROM HORIZ.: -90.00°	SURVEY:	START DATE: 27/3/15
			FINISH DATE: 27/3/15
			CONTRACTOR: DCN Drilling Ltd

GEOLOGICAL UNIT	DESCRIPTION OF CORE	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (cm)	RQD %	Description	Water Loss (%)	Water Level	Casing	Installation	Core Box
	SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	UW SW MW HW CW	ES VS S MS W VW EW								50 10 1		Type, Orientation, Spacing, Shape, Persistence, Roughness, Aperture, Weathering, Infill	25 50 75				
	Asphalt				63													
	Base course																	
Auckland Volcanic Field (*Basalt*)	Moderately weathered, highly vesicular, dark grey, BASALT, with dark reddish brown silt; very weak. [Recovered as: silty GRAVEL, dark grey mottled red brown. Tightly packed. silt is non-plastic.]				83													
					33													
					71													
					60													
					75							30						
					100							0						
	Slightly weathered, dark grey, highly vesicular, BASALT; strong. Vesicles are irregular in shape, <1 mm to 8 mm, irregular voids <40 mm. Random joint sets are generally rough, Iron stained, with firm red brown clay coating on joint surfaces.			HQ3	100							62						
					100							54						Box 1
					97							97						
	-grades; moderately vesicular				100							100						Box 2
	END OF BOREHOLE 6.5m (target depth)																	

COMMENTS:

TONKIN & TAYLOR LTD

BORE HOLE LOG

BOREHOLE No: **BH5**

SHEET 1 OF 1

PROJECT: 214 - 222 Dominion Rd	CO-ORDINATES: 800414.28 mN 398875.73 mE	R.L. GROUND: 52.35m	DRILLED BY:
JOB No: 30717		R.L. COLLAR:	LOGGED BY: RBE
LOCATION: Refer to site plan	DIRECTION: 0.00°	DATUM: NZGD2000	CHECKED: RGK
	ANGLE FROM HORIZ.: -90.00°	SURVEY:	START DATE: 26/3/15
			FINISH DATE: 26/3/15
			CONTRACTOR: DCN Drilling Ltd

GEOLOGICAL UNIT	DESCRIPTION OF CORE	Rock Weathering (UW SW MW HW CW)	Rock Strength (ES VS S MS W VW EW)	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (cm) (50 10 1)	RQD %	Description (Type, Orientation, Spacing, Shape, Persistence, Roughness, Aperture, Weathering, Infill)	Water Loss (%) (25 50 75)	Water Level	Casing	Installation	Core Box
	Asphalt																	
	Base course																	
	Gravelly SILT, dark brown. Stiff, moist, non-plastic. Relic structure. Gravel is angular, fine to medium.			OB	83	UTP in situ (gravel)	52	0										
				OB	100													
				HQ3	20			1										
Auckland Volcanic Field (*Basalt*)	Slightly weathered, dark grey, highly vesicular, BASALT; strong. Vesicles are irregular in shape, <1 mm to 8 mm, irregular voids <40 mm. Random joint sets are generally rough, Iron stained, with firm red brown clay coating on joint surfaces.			HQ3	100		51					100						
	-joints no longer have clay veneers			HQ3	93		50	2				93						Box 1
				HQ3	100		49	3				100						Box 2
	END OF BOREHOLE 5m (target depth)						48	4										
							47	5										
							46	6										
							45	7										
							44	8										
							43	9										
								10										

COMMENTS:

T+T DATATEMPLATE.GDT crg

TONKIN & TAYLOR LTD

BORE HOLE LOG

BOREHOLE No: **BH6**

SHEET 1 OF 1

PROJECT: 214 - 222 Dominion Rd	CO-ORDINATES: 800455.78 mN 398894.11 mE	R.L. GROUND: 52.36m	DRILLED BY:
JOB No: 30717		R.L. COLLAR:	LOGGED BY: RBE
LOCATION: Refer to site plan	DIRECTION: 0.00°	DATUM: NZGD2000	CHECKED: RGK
	ANGLE FROM HORIZ.: -90.00°	SURVEY:	START DATE: 27/3/15
			FINISH DATE: 27/3/15
			CONTRACTOR: DCN Drilling Ltd

GEOLOGICAL UNIT	DESCRIPTION OF CORE	Rock Weathering (UW SW MW HW CW)	Rock Strength (ES VS MS W VW EW)	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (cm) (50 10 1)	RQD %	Description: Type, Orientation, Spacing, Shape, Persistence, Roughness, Aperture, Weathering, Infill	Water Loss (%) (25 50 75)	Water Level	Casing	Installation	Core Box
Auckland Volcanic Field (*Basalt*)	Asphalt Highly to moderately weathered, highly vesicular, dark grey, BASALT, with dark reddish brown silt; moderately strong.			HQ3	70		52	0				29						
	[Recovered as: silty GRAVEL, dark grey mottled red brown. Tightly packed. silt is non-plastic.] Slightly weathered, dark grey, highly vesicular, BASALT; strong. Vesicles are irregular in shape, <1 mm to 8 mm, irregular voids <40 mm. Random joint sets are generally rough, Iron stained, with firm red brown clay coating on joint surfaces.			HQ3	100		51	1				52						
				HQ3	91		50	2				40						
				HQ3	90		49	3				52						Box 1
	-grades; slightly vesicular			HQ3	100		48	4				100						
				HQ3	100		47	5				100						Box 2
	END OF BOREHOLE 6.5m (target depth)						46	6										
							45	7										
							44	8										
							43	9										
								10										

COMMENTS:

T+T DATATEMPLATE.GDT crg

TONKIN & TAYLOR LTD

BORE HOLE LOG

BOREHOLE No: **BH7**

SHEET 1 OF 1

PROJECT: 214 - 222 Dominion Rd	CO-ORDINATES: 800500.6 mN 398892.17 mE	R.L. GROUND: 52.58m	DRILLED BY:
JOB No: 30717		R.L. COLLAR:	LOGGED BY: RBE
LOCATION: Refer to site plan	DIRECTION: 0.00°	DATUM: NZGD2000	CHECKED: RGK
	ANGLE FROM HORIZ.: -90.00°	SURVEY:	START DATE: 30/3/15
			FINISH DATE: 30/3/15
			CONTRACTOR: DCN Drilling Ltd

GEOLOGICAL UNIT	DESCRIPTION OF CORE	Rock Weathering (UW SW MW HW CW)	Rock Strength (ES VS S MS W VW EW)	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (cm) (50 10 1)	RQD %	Description (Type, Orientation, Spacing, Shape, Persistence, Roughness, Aperture, Weathering, Infill)	Water Loss (%) (25 50 75)	Water Level	Casing	Installation	Core Box
	Asphalt				75		52											
	No core recovered				0													
Auckland Volcanic Field (*Basalt*)	Highly to moderately weathered, highly vesicular, dark grey, BASALT, with dark reddish brown silt; moderately strong.				75			1										
	[Recovered as: silty GRAVEL, dark grey mottled red brown. Tightly packed. silt is non-plastic.]				75		51											
	Slightly weathered, dark grey, sligtly vesicular, BASALT; strong. Vesicles are irregular in shape, <1 mm to 4 mm. Random joint sets are generally rough, Iron stained, with firm red brown clay coating on joint surfaces.			HQ3	100			2										
	-grades; highly vesicular; Vesicles are irregular in shape, <1 mm to 8 mm, irregular voids <40 mm				90		50											
	-grades; slightly vesicular as above							3										
	-grades; highly vesicular; Vesicles are irregular in shape, <1 mm to 8 mm, irregular voids <40 mm						49											
	-grades; slightly vesicular, vesicles are large and regular shaped, 10 mm				100			4										Box 1
																		Box 2
	END OF BOREHOLE 4.5m (target depth)						48	5										
							47	6										
							46	7										
							45	8										
							44	9										
							43	10										

COMMENTS:

T+T DATATEMPLATE.GDT crg

TONKIN & TAYLOR LTD

BORE HOLE LOG

BOREHOLE No: **BH8**

SHEET 1 OF 1

PROJECT: 214 - 222 Dominion Rd	CO-ORDINATES: 800480.08 mN 398875.46 mE	R.L. GROUND: 51.45m	DRILLED BY:
JOB No: 30717		R.L. COLLAR:	LOGGED BY: RBE
LOCATION: Refer to site plan	DIRECTION: 0.00°	DATUM: NZGD2000	CHECKED: RGK
	ANGLE FROM HORIZ.: -90.00°	SURVEY:	START DATE: 27/3/15
			FINISH DATE: 30/3/15
			CONTRACTOR: DCN Drilling Ltd

GEOLOGICAL UNIT	DESCRIPTION OF CORE	Rock Weathering (UW SW MW HW CW)	Rock Strength (ES VS S MS W VW EW)	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (cm) (50 10 1)	RQD %	Description: Type, Orientation, Spacing, Shape, Persistence, Roughness, Aperture, Weathering, Infill	Water Loss (%) (25 50 75)	Water Level	Casing	Installation	Core Box
Fill (*Undifferentiated*)	Asphalt FILL, minimal recovery: 0.3-0.5m washings of red scoria, then complete circulation loss 0.8-1.5m soft, easy drilling, no recovery 1.5-1.7m harder (brick recovered) 1.7-2.1m soft, easy drilling, no recovery			HQ3	20		51											
	No core recovered			HQ3	25		50	1										
	-brick recovered No core recovered																	
Auckland Volcanic Field (*Basalt*)	Highly to moderately weathered, highly vesicular, dark grey, BASALT, with dark reddish brown silt; moderately strong. [Recovered as: silty GRAVEL, dark grey mottled red brown. Tightly packed. silt is non-plastic.]			HQ3	44		49	2				0						
				HQ3	33		48	3				0						
				HQ3	29		47	4				7						
	Slightly weathered, dark grey, highly vesicular, BASALT; strong. Vesicles are irregular in shape, <1 mm to 8 mm, irregular voids <40 mm. Random joint sets are generally rough, Iron stained, with firm red brown clay coating on joint surfaces.			HQ3	71		46	5				54						
				HQ3	92		45	6				72						Box 1
				HQ3	93		44	7				60						
							43	8										Box 2
	END OF BOREHOLE 8.5m (target depth) Piezometer installed: Pipe plain 0-1.5m, slotted 1.5-3.0m Bentonite 0-1.0m, sand 1.0--3.3m Backfill 3.3-8.5m						42	9										
								10										

COMMENTS:

T+T DATATEMPLATE.GDT crg

JOB NO: AJ88403
PDP ID No: 58

LOG OF CORED BOREHOLE
Global Aquifer Study

HOLE NO. **GWSP2-7**

CLIENT: Metrowater

LOCATION: 9 Carrick Place, Mt Eden

START DATE: 16/05/03
END DATE: 16/05/03

COORDINATES: 2666575.65E
6479294.68N

TOTAL DEPTH: 25.0m

LOGGED BY: Driller

SHEET 1 OF 3

GROUND LEVEL:58.72m

TOP OF CASING:--

INTERPRE-TATION	DESCRIPTION OF SOIL / ROCK (based on cuttings etc.)	STRENGTH (VS S MS W)	FRACTURE SPACING (cm) (50 10 5 1)	GRAPHIC LOG	DEPTH (m)	RL (m)	CORE LOSS (%) (20 40 60 80)	DRILLING DEPTH / DATE	WATER LEVEL GAIN / LOSS	CORE BOX No.	INSTALLATION
	BASALT - fractured.				0.0	58					
					1.0	57					
					2.0	56					
					3.0	55					
					4.0	54					
					5.0	53					
					6.0	52					
	BASALT - unfractured.				7.0	51					
					8.0	50					
					9.0	49					

Drilled By: Niederer
Diameter: 76mm
Method: Percussion
Datum: L&S 1946
Notes: --

KEY
- Groundwater Level
- Water Gain
- Water Loss

STRENGTH
ES = extremely strong
VS = very strong
S = strong
MS = moderately strong
W = weak
VW = very weak

pdp solutions for your environment
PATTLE DELAMORE PARTNERS LTD

Logs based on New Zealand Geomechanics Society Field Description Guidelines (1988)

JOB NO: AJ88403
PDP ID No: 58

LOG OF CORED BOREHOLE
Global Aquifer Study

HOLE NO. **GWSP2-7**

CLIENT: Metrowater

LOCATION: 9 Carrick Place, Mt Eden

START DATE: 16/05/03
END DATE: 16/05/03

COORDINATES: 2666575.65E
6479294.68N

TOTAL DEPTH: 25.0m

LOGGED BY: Driller

SHEET 2 OF 3

GROUND LEVEL:58.72m

TOP OF CASING:--

INTERPRE-TATION	DESCRIPTION OF SOIL / ROCK (based on cuttings etc.)	STRENGTH (VS S MS W)	FRACTURE SPACING (cm) (50 10 5 1)	GRAPHIC LOG	DEPTH (m)	RL (m)	CORE LOSS (%) (20 40 60 80)	DRILLING DEPTH / DATE	WATER LEVEL GAIN / LOSS	CORE BOX No.	INSTALLATION
AUCKLAND VOLCANIC GROUP	BASALT - fractured.				10.0	48					
					11.0	47					
					12.0	46					
					13.0	45					
					14.0	44					
					15.0	43					
					16.0	42					
					17.0	41					
					18.0	40					
	BASALT - vesicular.				19.0	39					

Drilled By: Niederer
Diameter: 76mm
Method: Percussion
Datum: L&S 1946
Notes: --

KEY
- Groundwater Level
- Water Gain
- Water Loss

STRENGTH
ES = extremely strong
VS = very strong
S = strong
MS = moderately strong
W = weak
VW = very weak

pdp solutions for your environment
PATTLE DELAMORE PARTNERS LTD

Logs based on New Zealand Geomechanics Society Field Description Guidelines (1988)

JOB NO: AJ88403
PDP ID No: 58

LOG OF CORED BOREHOLE
Global Aquifer Study

HOLE NO. **GWSP2-7**

CLIENT: Metrowater

LOCATION: 9 Carrick Place, Mt Eden

START DATE: 16/05/03
END DATE: 16/05/03

COORDINATES: 2666575.65E
6479294.68N

TOTAL DEPTH: 25.0m

LOGGED BY: Driller

SHEET 3 OF 3

GROUND LEVEL:58.72m

TOP OF CASING:--

INTERPRETATION	DESCRIPTION OF SOIL / ROCK (based on cuttings etc.)	STRENGTH (VS S MS W)	FRACTURE SPACING (cm) (50 10 5 1)	GRAPHIC LOG	DEPTH (m)	RL (m)	CORE LOSS (%) (20 40 60 80)	DRILLING DEPTH / DATE	WATER LEVEL GAIN / LOSS	CORE BOX No.	INSTALLATION
UNCERTAIN	SEDIMENTS.				20.0	38					
					21.0						
						37					
					22.0						
						36					
					23.0						
						35					
					24.0						
						34					
					25.0						

END OF BOREHOLE AT 25.0m

Drilled By: Niederer
Diameter: 76mm
Method: Percussion
Datum: L&S 1946
Notes: --

KEY
- Groundwater Level
- Water Gain
- Water Loss

STRENGTH
- ES = extremely strong
- VS = very strong
- S = strong
- MS = moderately strong
- W = weak
- VW = very weak

PATTLE DELAMORE PARTNERS LTD

Logs based on New Zealand Geomechanics Society Field Description Guidelines (1988)