REPORT

Tonkin+Taylor

Balaclava Retail Renewal Precinct

Geotechnical Investigation

Prepared for
Port Phillip City Council
Prepared by
Tonkin & Taylor Pty Ltd
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1 Introduction

Tonkin & Taylor Pty Ltd (T+T) has been engaged by Port Phillip City Council (PPCC) to undertake a geotechnical investigation for the proposed mixed use development on Alfred Street, Balaclava, VIC 3183. The site is currently being used as carparks at the front of Coles and Woolworths.

The purpose of this geotechnical investigation is to support the development of preliminary architectural schematic design and feasibility, and to provide preliminary design guidance on geotechnical matters including:

- Evaluation of ground and groundwater conditions encountered;
- An assessment of site classification in accordance with AS2870 for guidance purposes;
- An assessment of the earthquake risk in accordance with AS1170;
- An assessment and discussion of geotechnical foundation design parameters for spread and piled foundations;
- An assessment of geotechnical parameters for the preliminary design of retaining walls;
- A discussion on ease of excavation and potential groundwater control requirements;
- A discussion on potential impacts on adjacent structures by the proposed development.

The scope of work was undertaken in accordance with our proposal dated 5 November 2018[1] and was subsequently extended via a variation order on 19 November 2018[2] to include development of the two standpipes installed during the geotechnical investigation for environmental sampling in future.

This report presents the findings of the geotechnical investigation.

2 Proposed Structure and Scope of Investigation

It is understood that the project consists of a multi-level mixed use development for the length of Alfred Street and along Camden Street from opposite Alfred Street to Carlisle Street. The proposed development likely to have two to three level basements. The buildings will be up to 5 storeys and cover an area of between three to four hectares.

3 Regional Geology

The Geological Survey of Victoria, Melbourne map sheet (1:63,360), indicates that the near surface geology comprises Quaternary age alluvial deposits comprising clay, silt and sand.

The investigation found Tertiary period Brighton Group, typically comprising sands and clay soils, to be underlying alluvial deposits which in turn underlies by Silurian age Melbourne Formation.

4 Fieldwork

4.1 General

Fieldwork was carried out between 13 November 2018 and 21 November 2018. The fieldwork comprised:

- Five (5) boreholes to 20m depth;

[1] Tonkin & Taylor Pty Ltd (5 November 2018). Proposed Mixed use Development, Alfred Street, Balaclava – Geotechnical Investigation. Ref: 1008831.P1

[2] Tonkin & Taylor Pty Ltd (19 November 2018). Proposed Mixed use Development, Alfred Street, Balaclava – Geotechnical Investigation. Ref: 1008831.P2

- Standard penetration tests (SPT) at nominal 1.5m intervals;
- Development of the installed standpipes for environmental sampling by groundwater purging.

All fieldwork was carried out under the direction and full time presence of a T+T geotechnical engineer who was responsible for directing the extent of sampling and testing, performing the standard penetration test, logging the conditions encountered and directing the groundwater purging.

The borehole locations are shown on **Figure A1** in Appendix A. The coordinates of the boreholes were recorded using a GPS enabled mobile phone with some minor adjustments using the existing carpark layout plan shown on Google Earth. The accuracy of the locations is about ±3m.

4.2 Boreholes

A total of five boreholes numbered BH01 to BH05 were drilled to 20m below ground level to provide information on the subsurface conditions. Boreholes BH01 and BH02 were drilled within the car park site at the front of Woolworths while boreholes BH03 to BH05 at the car park site at the front of Coles.

All the boreholes were drilled within the parking lots except for borehole BH03 which was advanced through a concrete driveway. The borehole locations were confirmed on the site with PPCC and the nominated locations were cleared of any underground utilities prior to the fieldwork.

The boreholes were drilled using a track mounted Comacchio GEO 305 supplied and operated by Chadwick Geotechnics Pty Ltd. The drilling was performed using solid flight auger for the upper section to 3m depth followed by wash-boring to the termination depth.

Disturbed soil samples, Standard Penetration Test (SPT) samples and thin walled push tube (U_{63}) samples were collected during drilling, and were used to assist with logging and to provide soil samples for laboratory testing.

On completion, boreholes BH2 to BH04 were backfilled with drill cuttings and tamped in place to approximately 100mm below the surface. The surface was reinstated using cold-mix asphalt or pre-mix concrete where pavements were penetrated. Standpipes were installed in BH01 and BH05 to enable the measurement of groundwater levels. The standpipe boreholes were finished at the surface with lockable gatic covers. All the drilled locations were reinstated to flush with the surrounding ground surface.

The engineering field logs are presented in Appendix B. Material classification and logging techniques were carried out in accordance with the attached explanatory notes and wherever possible, material classifications have been correlated to the results of laboratory testing. However, it should be noted that field classifications of materials are a subjective opinion based on the personal experience of the engineer and may be open to alternative interpretations.

4.3 In-situ testing

SPTs were carried out at nominal 1.5m depth intervals as the drilling progressed. The test results are included on the relevant engineering logs in Appendix B.

In order to develop the standpipes that would be suitable for environmental sampling, groundwater purging was performed on the two installed standpipes. In total, 200 litres of water was purged from each standpipe.

5 Laboratory testing

Laboratory testing was undertaken by a NATA approved Chadwick Geotechnics laboratory. The testing comprised:

- One Atterberg limits tests
- Two sieve analyses; and
- Five moisture content tests

A summary of the test results are presented in Table 5.1. The laboratory test reports are included in Appendix C.

Table 5.1: Summary of laboratory test results

Borehole Ref.	Material	Layer Depth (m)	Moisture content (%)	Liquid Limit (%)	Plasticity Index (%)	Linear Shrinkage (%)	(%) Passing		
							0.075mm	0.425mm	2.36mm
BH01	CLAY	3.0 – 3.3	26.7						
BH01	Silty SAND/Sandy SILT	10.5 – 11.0					54	96	98
BH02	Sandy CLAY	1.5 – 1.8	17.5						
BH02	Sandy CLAY	2.5 – 3.0		40	29	11			
BH03	Sandy CLAY	4.0 – 4.5	18.6						
BH05	Sandy CLAY	1.0 – 1.5	12.5						

6 Discussion and Recommendations

6.1 Surface conditions

The site is located within two open car parking areas. The existing surface is covered by asphalt pavement and concrete driveways. The asphalt and concrete pavements within the site appears to be in a relatively good condition. The ground surface is generally flat.

6.2 Subsurface conditions

The following summary of the subsurface stratigraphy is inferred from the available site investigation data, and as such only represents the conditions at the locations of the boreholes. Variation to the ground conditions are possible and potential vertical and lateral variabilities in the extent of the subsoil conditions must be recognised.

The boreholes indicate subsurface profile comprising the following four principal units:

- Unit 1: Fill (road pavement)
- Unit 2: Alluvium/Brighton Group
- Unit 3: Brighton Group
- Unit 4: Extremely weathered to highly weathered Siltstone (Melbourne Formation)

Unit 1 Fill

This unit was encountered below the asphalt pavement in Boreholes BH01, BH02, BH04 and BH05, and below concrete driveway in borehole BH03. The fill was variably described as sandy Gravel and Sand with gravel and it extends to a maximum depth of 0.6m below ground level.

Unit 2 Alluvium/Brighton Group

The fill was underlain by CLAY with sand, clayey SAND, sandy CLAY to depths between 3.5m and 4.5m below ground level. The material was described as medium plasticity, pale grey brown, mottled yellow brown, find to medium grained, trace of fine to medium grained gravel, stiff to very stiff, and loose to medium dense. Atterberg Limits tests within the unit recorded Liquid Limits of 40% with corresponding Plastic Limits of 11%, resulting in Plasticity Index values between 29%. These values are indicative of a medium plasticity clay.

The unit is inferred to represent alluvial deposits or Brighton Group as there is no clear signs or characteristics of the recovered soil samples to distinguish the material between these two geological units.

Unit 3 Brighton Group

Brighton Group predominantly comprising clayey SAND, silty SAND and sandy SILT was encountered below Unit 2 and extended to depths between 15m and 16.3m. The soil was described as fine to coarse grained, yellow-brown, pale grey, brown, orange-brown, trace of fine to medium grained gravel, and loose to very dense. Sandy CLAY of low to medium plasticity and stiff to very stiff was encountered in borehole BH02 between 6.5m and 8.5m depth. Interbedded cemented band was encountered within the upper horizon in boreholes BH01 and BH02.

The upper horizon of this unit from 4m to 9m below ground surface, about 3.5m to 4.5m thick, was predominantly medium dense to dense, grading low to medium dense below this zone and towards the bottom of the unit.

Unit 4 Melbourne Formation

SILTSTONE decomposed into Clayey SILT was encountered below the Brighton Group at depth between 15m to 16.3m below ground level. Very low to low strength rock fabric, Point Load Index $I_{s(50)}$ is expected to be not greater than 0.3MPa by tactile assessment, is traceable in the matrix. The material was described as medium plasticity, pale grey mottled yellow-brown, with a hard consistency.

The material is inferred as extremely weathered (XW) to highly weathered (HW) SILTSTONE of Melbourne Formation and was not penetrated at the end of borehole at 20m below ground level.

A geological section (Section A-A) across the boreholes is shown in **Figure A2**.

6.3 Groundwater

To assist with the groundwater monitoring, the current geotechnical investigation has included installation of two standpipes which were installed in Boreholes BH01 and BH05. Standpipe in Borehole BH01 was installed to 16m depth with screening up to 10m depth and sand fill to 5m depth. Borehole BH02 standpipe was installed to 15m depth, screened to 2m depth and sand fill to 1.5 depth. **Figures B1** and **B2** in Appendix B show the details of the standpipes.

Initial groundwater measurements were taken on 19 November 2018 and water levels were recorded at the following depths:

- Borehole BH01: 3m below ground level

- Borehole BH05: 3.7m below ground level

At the request of PPCC, the standpipes were developed so that they would be suitable for environmental sampling. The standpipes were developed by purging with the aim to draw in regional groundwater and to remove water potentially left in the standpipe by washed boring. The standpipes was purged on 21 November 2018. The water was collected in drums and disposed of in a collection centre.

Prior to purging, water level in the standpipes was measured which returned 2.9m and 3.55m below ground level for BH02 and BH05 standpipe, respectively. A rubber hose was then inserted to the bottom of the standpipe and pumping commenced at the bottom to draw the water out from the standpipe. Initially, the water was observed to be murky and, as such, the rubber hose was kept at the bottom until the water became clear. The hose was then slowly withdrew from the standpipe until 3m below the top of the standpipe while the pumping continued. Thereafter, the hose was kept in the standpipe until at least 200 litres of water was withdrawn.

Upon termination of the purging process, the water level in the standpipe was measured which returned a level of 2.94m and 3.55m in borehole BH01 and BH05, respectively. The recovery was noted to have taken place within a time span of about 10 minutes. This quick recovery indicates that the subsurface materials are highly permeable, which is expectable considering the material predominantly consisted of granular soils.

The above measurements represent the groundwater levels at the time of the observations. It is noted that groundwater level may fluctuate over time due to rainfall, weather condition and factors such as tidal influences.

6.4 Footing Systems

6.4.1 Site Classification

The near surface material comprises a road pavement consisting of asphalt, concrete, base and subbase course with a total thickness of up to 0.6m. The material is not suitable for footing support and it is recommended that all new footings be founded on the underlying natural soils comprising clays and sands.

The clay underlying the road pavement is medium plasticity. In accordance with AS2870-2011, Residential Slabs and Footings, a characteristic surface movement (y_s) similar to a Class M (20mm < $y_s \leq$ 40mm) may be adopted for preliminary purposes. This classification was assessed by taking into consideration the area geology, soil profile encountered, and the climatic zone of the area. Further testing including shrink-swell tests would be required for a more detailed site classification assessment. However, it should be noted that the proposed development is not similar to a residential property as described in the standard and the site classification is provided for guidance purposes only.

6.4.2 Earthquake Rating

Seismic accelerations to be resisted by a structure are dependent upon the stiffness of the underlying soil and rock. Soft soils have the potential to amplify ground accelerations, requiring structures built upon them to be designed to resist a higher seismic coefficient. In accordance with AS 1170.4 , the following factors are considered appropriate:

- Site sub-soil class Ce (Shallow Soil site) as the depth of the natural soils does not exceed those listed in Table 4.1 of the standard.
- Hazard Factor (Z) of 0.08 (Melbourne).

6.4.3 Spread Footings

It is understood that the proposed development is likely to have two to three level basement. Therefore, it is anticipated that majority of the spread footings (if adopted) within the basement excavation footprint will be founded within Brighton Group comprising sand, clay and silt. Shallow footings located outside the basement are recommended to be founded on natural clays and sands (Alluvium/Brighton Group).

Based upon published information and correlations with in-situ test and laboratory test results, the bearing capacity presented in Table 6.1 are considered suitable for spread footings.

Table 6.1: Spread footing bearing capacity

Unit	Founding Material	Allowable Bearing Pressure[1] (kPa)	
		Strip Footings	Pad Footings
1	FILL	Not suitable	
2	Sandy CLAY/Clayey SAND: Stiff or better, medium dense or better [Alluvium/Brighton Group][2]	80	100
3	Clayey SAND/Clayey SILT/Sandy CLAY: very stiff or better, medium dense to dense or better [upper horizon Brighton Group][3]	80	100
	Silty SAND/Sandy SILT/Clayey SAND, loose to medium dense [lower horizon Brighton Group][3]	50	50

Notes:

1. *Factor of safety of 3.0. Footings are at least 1.5m wide. Smaller footing will need to be assessed on case-by-case basis.*
2. *Groundwater table is located not shallower than the footing width from the base of the footing*
3. *Groundwater table is located within the footing width from the base of the footing. The impact of groundwater has been considered in the bearing capacity calculations.*

It should be noted that the following assumptions have been made in the derivation of the allowable bearing pressures provided in Table 6.1:

- For footings founded on granular material, the effect of groundwater has been taken into account in the calculations of the allowable bearing capacity;
- Footings located outside the basement is assumed to be founded on Unit 2 natural material;
- Footings are not located near excavations or downsloping batters;
- Footings are subject to concentric loadings only;
- Effects of unloading due to basement excavation can be reasonably ignored;
- Material of similar or better quality is available within a distance of at least two times (2x) the footing width below the footing; and
- The recommended allowable bearing capacity does not apply to a raft foundation.

Further advice should be sought from T+T if a specific footing is required to be designed based on different conditions than those described above.

It must be noted that the design of spread footing is likely be governed by settlement criteria other than bearing capacity. A detailed analysis should be carried out to assess the expected footing settlement with respect to the design load. For footings located within the basement, the analysis should consider the effect of removing the overburden pressure (unload-reload condition) after

excavation. The elastic modulus value of the founding material as presented in Table 6.4 can be adopted for preliminary settlement estimation.

Cohesive soils can suffer softening and degradation on exposure and wetting. It is therefore recommended that exposed surfaces are protected as soon as practicable with compacted granular fill or blinding. It is also recommended that the founding stratum is inspected by a suitably experience geotechnical engineer to confirm actual conditions are in accordance with design ground models.

6.4.4 Pile Footing

Consideration could be given to supporting the proposed building on pile footings. Bored piles or Continuous Flight Auger (CFA) piles is considered appropriate while the use of driven piles would be limited due to proximity of the site to the existing buildings. Given the presence of groundwater and the permeable subsurface materials, the use of bored piles may be limited as it will require the bored holes to be stabilised during boring.

Weathered siltstone is considered suitable to support the proposed structure. Based upon in-situ strength tests, laboratory test results and published guidelines[3], the design parameters appropriate for the design of a single bored pile are presented in Table 6.2. It should be noted that less weathered SILTSTONE may by presence below the current investigation depth of 20m. The better quality SILTSTONE should be assessed for its ultimate unit stresses if encountered.

Table 6.2: Bored pile design parameters

Unit	Founding Material	Ultimate Unit Stresses (kPa)	
		End Bearing	Shaft Adhesion
1	FILL	Not suitable	
2	Sandy CLAY/Clayey SAND: Stiff or better, medium dense or better[2] [Alluvium/Brighton Group]	675	45
3	Clayey SAND/Clayey SILT/Sandy CLAY: very stiff or better, medium dense to dense or better[3] [upper horizon Brighton Group]	1000	50
	Silty SAND/Sandy SILT/Clayey SAND, loose to medium dense [lower horizon Brighton Group]	675	45
4	Extremely weathered to highly weathered siltstone	3000	150

In order to assess pile capacity, a geotechnical strength reduction factor (ϕ_g) is applied to the above ultimate end bearing and the ultimate side friction presented in Table 6.2 in accordance with Australian Standard, AS 2159-2009 Piling – Design and installation. The appropriate ϕ_g value will depend on many factors associated with the site, design, installation and testing, some of which are not known at the time of preparing this report. The various factors to be considered include the following:

- Geological complexity of the site,
- Extent of geotechnical investigation with consideration of pile founding levels,
- Available geotechnical data and method of assessment of geotechnical parameters,

[3] Sinclair, T.J.E. & Every, C.P. (2006) Designing for Rock Socket Piles. *Earthquakes and Urban Development: New Zealand Geotechnical Society 2006 Symposium*, (pp. 341-351). Nelson.

- Design experience and methods adopted,
- Level of construction control and performance monitoring, and
- Pile testing undertaken.

Based on some typical broad assumptions regarding the construction of pile footing on this site, it is considered that a ϕ_g of 0.45 may be adopted for preliminary pile design purposes, assuming no load testing of constructed piles is to be undertaken. Nonetheless, designers should make their own assessment of appropriate ϕ_g values based on the particular risk circumstances, experience and testing regime appropriate for their design and a different value may apply.

In accordance with AS2159-2009, higher ϕ_g values may be adopted if the following apply:

- The designer has extensive experience in similar geotechnical conditions;
- High redundancy systems are adopted;
- Load testing is undertaken on constructed piles; and
- Detailed professional geotechnical supervision is undertaken.

An appropriate load factor also needs to be applied to the pile loading

To fully develop the end bearing capacity within a geological unit, the pile should be socketed at least 3 pile diameters into the design founding material, for instance, weathered SILTSTONE. Alternatively, the end bearing capacity may be reduced to less than 67% of the presented value based upon negligible embedment. Interpolation of the end bearing capacity may be undertaken between these embedment depths.

Uplift forces may also be resisted by piles. Specific design will need to be undertaken to confirm that the piles are embedded at a sufficient depth. For preliminary assessment purposes, the skin friction values presented in Table 6.2 should be reduced by 25% for piles resisting uplift. The potential for cone pull-out failure shall also be assessed for piles subjected to tension load.

It is recommended that bored pile excavations are assessed by a geotechnical engineer during construction to ensure that founding conditions are consistent with those on which the design recommendations are based. Care should be taken to ensure that the base and side of any pile excavations are clean of loose material, water and clay smear prior to pouring concrete.

6.5 Excavations and retaining walls

6.5.1 Excavatability

Basement excavations are expected to encountered fill underlain natural clay, sand and silt of Alluvium and Brighton Group units. Medium dense to dense sands containing gravel and stiff to very stiff clays were encountered within these units while cemented bands were encountered from 3.5m to 6m depth in borehole BH01 and 7m to 8.5m depth in borehole BH02.

The excavation conditions within the site will not be difficult and can be achieved using conventional earthmoving equipment such as backhoes and tracked excavators. Minor ripping maybe required locally where bands of stronger cemented soils are encountered during excavation.

6.5.2 Temporary batter stability

Worksafe Victoria recommends that excavations deeper than 1.5 m should be battered, benched or shored to provide a safe working environment. It is anticipated that retaining walls will be constructed top-down for the basement excavation and temporary unsupported excavations greater than 3 m will not be required. Permanent batters are not anticipated at the site.

The recommended temporary batter slopes are presented in Table 6.3.

Table 6.3: Recommended temporary batter slopes (up to 3m high)

Unit	Material	Short term (up to 2 weeks)
1	FILL	1V:2H, or gentler
2	Sandy CLAY/Clayey SAND: Stiff or better, medium dense or better[2] [Alluvium/Brighton Group]	1V:1H, or gentler
3	Clayey SAND/Clayey SILT/Sandy CLAY: very stiff or better, medium dense to dense or better[3] [upper horizon Brighton Group]	1V:1H, or gentler
	Silty SAND/Sandy SILT/Clayey SAND, loose to medium dense [lower horizon Brighton Group]	1V:2H, or gentler

Where excavations are to remain open for a longer period (>2 weeks), it is recommended that further geotechnical advice is sought. Surcharge loading on the unsupported slope should be eliminated by maintaining a distance from the crest equal to the height of the temporary cut.

Notwithstanding the above, it is recommended that the slopes to be monitored at regular intervals to check for signs of instability throughout the construction period. This may be undertaken by placing a string line along the crest of the slope with pins installed at intervals beneath. Monitoring the offset distance of the pins from the string line can provide early indication of ground movement. Where this is observed, work should cease within the affected area and the advice of a suitably experienced and qualified geotechnical engineer sought.

The basement excavation will require permanent retaining walls to be constructed. It is envisaged that these will consist of top down constructed soldier or contiguous pile walls. On the basis of correlations with the measured in-situ shear strengths, published guidelines and our experience with similar soils, the effective strength parameters as set out in Table 6.4 are considered appropriate for the calculation of lateral earth pressures on the basement walls.

It should be noted that less weathered material may by presence below the XW/HW Siltstone current encountered up to the termination depth of 20m. The better quality siltstone should be assessed for its effective strength parameters if encountered.

Table 6.4: Preliminary retaining wall design parameters

Stratum	Approximate depth to top of layer (m bgl)	Unit weight (γ) kN/m^3	Undrained Cohesion (c_u) kPa	Cohesion (c') kPa	Friction Angle (ϕ') degrees	Young's Modulus (E') MPa	Coefficient of Earth pressure 'active' (k_a)	Coefficient of Earth pressure 'at rest' (k_o)
Stiff Sandy CLAY/ Medium Dense Clayey SAND [Alluvium/Brighton Group]	0.6	19	---	5	25	25	0.4	0.6
Medium Dense to Dense Clayey SAND/Clayey SILT/ Very still Sandy CLAY [upper horizon Brighton Group]	3.5 – 4.5	20	---	1	33	50	0.3	0.5
Loose to medium Silty SAND/Sandy SILT/Clayey SAND, [lower horizon Brighton Group]	7.5 - 10	18.5	---	1	30	28	0.35	0.5
SILTSTONE (XW/HW)	15. – 16.3	21	300	13	30	80	0.35	1.0

Design of piled retention systems in soils are usually carried out using industry standard finite element analysis software such as WALLAP or PLAXIS.

It is recommended that the parameters shown in Table 6.4 are used for retaining wall design. The design of the retaining walls should also include numerical modelling to assess potential wall deformations.

During construction, the wall will be cantilevered and free to move, with propping only occurring when the floor slabs are constructed. It is likely that the retaining walls will require multiple levels of temporary anchors to facilitate the excavation.

6.5.3 Ground anchors

Given the proposed depth of the excavation, ground anchors are expected to be required to provide temporary support to the basement wall system.

The design and construction of ground anchors should consider the presence of neighbouring basement levels (including anchors and piled foundations), underground services, buried structures, or future developments. As anchors are installed close to the site boundary, it may be preferable or required to use removable ground anchors.

Bond strength of ground anchors will be a function of the installation methods adopted as well as the ground characteristics, which should be discussed with the specialist subcontractor engaged to assess the required size and length of the anchor to achieve the design load.

As a preliminary guide to the design of ground anchors, an allowable bond stress of 50kPa may be adopted for air flush drilled anchors supported in the natural stiff or better clay.

In sand it is considered that the anchor capacity may be dependent on the grouting pressure that can be achieved and specific advice should be sought from specialist subcontractors.

Anchors should be proof loaded and tested during construction to ensure that design loads are being achieved. Allowance should also be made for some loss of capacity due potential creep.

To limit the interaction between the ground anchor bond length and the zone of active ground movement in the vicinity of the excavation, ideally the free length of ground anchors should extend to a plane extending at 45º to the horizontal behind the base of the excavation. However, this is not always practical, particularly where anchors are installed close to the site boundary and the anchor length may need to be limited. In these instances, the interaction between the anchors and the rest of the excavation support system needs to be considered in detail, including reduced stiffness and capacity of the anchors. It is recommended that the anchors be modelled as part of the retention system in a finite element analysis.

6.5.4 Groundwater control

As noted in Section 6.3, the groundwater levels measured on 19 and 21 November 2018 in the standpipes in Boreholes BH01 and BH05 were between 2.9m and 3m, and between 3.55m and 3.7m, respectively. It should be noted that groundwater levels are subject to variations due to the influence of rainfall, temperature, local drainage, and the seasons. It is possible that the groundwater table may be different from these measurements at the time of the construction.

The proposed excavation for basement construction is expected to intercept the groundwater and inflows would be expected. The may require the use of dewatering measures such as sump pumping, spear points or well during excavation to assist construction and minimise softening of soils exposed at the base of excavations.

Excessive dewatering of groundwater from the site may not be permissible. Under this circumstance, a tanked retaining wall would be required.

Uplift from groundwater should be considered in the design of the basement structures in the long term conditions.

6.5.5 Basement drainage

The design of the basement drainage system will need to consider perched water, seepage and the local groundwater table. At the time of our investigation standpipes indicated groundwater level at about 2.9m to 3.7m below the existing ground level.

It is expected that the proposed basement may be designed as a drained basement or an undrained basement (tanked option). A drained option is likely to be limited to not more than one level basement considering the groundwater level was observed to be at around 3m below ground level at the time of the geotechnical investigation and the presence of permeable subsurface materials. If a drained basement is to be adopted adequate drainage will need to be provided behind the walls such that hydrostatic pressure build-up does not occur. For an undrained (tanked) basement, hydrostatic pressures will need to be included in the retained ground and across the floor of the excavation in the structural design.

In deciding the appropriate basement system to be adopted, the designer should consider some crucial factors such as those presented below:

- Groundwater levels and fluctuations;
- The likely maximum groundwater level which may apply uplift or buoyant forces to the basement floor slab;

- The volume, quality, treatment and disposal of groundwater inflow, including the associated costs;
- Maintenance requirements to ensure the drainage system continues to operate for the required design life;
- The implications of a failure of the drainage system on the structure; and
- The potential effect of any drawdown of the groundwater on settlement of nearby buildings.

The design of basement drainage systems may require a detailed assessment of groundwater depths and volumes. At this stage groundwater flow rates are not known although from the groundwater purging exercise as described in Section 6.3, the inflow is rapid. In order to obtain accurate estimates of likely groundwater inflow rates, further investigations and assessments including on-going groundwater monitoring and pump tests would be required.

6.5.6 Adjacent structures

The nearest adjacent structures include single storey and double storey commercial and residential buildings, and one three storey commercial building, which are located around the site boundary. It is anticipated that the adjacent structures will be sensible to the proposed excavation as majority of the structures are masonry. Buried services around the site include gas, sewer, electrical cable, Telstra lines, Fibre optic cable and etc. which the construction works will need to be managed to ensure the integrity of the adjacent buried services are not adversely affected. This includes, but is not limited to, the impact of potential vibrations, removal of overburden and advancement of temporary ground anchors (if use).

7 Implication

Recommendations and options in this report are based on data from (boreholes or pits or other). The nature and continuity of subsoil away from the (boreholes/pits or other) are inferred but it must be appreciated that actual conditions could vary from the assumed model.

During excavation and construction, the site should be examined by an engineer or engineering geologist competent to judge whether the exposed subsoils are compatible with the inferred conditions on which the report has been based. We would be please to provide this service to you (or name of client) and believe your project would benefit from such continuity. However, it is important that we be contacted if there is any variation in subsoil conditions from those described in the report.

8 Applicability

This report has been prepared for the exclusive use of our client Port Phillip City Council, with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose, or by any person other than our client, without our prior written agreement.

Tonkin & Taylor Pty Ltd

Report prepared by:	Authorised for Tonkin & Taylor Pty Ltd by:
	
.....	.....
Roger Lim Principal Geotechnical Engineer	Trevor Smith Technical Director

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Appendix A: Figures

Figure A1 – Borehole Layout Plan

Figure A2 – Inferred Geological Section

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LEGEND

BH01 BOREHOLE LOCATIONS

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IMAGERY DATE: 19/10/2018.

A3 SCALE 1:1000

0 5 10 15 20 30 40 50 (m)

ORIGINAL IN COLOUR

PROJECT No.	1008831.1000	
DESIGNED		
DRAWN	KMJA	Nov.18
CHECKED		
APPROVED	DATE	

CLIENT **PORT PHILLIP CITY COUNCIL**

PROJECT **BALACLAVA RETAIL RENEWAL PRECINCT**

TITLE GEOTECHNICAL INVESTIGATION
SITE PLAN

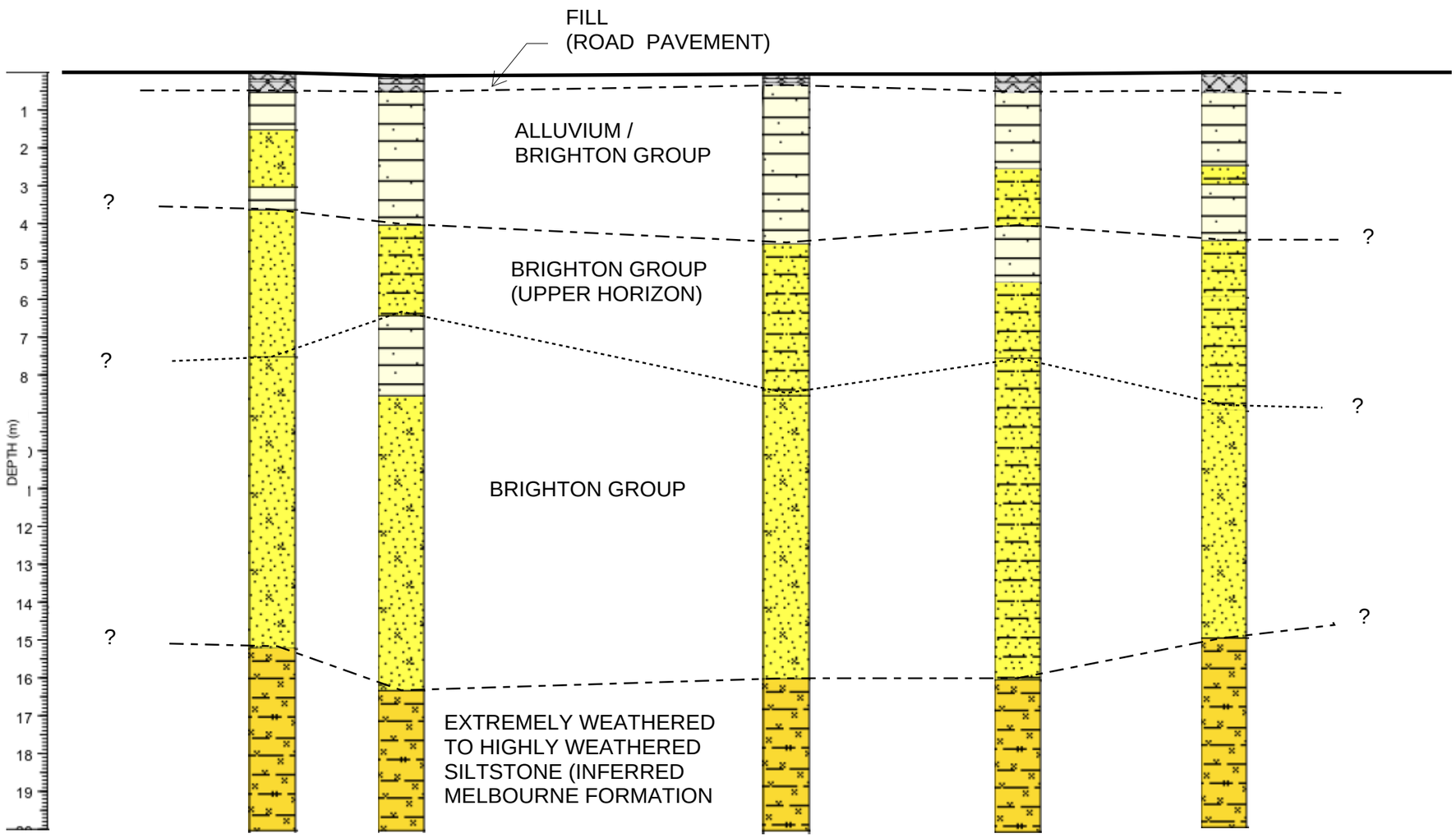
UNDER REVISION 1

SCALE (A3) 1:1000 FIG No. FIGURE A1 REV 1

P:\1008831\1008831.1000\WorkingMaterial\CAD\FIG\1008831.1000-F01.dwg 2018-Nov-21 3:21:27 PM Plotted By: KATHRYN JACKSON

BOREHOLE LOCATIONS

BH01 BH02 BH03 BH04 BH05



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LEGEND

REFER TO BOREHOLE LOGS

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IMAGERY DATE: 19/10/2018.

A3 SCALE 1:1000

0 5 10 15 20 30 40 50 (m)

ORIGINAL IN COLOUR

PROJECT No.	1008831.1000		
DESIGNED			
DRAWN	KMJA	Nov.18	
CHECKED			
APPROVED	DATE		

CLIENT PORT PHILLIP CITY COUNCIL

PROJECT BALACLAVA RETAIL RENEWAL PRECINCT

TITLE INFERRED GEOLOGICAL SECTION

SCALE (A3) 1:1000 FIG No. FIGURE A2 REV

Appendix B: Borehole logs

- T+T Explanatory sheet
- Borehole logs
- Standpipe details for borehole BH01 and BH05

BOREHOLE LOG

INVESTIGATION Id.: **BH01**

SHEET: 1 OF 4

PROJECT: Balaclava Retail Renewal Precinct	LOCATION: Alfred Street, Balaclava VIC		JOB No.: 1008831.1000.TTAU
CO-ORDINATES: (UTM55H) 5806960 mN 323310 mE	METHOD: SA	START DATE:	16/11/2018
	EQUIPMENT: Comacchio GEO305	FINISH DATE:	16/11/2018
R.L.: NA	TECHNICIAN: PWIL	LOGGED BY:	JSPH
DATUM: NA	CONTRACTOR: Chadwick Geotechnics	CHECKED BY:	CHL

GEOLOGICAL | TESTING

METHOD	WATER	UNIT	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE	CONSISTENCY / RELATIVE DENSITY	RL (m)	DEPTH (m)	SAMPLES TESTS	SAMPLES	DCP Dynamic Cone Penetrometer	ADDITIONAL COMMENTS
SA				FILL	ASPHALT (150mm thick)								
				FILL	Sandy GRAVEL, fine to coarse grained, subangular to subrounded, dark brown. Sand, fine to coarse grained.	M	D-VD						
				FILL	SAND with gravel, fine to coarse grained, brown. Gravel, fine to coarse grained, subangular.	D-M	D			0.3-0.4			
		Alluvium/Brighton Group		CL	CLAY with sand, medium plasticity, pale grey mottled yellow-brown. Sand, fine to medium grained.	M	VSt		0.5	0.8			
				SC	Clayey SAND trace gravel, fine to coarse grained, pale grey-brown mottled yellow-brown. Gravel, fine to medium grained, subangular.		L-MD		1.0	1.5-2.5 SPT 4 5 5 **N=10**			
WB	19/11/2018			CL	CLAY with sand, medium plasticity, pale grey mottled yellow-brown. Sand, fine to medium grained. 3.5m: Sand becoming fine to coarse grained.		St		1.5 2.0 2.5 3.0	SPT 2 4 5 **N=9**			
		Brighton Group Pavement		SC	Clayey SAND, fine to coarse grained, yellow-brown mottled pale grey. Interbedded cemented band within the range.		MD-D		3.5 4.0 4.5	SPT 10 12 13 **N=25**			

COMMENTS:

Hole Depth 20m

Scale 1:25

These logs are to be read in conjunction with the full Tonkin & Taylor report

Rev.: A

BOREHOLE LOG

INVESTIGATION Id.: **BH01**

SHEET: 2 OF 4

PROJECT: Balaclava Retail Renewal Precinct	LOCATION: Alfred Street, Balaclava VIC		JOB No.: 1008831.1000.TTAU
CO-ORDINATES: (UTM55H) 5806960 mN 323310 mE	METHOD: SA	START DATE:	16/11/2018
	EQUIPMENT: Comacchio GEO305	FINISH DATE:	16/11/2018
R.L.: NA	TECHNICIAN: PWIL	LOGGED BY:	JSPH
DATUM: NA	CONTRACTOR: Chadwick Geotechnics	CHECKED BY:	CHL

GEOLOGICAL | TESTING

METHOD	WATER	UNIT	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE	CONSISTENCY / RELATIVE DENSITY	RL (m)	DEPTH (m)	SAMPLES TESTS	SAMPLES	DCP Dynamic Cone Penetrometer	ADDITIONAL COMMENTS
WB		Brighton Group			[CONT] Clayey SAND, fine to coarse grained, yellow-brown mottled pale grey. Interbedded cemented band within the range.				5.5	5.0-6.0			
					6.4m: Trace gravel, yellow-brown, orange mottled pale grey. Gravel, fine grained, subangular to subrounded.				6.0	SPT 10 15 22 **N=37**			
				SC	Silty SAND/Sandy SILT trace gravel, fine to medium grained, yellow-brown. Gravel, fine to medium grained, subangular.	M	MD		6.5				
					8.5m: Sand becoming fine to coarse grained.				7.0				
					9.0m: Sand becoming fine to medium grained. Interbedded Silty SAND/Sandy SILT.				7.5	SPT 7 12 13 **N=25**			
					10.0m: Sand becoming fine grained.				8.0				
									8.5				
									9.0	SPT 3 4 8 **N=12**			
									9.5				

COMMENTS:

Hole Depth 20m

Scale 1:25

These logs are to be read in conjunction with the full Tonkin & Taylor report

Rev.: A

BOREHOLE LOG

INVESTIGATION Id.: **BH01**

SHEET: 3 OF 4

PROJECT: Balaclava Retail Renewal Precinct		LOCATION: Alfred Street, Balaclava VIC		JOB No.: 1008831.1000.TTAU	
CO-ORDINATES: (UTM55H)	5806960 mN 323310 mE	METHOD:	SA	START DATE:	16/11/2018
		EQUIPMENT:	Comacchio GEO305	FINISH DATE:	16/11/2018
R.L.:	NA	TECHNICIAN:	PWIL	LOGGED BY:	JSPH
DATUM:	NA	CONTRACTOR:	Chadwick Geotechnics	CHECKED BY:	CHL

GEOLOGICAL | TESTING

METHOD	WATER	UNIT	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE	CONSISTENCY / RELATIVE DENSITY	RL (m)	DEPTH (m)	SAMPLES TESTS	SAMPLES	DCP Dynamic Cone Penetrometer	ADDITIONAL COMMENTS
WB		Brighton Group			[CONT] Silty SAND/Sandy SILT trace gravel, fine to medium grained, yellow-brown. Gravel, fine to medium grained, subangular.		L-MD		10.5	SPT 3 3 6 **N=9**			
										U63			
									11.0				
									11.5				
									12.0	SPT 2 6 10 **N=16**			
					13.0m: Increase in silt content.				12.5				
									13.0				
									13.5	SPT 2 3 5 **N=8**			
									14.0				
									14.5				

COMMENTS:

Hole Depth 20m

Scale 1:25

These logs are to be read in conjunction with the full Tonkin & Taylor report

Rev.: A

BOREHOLE LOG

INVESTIGATION Id.: **BH01**

SHEET: 4 OF 4

PROJECT Balaclava Retail Renewal Precinct	LOCATION: Alfred Street, Balaclava VIC	JOB No.: 1008831.1000.TTAU
CO-ORDINATES: (UTM55H) 5806960 mN 323310 mE	METHOD: SA	START DATE: 16/11/2018
	EQUIPMENT: Comacchio GEO305	FINISH DATE: 16/11/2018
R.L.: NA	TECHNICIAN: PWIL	LOGGED BY: JSPH
DATUM: NA	CONTRACTOR: Chadwick Geotechnics	CHECKED BY: CHL

GEOLOGICAL | TESTING

METHOD	WATER	UNIT	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE	CONSISTENCY / RELATIVE DENSITY	RL (m)	DEPTH (m)	SAMPLES TESTS	SAMPLES	DCP Dynamic Cone Penetrometer	ADDITIONAL COMMENTS
WB		Brighton Group			[CONT] Silty SAND trace gravel, fine to medium grained, yellow-brown. Gravel, fine to medium grained, subangular.					SPT 1 2 7 **N=9**			
				ML/CL	Clayey SILT, medium plasticity, pale grey mottled yellow-brown. Trace of very low to low, dark grey siltstone bands.	D-M	H		15.5				*15.2 - 20.0m:* Inferred extremely weathered to highly weathered Siltstone/ Sandstone
									16.0				
									16.5	SPT 17 25/70mm			
		Melbourne Formation			17.5m: Trace of low strength, dark grey siltstone bands.				17.0				
									17.5				
									18.0	SPT 25/70mm			
									18.5				
									19.0				
									19.5				

COMMENTS: 20m: Target Depth

Hole Depth 20m

Scale 1:25

These logs are to be read in conjunction with the full Tonkin & Taylor report

Rev.: A

BOREHOLE LOG

INVESTIGATION Id.: **BH02**

SHEET: 1 OF 4

PROJECT: Balaclava Retail Renewal Precinct	LOCATION: Alfred Street, Balaclava VIC	JOB No.: 1008831.1000.TTAU
CO-ORDINATES: (UTM55H) 5806938 mN 323334 mE	METHOD: SA	START DATE: 19/11/2018
	EQUIPMENT: Comacchio GEO305	FINISH DATE: 19/11/2018
R.L.: NA	TECHNICIAN: PWIL	LOGGED BY: JSPH
DATUM: NA	CONTRACTOR: Chadwick Geotechnics	CHECKED BY: CHL

GEOLOGICAL | TESTING

METHOD	WATER	UNIT	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE	CONSISTENCY / RELATIVE DENSITY	RL (m)	DEPTH (m)	SAMPLES TESTS	SAMPLES	DCP Dynamic Cone Penetrometer	ADDITIONAL COMMENTS
SA		Pavement		FILL	ASPHALT (120mm thick)								
				FILL	Sandy GRAVEL, fine to coarse grained, subangular to subrounded, dark brown-grey.	M	D						
				FILL	SAND, fine to medium grained, brown.	D-M	MD						
		Alluvium/Brighton Group		CL	Sandy CLAY, medium plasticity, pale grey mottled yellow-brown. Sand, fine to medium grained.	M	St		0.5	0.8			
									1.0	1.0-2.0			
									1.5	SPT 3 4 5 **N=9**			
									2.0				
					2.5m: Becoming grey, pale grey.				2.5	U63			
									3.0	SPT 2 5 5 **N=10**			
									3.5				
									4.0	4.0			
		Brighton Group		SC	Clayey SAND, fine to coarse grained, pale grey mottled yellow-brown.		MD		4.5	SPT 7 13 16 **N=29**			

COMMENTS:

Hole Depth 20m

Scale 1:25

These logs are to be read in conjunction with the full Tonkin & Taylor report

Rev.: A

BOREHOLE LOG

INVESTIGATION Id.: **BH02**

SHEET: 2 OF 4

PROJECT: Balaclava Retail Renewal Precinct	LOCATION: Alfred Street, Balaclava VIC		JOB No.: 1008831.1000.TTAU
CO-ORDINATES: (UTM55H) 5806938 mN 323334 mE	METHOD: SA	START DATE:	19/11/2018
	EQUIPMENT: Comacchio GEO305	FINISH DATE:	19/11/2018
R.L.: NA	TECHNICIAN: PWIL	LOGGED BY:	JSPH
DATUM: NA	CONTRACTOR: Chadwick Geotechnics	CHECKED BY:	CHL

GEOLOGICAL | TESTING

METHOD	WATER	UNIT	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE	CONSISTENCY / RELATIVE DENSITY	RL (m)	DEPTH (m)	SAMPLES TESTS	SAMPLES	DCP Dynamic Cone Penetrometer	ADDITIONAL COMMENTS
WB		Brighton Group			[CONT] Clayey SAND, fine to coarse grained, pale grey mottled yellow-brown.				5.5				
				CL	Sandy CLAY trace gravel, medium plasticity, pale grey mottled yellow-brown and brown. Sand, fine to medium grained; gravel, fine to medium grained, subangular.	M	St		6.0	SPT 3 4 7 **N=11**			
					7.0m: Becoming brown, increasing gravel content. Sand, predominantly medium grained, trace of cemented band.				6.5	6.5-7.0			
									7.0				
									7.5	SPT 5 6 6 **N=12**			
									8.0	8.0-8.5			
				SC	Silty SAND, fine to medium grained, brown.		L-MD		8.5				
									9.0	SPT 3 2 5 **N=7**			
									9.5				

COMMENTS:

Hole Depth 20m

Scale 1:25

These logs are to be read in conjunction with the full Tonkin & Taylor report

Rev.: A

BOREHOLE LOG

INVESTIGATION Id.: **BH02**

SHEET: 3 OF 4

PROJECT: Balaclava Retail Renewal Precinct		LOCATION: Alfred Street, Balaclava VIC		JOB No.: 1008831.1000.TTAU	
CO-ORDINATES: (UTM55H)	5806938 mN 323334 mE	METHOD:	SA	START DATE:	19/11/2018
		EQUIPMENT:	Comacchio GEO305	FINISH DATE:	19/11/2018
R.L.:	NA	TECHNICIAN:	PWIL	LOGGED BY:	JSPH
DATUM:	NA	CONTRACTOR:	Chadwick Geotechnics	CHECKED BY:	CHL

GEOLOGICAL | TESTING

METHOD	WATER	UNIT	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE	CONSISTENCY / RELATIVE DENSITY	RL (m)	DEPTH (m)	SAMPLES TESTS	SAMPLES	DCP Dynamic Cone Penetrometer	ADDITIONAL COMMENTS
WB		Brighton Group			[CONT] Silty SAND, fine to medium grained, brown.				10.5	SPT 2 4 7 **N=11**			
									11.0				
									11.5				
									12.0	SPT 3 5 8 **N=13**			
									12.5				
									13.0				
									13.5	SPT 2 4 8 **N=12**			
									14.0				
									14.5				

COMMENTS:

Hole Depth 20m

Scale 1:25

These logs are to be read in conjunction with the full Tonkin & Taylor report

Rev.: A

BOREHOLE LOG

INVESTIGATION Id.: **BH02**

SHEET: 4 OF 4

PROJECT: Balaclava Retail Renewal Precinct	LOCATION: Alfred Street, Balaclava VIC		JOB No.: 1008831.1000.TTAU
CO-ORDINATES: (UTM55H) 5806938 mN 323334 mE	METHOD: SA	START DATE:	19/11/2018
	EQUIPMENT: Comacchio GEO305	FINISH DATE:	19/11/2018
R.L.: NA	TECHNICIAN: PWIL	LOGGED BY:	JSPH
DATUM: NA	CONTRACTOR: Chadwick Geotechnics	CHECKED BY:	CHL

GEOLOGICAL | TESTING

METHOD	WATER	UNIT	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE	CONSISTENCY / RELATIVE DENSITY	RL (m)	DEPTH (m)	SAMPLES TESTS	SAMPLES	DCP Dynamic Cone Penetrometer	ADDITIONAL COMMENTS
WB		Brighton Group			[CONT] Silty SAND, fine to medium grained, brown.				15.5	SPT 2 2 3 **N=5**			
		Melbourne Formation		ML/CL	Clayey SILT, medium plasticity, pale grey mottled yellow-brown. Trace of low to very low strength, dark grey siltstone bands.	D-M	H		16.0				*16.3 - 20.0m:* Inferred extremely weathered to highly weathered Siltstone/ Sandstone
									16.5	SPT 5 18 25/120mm			
									17.0				
									17.5				
									18.0	SPT 25/120mm			
									18.5				
									19.0				
									19.5	SPT 25/100mm			

COMMENTS: 20m: Target Depth

Hole Depth 20m

Scale 1:25

These logs are to be read in conjunction with the full Tonkin & Taylor report

Rev.: A

Tonkin+Taylor

BOREHOLE LOG

INVESTIGATION Id.: **BH03**

SHEET: 1 OF 4

PROJECT: P- Balaclava Retail Renewal Precinct	LOCATION: AlfredStreet, Balaclava VIC		JOB No.: 1008831.1000.TTAU
CO-ORDINATES: (UTM55H) 5806942 mN 323409 mE	METHOD: SA	START DATE:	15/11/2018
	EQUIPMENT: Comacchio GEO305	FINISH DATE:	15/11/2018
R.L.: NA	TECHNICIAN: PWIL	LOGGED BY:	JSPH
DATUM: NA	CONTRACTOR: Chadwick Geotechnics	CHECKED BY:	CHL

GEOLOGICAL | TESTING

METHOD	WATER	UNIT	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE	CONSISTENCY / RELATIVE DENSITY	RL (m)	DEPTH (m)	SAMPLES TESTS	SAMPLES	DCP Dynamic Cone Penetrometer	ADDITIONAL COMMENTS
SA		Pavement		FILL	CONCRETE. (135mm thick)				0.0				
				FILL	Sandy GRAVEL, fine to coarse grained, subrounded to subangular, dark brown. Sand, fine to coarse grained.	M	D						
				FILL		D-M	MD-D						
		Alluvium/Brighton Group		CL	SAND with gravel, fine to coarse grained, brown. Gravel, fine to medium grained, subrounded to subangular.	M	VSt		0.5				
					Sandy CLAY trace gravel, medium plasticity, pale grey mottled yellow-brown. Sand, fine to medium grained; gravel, fine grained, subrounded to subangular.					0.8			
									1.0				
										1.5-2.5 SPT 4 8 7 **N=15**			
									1.5				
									2.0				
									2.5				
WB					3.0m: Sand becoming fine grained.				3.0	SPT 3 7 8 **N=15**			
									3.5				
									4.0	4.0-4.5			
		Brighton Group		SC	Clayey SAND, fine grained, pale grey mottled yellow-brown.		MD		4.5	SPT 9 11 9 **N=20**			

COMMENTS:

Hole Depth 20m

Scale 1:25

These logs are to be read in conjunction with the full Tonkin & Taylor report

Rev.: A

BOREHOLE LOG

INVESTIGATION Id.: **BH03**

SHEET: 2 OF 4

PROJECT: Balaclava Retail Renewal Precinct		LOCATION: Alfred Street, Balaclava VIC		JOB No.: 1008831.1000.TTAU	
CO-ORDINATES: (UTM55H)	5806942 mN 323409 mE	METHOD:	SA	START DATE:	15/11/2018
		EQUIPMENT:	Comacchio GEO305	FINISH DATE:	15/11/2018
R.L.:	NA	TECHNICIAN:	PWIL	LOGGED BY:	JSPH
DATUM:	NA	CONTRACTOR:	Chadwick Geotechnics	CHECKED BY:	CHL

GEOLOGICAL | TESTING

METHOD	WATER	UNIT	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE	CONSISTENCY / RELATIVE DENSITY	RL (m)	DEPTH (m)	SAMPLES TESTS	SAMPLES	DCP Dynamic Cone Penetrometer	ADDITIONAL COMMENTS
WB		Brighton Group			[CONT] Clayey SAND, fine grained, pale grey mottled yellow-brown.				5.5				
					6.1m: Becoming orange, yellow-brown, with some fine to medium grained, subangular gravel.	M	D-VD		6.0	SPT 8 25/70mm			
									6.5				
									7.0				
									7.5	SPT 2 5 /100mm			
									8.0				
				SC	Silty SAND/Sandy SILT with clay, low plasticity, fine grained, yellow-brown.		L		8.5				
									9.0	SPT 4 3 4 **N=7**			
									9.5				

COMMENTS:

Hole Depth 20m

Scale 1:25

These logs are to be read in conjunction with the full Tonkin & Taylor report

Rev.: A

BOREHOLE LOG

INVESTIGATION Id.: **BH03**

SHEET: 3 OF 4

PROJECT: Balaclava Retail Renewal Precinct		LOCATION: Alfred Street, Balaclava VIC		JOB No.: 1008831.1000.TTAU	
CO-ORDINATES: (UTM55H)	5806942 mN 323409 mE	METHOD:	SA	START DATE:	15/11/2018
		EQUIPMENT:	Comacchio GEO305	FINISH DATE:	15/11/2018
R.L.:	NA	TECHNICIAN:	PWIL	LOGGED BY:	JSPH
DATUM:	NA	CONTRACTOR:	Chadwick Geotechnics	CHECKED BY:	CHL

GEOLOGICAL | TESTING

METHOD	WATER	UNIT	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE	CONSISTENCY / RELATIVE DENSITY	RL (m)	DEPTH (m)	SAMPLES TESTS	SAMPLES	DCP Dynamic Cone Penetrometer	ADDITIONAL COMMENTS
WB		Brighton Group			[CONT] Silty SAND/Sandy SILT with clay, low plasticity, fine grained, yellow-brown.				10.5	1 0 .5 -11.5 SPT 1 3 5 **N=8**			
									11.0				
									11.5				
									12.0	SPT 2 4 4 **N=8**			
									12.5				
									13.0				
									13.5	U63			
									14.0	SPT 2 2 5 **N=7**			
									14.5				

COMMENTS:

Hole Depth 20m

Scale 1:25

These logs are to be read in conjunction with the full Tonkin & Taylor report

Rev.: A

BOREHOLE LOG

INVESTIGATION Id.: **BH03**

SHEET: 4 OF 4

PROJECT: Balaclava Retail Renewal Precinct	LOCATION: Alfred Street, Balaclava VIC		JOB No.: 1008831.1000.TTAU
CO-ORDINATES: (UTM55H) 5806942 mN 323409 mE	METHOD: SA	START DATE:	15/11/2018
	EQUIPMENT: Comacchio GEO305	FINISH DATE:	15/11/2018
R.L.: NA	TECHNICIAN: PWIL	LOGGED BY:	JSPH
DATUM: NA	CONTRACTOR: Chadwick Geotechnics	CHECKED BY:	CHL

GEOLOGICAL | TESTING

METHOD	WATER	UNIT	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE	CONSISTENCY / RELATIVE DENSITY	RL (m)	DEPTH (m)	SAMPLES TESTS	SAMPLES	DCP Dynamic Cone Penetrometer	ADDITIONAL COMMENTS
WB		Brighton Group			[CONT] Silty SAND/Sandy SILT with clay, low plasticity, fine grained, yellow-brown.				15.5	SPT 3 3 4 **N=7**			
		Melbourne Formation		ML/CL	Clayey SILT, medium plasticity, pale grey mottled red and yellow-brown. Trace of low to very low strength, dark grey siltstone bands.	D-M	H		16.0				*16.0 - 20.0m:* Inferred extremely weathered to highly weathered Siltstone/ Sandstone
									16.5	SPT 16 25/50mm			
									17.0				
									17.5				
									18.0				
									18.5				
					19.0m: Becoming dark grey mottled yellow-brown and red.				19.0				
									19.5	SPT 10 24 25/100mm			

COMMENTS: 20m: Target Depth

Hole Depth 20m

Scale 1:25

These logs are to be read in conjunction with the full Tonkin & Taylor report

Rev.: A

BOREHOLE LOG

INVESTIGATION Id.: **BH04**

SHEET: 1 OF 4

PROJECT: Balaclava Retail Renewal Precinct		LOCATION: Alfred Street, Balaclava VIC		JOB No.: 1008831.1000.TTAU	
CO-ORDINATES: (UTM55H)	5806936 mN 323458 mE	METHOD:	SA	START DATE:	14/11/2018
		EQUIPMENT:	Comacchio GEO305	FINISH DATE:	14/11/2018
R.L.:	NA	TECHNICIAN:	PWIL	LOGGED BY:	JSPH
DATUM:	NA	CONTRACTOR:	Chadwick Geotechnics	CHECKED BY:	CHL

GEOLOGICAL | TESTING

METHOD	WATER	UNIT	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE	CONSISTENCY / RELATIVE DENSITY	RL (m)	DEPTH (m)	SAMPLES TESTS	SAMPLES	DCP Dynamic Cone Penetrometer	ADDITIONAL COMMENTS
SA		Pavement		FILL	ASPHALT (200mm thick).				0.0				
				FILL	SAND with gravel, fine to coarse grained, brown. Gravel, fine grained, subrounded to subangular.	D-M	D						
		Alluvium/Brighton Group		CL	Sandy CLAY trace gravel, medium plasticity, yellow-brown mottled pale grey. Sand, fine to coarse grained; gravel, fine to medium grained, subrounded to subangular.	M	VSt		0.5	0.8			
				SC	Clayey SAND trace gravel, fine to coarse grained, yellow-brown mottled pale grey. Gravel, fine to medium grained, subrounded to subangular.		MD		1.0				
WB									1.5	1.5-2.5 SPT 5 7 9 **N=16**			
									2.0				
									2.5				
									3.0	SPT 5 8 7 **N=15**			
									3.5				
		Brighton Group		CL	Sandy CLAY trace gravel, medium plasticity, pale grey, yellow-brown. Sand, fine to coarse grained; gravel, fine to medium grained, subrounded to subangular.		VSt		4.0				
									4.5	SPT 6 9 9 **N=18**			

COMMENTS:

Hole Depth 20m

Scale 1:25

These logs are to be read in conjunction with the full Tonkin & Taylor report

Rev.: A

BOREHOLE LOG

INVESTIGATION Id.: **BH04**

SHEET: 2 OF 4

PROJECT: Balaclava Retail Renewal Precinct		LOCATION: Alfred Street, Balaclava VIC		JOB No.: 1008831.1000.TTAU	
CO-ORDINATES: (UTM55H)	5806936 mN 323458 mE	METHOD:	SA	START DATE:	14/11/2018
		EQUIPMENT:	Comacchio GEO305	FINISH DATE:	14/11/2018
R.L.:	NA	TECHNICIAN:	PWIL	LOGGED BY:	JSPH
DATUM:	NA	CONTRACTOR:	Chadwick Geotechnics	CHECKED BY:	CHL

GEOLOGICAL | TESTING

METHOD	WATER	UNIT	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE	CONSISTENCY / RELATIVE DENSITY	RL (m)	DEPTH (m)	SAMPLES TESTS	SAMPLES	DCP Dynamic Cone Penetrometer	ADDITIONAL COMMENTS
WB		Brighton Group			[CONT] Sandy CLAY trace gravel, medium plasticity, pale grey, yellow-brown. Sand, fine to coarse grained; gravel, fine to medium grained, subrounded to subangular.				5.5				
				SC	Clayey SAND trace gravel, fine grained, pale grey, yellow-brown. Gravel, fine to medium grained, subrounded to subangular.	M	MD		6.0	U63			
									6.5	SPT 10 15 15 **N=30**			
									7.0				
				SC	Clayey SAND, fine grained, yellow-brown, pale grey, orange brown.		L-MD		7.5	SPT 3 6 7 **N=13**			
									8.0				
									8.5				
									9.0	SPT 4 4 6 **N=10**			
									9.5	9.5-10.0			

COMMENTS:

Hole Depth 20m

Scale 1:25

These logs are to be read in conjunction with the full Tonkin & Taylor report

Rev.: A

BOREHOLE LOG

INVESTIGATION Id.: **BH04**

SHEET: 3 OF 4

PROJECT: Balaclava Retail Renewal Precinct		LOCATION: Alfred Street, Balaclava VIC		JOB No.: 1008831.1000.TTAU	
CO-ORDINATES: (UTM55H)	5806936 mN 323458 mE	METHOD:	SA	START DATE:	14/11/2018
		EQUIPMENT:	Comacchio GEO305	FINISH DATE:	14/11/2018
R.L.:	NA	TECHNICIAN:	PWIL	LOGGED BY:	JSPH
DATUM:	NA	CONTRACTOR:	Chadwick Geotechnics	CHECKED BY:	CHL

GEOLOGICAL | TESTING

METHOD	WATER	UNIT	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE	CONSISTENCY / RELATIVE DENSITY	RL (m)	DEPTH (m)	SAMPLES TESTS	SAMPLES	DCP Dynamic Cone Penetrometer	ADDITIONAL COMMENTS
WB		Brighton Group			[CONT] Clayey SAND, fine grained, yellow-brown, pale grey, orange brown.					U63			
									10.5	SPT 3 4 6 **N=10**			
									11.0				
									11.5				
					12.0m: Trace gravel, yellow-brown. Gravel, medium grained, subangular; Sand becoming fine to medium grained.				12.0	SPT 1 1 18 **N=19**			
									12.5				
									13.0				
									13.5	SPT 2 4 7 **N=11**			
									14.0				
					14.5m: Sand becoming fine to coarse grained. Gravel, fine to medium grained, subangular.				14.5	14.5-15.5			

COMMENTS:

Hole Depth 20m

Scale 1:25

These logs are to be read in conjunction with the full Tonkin & Taylor report

Rev.: A

BOREHOLE LOG

INVESTIGATION Id.: **BH04**

SHEET: 4 OF 4

PROJECT: Balaclava Retail Renewal Precinct		LOCATION: Alfred Street, Balaclava VIC		JOB No.: 1008831.1000.TTAU	
CO-ORDINATES: (UTM55H)	5806936 mN 323458 mE	METHOD:	SA	START DATE:	14/11/2018
		EQUIPMENT:	Comacchio GEO305	FINISH DATE:	14/11/2018
R.L.:	NA	TECHNICIAN:	JSPH	LOGGED BY:	JSPH
DATUM:	NA	CONTRACTOR:	Chadwick Geotechnics	CHECKED BY:	CHL

GEOLOGICAL | TESTING

METHOD	WATER	UNIT	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE	CONSISTENCY / RELATIVE DENSITY	RL (m)	DEPTH (m)	SAMPLES TESTS	SAMPLES	DCP Dynamic Cone Penetrometer	ADDITIONAL COMMENTS
WB		Brighton Group			[CONT] Clayey SAND, fine grained, yellow-brown, pale grey, orange brown. 15.4m: Increasing clay content				15.5	SPT 2 4 8 **N=12**			
		Melbourne Formation		ML/CL	Clayey SILT, medium plasticity, pale grey mottled red and yellow-brown. Trace of low to very low strength, dark grey siltstone.	D-M	H		16.0				*16.0 - 20.0m:* Inferred extremely weathered to highly weathered Siltstone/ Sandstone
									16.5	SPT 25/100mm			
									17.0				
									17.5				
									18.0	SPT 25/80mm			
									18.5				
									19.0	19-19.5			
									19.5	SPT 25/80mm			

COMMENTS: 20m: Target Depth

Hole Depth 20m

Scale 1:25

These logs are to be read in conjunction with the full Tonkin & Taylor report

Rev.: A

BOREHOLE LOG

INVESTIGATION Id.: **BH05**

SHEET: 1 OF 4

PROJECT: Balaclava Retail Renewal Precinct		LOCATION: Alfred Street, Balaclava VIC		JOB No.: 1008831.1000.TTAU	
CO-ORDINATES: (UTM55H)	5806946 mN 323491 mE	METHOD:	SA	START DATE:	13/11/2018
		EQUIPMENT:	Comacchio GEO305	FINISH DATE:	13/11/2018
R.L.:	NA	TECHNICIAN:	PWIL	LOGGED BY:	JSPH
DATUM:	NA	CONTRACTOR:	Chadwick Geotechnics	CHECKED BY:	CHL

GEOLOGICAL | TESTING

METHOD	WATER	UNIT	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE	CONSISTENCY / RELATIVE DENSITY	RL (m) / DEPTH (m)	SAMPLES TESTS	SAMPLES	DCP (Dynamic Cone Penetrometer)	ADDITIONAL COMMENTS
SA		Pavement		FILL	ASPHALT (180mm thick)							
				FILL	SAND with gravel, fine to coarse grained, brown. Gravel, fine to medium grained, subrounded to subangular.	D	MD	0.5	0.5			
		Alluvium/Brighton Group		CL	Sandy CLAY trace gravel, medium plasticity, pale grey, yellow-brown. Sand, fine to coarse grained; gravel, fine to medium grained, subangular to subrounded.	M	St	1.0	U63			
								1.5	SPT 6 7 7 **N=14**			
								2.0				
				SC	Clayey SAND trace gravel, fine to coarse grained, yellow-brown, pale grey. Gravel, fine to medium grained, subrounded to subangular.		MD	2.5	SPT 3 7 7 **N=14**			
WB	13/11/2018			CL	Sandy CLAY trace gravel, medium plasticity, pale grey mottled yellow-brown. Sand, fine grained; gravel, fine to medium grained, subrounded to subangular.		St	3.0				
								3.5				
								4.0				
		Brighton Group		SC	Clayey SAND trace gravel, fine grained, pale grey mottled yellow-brown. Gravel, fine to medium grained, subangular.		MD	4.5	SPT 5 7 8 **N=15**			

COMMENTS:

Hole Depth 20m

Scale 1:25

These logs are to be read in conjunction with the full Tonkin & Taylor report

Rev.: A

BOREHOLE LOG

INVESTIGATION Id.: **BH05**

PROJECT: Balaclava Retail Renewal Precinct	LOCATION: Alfred Street, Balaclava VIC		JOB No.: 1008831.1000.TTAU
CO-ORDINATES: (UTM55H) 5806946 mN 323491 mE	METHOD: SA	START DATE:	13/11/2018
	EQUIPMENT: Comacchio GEO305	FINISH DATE:	13/11/2018
R.L.: NA	TECHNICIAN: PWIL	LOGGED BY:	JSPH
DATUM: NA	CONTRACTOR: Chadwick Geotechnics	CHECKED BY:	CHL

GEOLOGICAL | TESTING

METHOD	WATER	UNIT	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE	CONSISTENCY / RELATIVE DENSITY	RL (m)	DEPTH (m)	SAMPLES TESTS	SAMPLES	DCP Dynamic Cone Penetrometer	ADDITIONAL COMMENTS
WB					[CONT] Clayey SAND trace gravel, fine grained, pale grey mottled yellow-brown. Gravel, fine to medium grained, subangular.				5.5				
		Brighton Group		SC	Clayey SAND, fine to coarse grained, pale grey mottled brown and yellow-brown.	M	MD		6.0	SPT 4 5 5 **N=10**			
					7.0m: Predominantly coarse grained sand.		D		6.5				
									7.0				
									7.5	SPT 8 10 25/130mm			
									8.0				
									8.5	8.5-9.0			
				SC	Silty SAND trace gravel, fine grained, yellow-brown mottled pale grey. Gravel, fine to medium grained, subrounded to subangular.		L-MD		9.0	SPT 4 5 9 **N=14**			
									9.5				

COMMENTS:

Hole Depth 20m

Scale 1:25

These logs are to be read in conjunction with the full Tonkin & Taylor report

Rev.: A

BOREHOLE LOG

INVESTIGATION Id.: **BH05**

SHEET: 3 OF 4

PROJECT: Balaclava Retail Renewal Precinct		LOCATION: Alfred Street, Balaclava VIC		JOB No.: 1008831.1000.TTAU	
CO-ORDINATES: (UTM55H)	5806946 mN 323491 mE	METHOD:	SA	START DATE:	13/11/2018
		EQUIPMENT:	Comacchio GEO305	FINISH DATE:	13/11/2018
R.L.:	NA	TECHNICIAN:	PWIL	LOGGED BY:	JSPH
DATUM:	NA	CONTRACTOR:	Chadwick Geotechnics	CHECKED BY:	CHL

GEOLOGICAL | TESTING

METHOD	WATER	UNIT	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE	CONSISTENCY / RELATIVE DENSITY	RL (m)	DEPTH (m)	SAMPLES TESTS	SAMPLES	DCP Dynamic Cone Penetrometer	ADDITIONAL COMMENTS
WB		Brighton Group			[CONT] Silty SAND trace gravel, fine grained, yellow-brown mottled pale grey. Gravel, fine to medium grained, subrounded to subangular.				10.5	SPT 2 4 6 **N=10**			
									11.0				
									11.5				
									12.0	SPT 3 5 6 **N=11**			
									12.5				
									13.0				
									13.5	SPT 2 4 7 **N=11**			
									14.0				
									14.5				

COMMENTS:

Hole Depth 20m

Scale 1:25

These logs are to be read in conjunction with the full Tonkin & Taylor report

Rev.: A

Tonkin+Taylor

BOREHOLE LOG

INVESTIGATION Id.: **BH05**

SHEET: 4 OF 4

PROJECT: Balaclava Retail Renewal Precinct		LOCATION: Alfred Street, Balaclava VIC		JOB No.: 1008831.1000.TTAU	
CO-ORDINATES: (UTM55H)	5806946 mN 323491 mE	METHOD:	SA	START DATE:	13/11/2018
		EQUIPMENT:	Comacchio GEO305	FINISH DATE:	13/11/2018
R.L.:	NA	TECHNICIAN:	PWIL	LOGGED BY:	JSPH
DATUM:	NA	CONTRACTOR:	Chadwick Geotechnics	CHECKED BY:	CHL

GEOLOGICAL | TESTING

METHOD	WATER	UNIT	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE	CONSISTENCY / RELATIVE DENSITY	RL (m)	DEPTH (m)	SAMPLES TESTS	SAMPLES	DCP Dynamic Cone Penetrometer	ADDITIONAL COMMENTS
WB		Melbourne Formation		ML/CL	Clayey SILT, medium plasticity, pale grey mottled red and yellow-brown. Trace of low to very low strength, dark grey siltstone.	D-M	H		15.5	SPT 6 13 25/60mm			*15.0 - 20.0m:* Inferred extremely weathered to highly weathered Siltstone/ Sandstone
									16.0				
									16.5	SPT 25/110mm			
									17.0				
									17.5				
									18.0				
									18.5				
									19.0				
									19.5	SPT 25/60mm			

COMMENTS: 20m: Target Depth

Hole Depth 20m

Scale 1:25

These logs are to be read in conjunction with the full Tonkin & Taylor report

Rev.: A

STANDPIPE RECORD

PIEZO No
BH01

Coordinates: 5806960 mN 323310 mE

Job Name: Balaclava Retail Renewal Precinct Location: Alfred Street, Balaclava VIC

Job No: 1008831.0000
Prepared by: OPRI

Drilling Commencement Date: 16/11/2018
Installation Completion Date: 16/11/2018

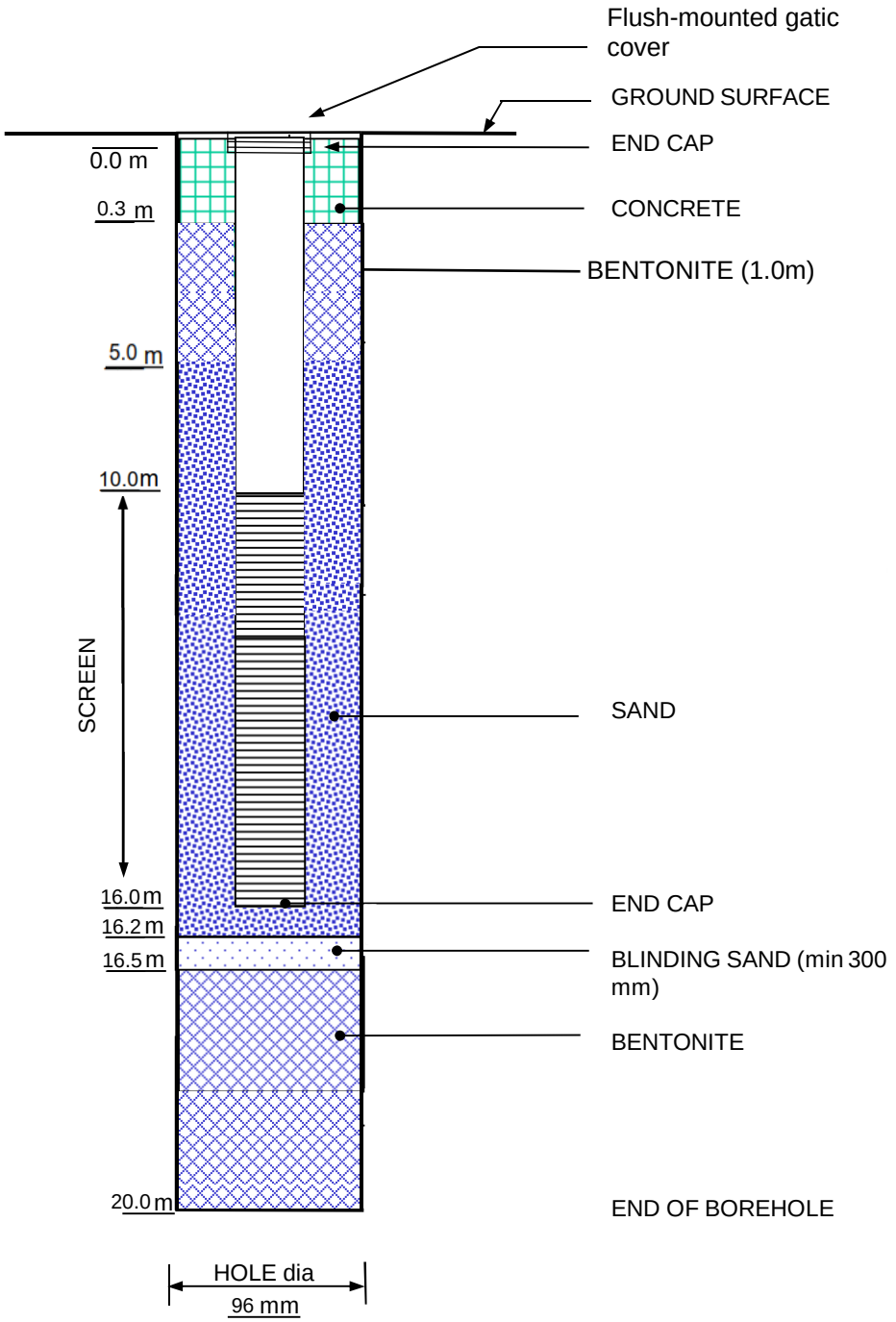


FIGURE B1

STANDPIPE: 50 mm internal diameter PVC

Template
NOT TO SCALE

STANDPIPE RECORD

PIEZO No
BH05

Coordinates:	5806946 mN		323491 mE
Job Name:	Balaclava Retail Renewal Precinct	Location:	Alfred Street, Balaclava VIC
Job No:	1008831.0000	Drilling Commencement Date:	13/11/2018
Prepared by:	OPRI	Installation Completion Date:	13/11/2018

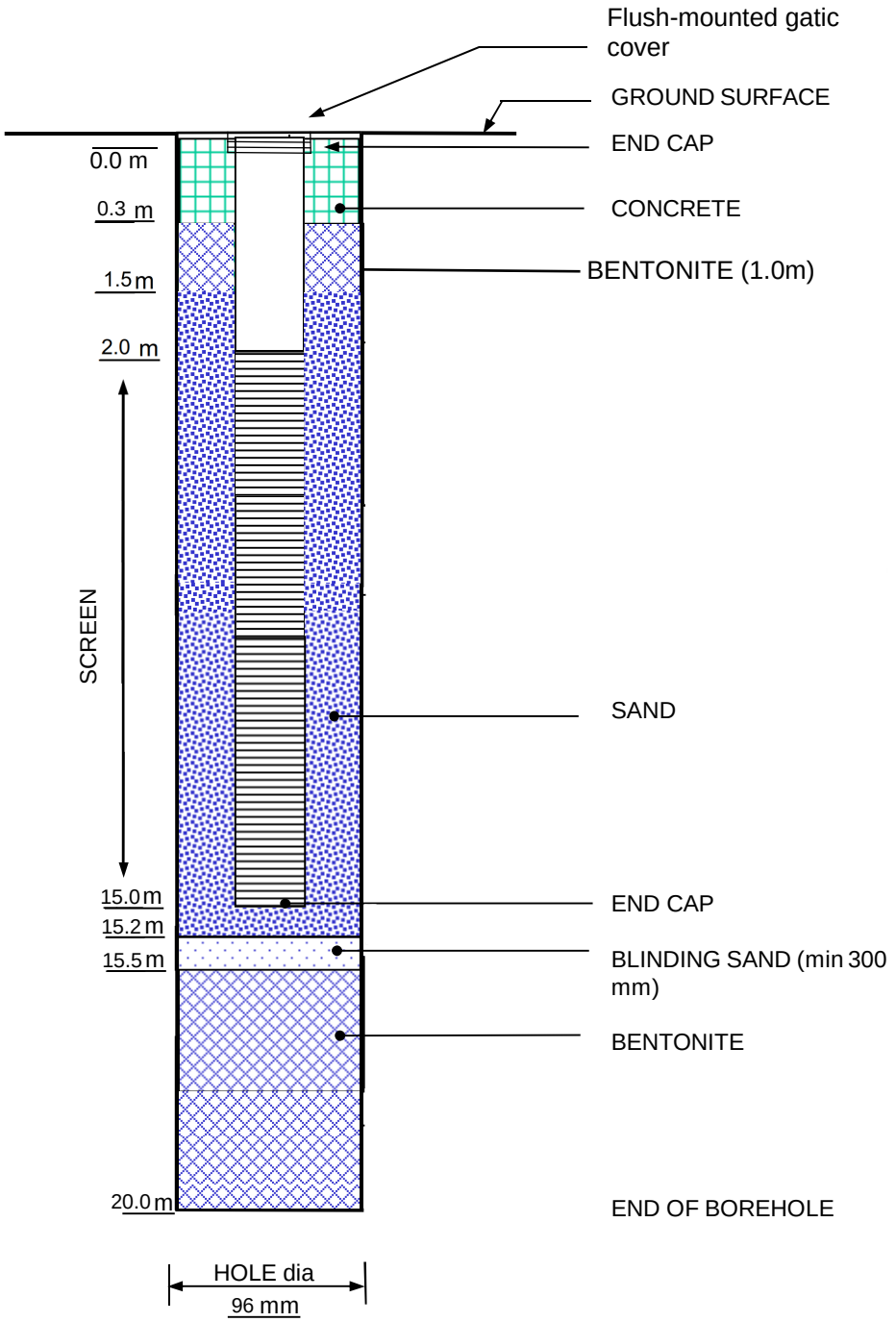


FIGURE B2

STANDPIPE: 50 mm internal diameter PVC

Template
NOT TO SCALE

Appendix C: Laboratory Test Results

Head Office
25 Metcalf Drive
DANDENONG SOUTH VIC 3175

Ph: +61 3 8796 7900
Fax: +61 3 8796 7944

CHADWICK GEOTECHNICS

MOISTURE CONTENT REPORT

Customer: Tonkin & Taylor (Aus) Pty Ltd
Report Number: **W18DS03470**

Customer Address: Ground Floor, 95 Coventry Street, South Melbourne, VIC
Report Date: 30/11/18

Project: Balaclava Retail Renewal Precinct
Request No: 1008831.100

Location: Alfred Street
Test Method: AS 1289 2.1.1

Customer Order No.: -

Testing performed and reported at our Dandenong South Laboratory 12712

Sample No.:	S18DS-13560	S18DS-13562	S18DS-13564	S18DS-13565	S18DS-13566					
ID No.:	-	-	-	-	-					
Lot No.:	-	-	-	-	-					
Date Sampled:	16/11/2018	16/11/2018	16/11/2018	16/11/2018	16/11/2018					
Time Sampled:	-	-	-	-	-					
Date Tested:	26/11/18	26/11/2018	26/11/2018	26/11/2018	26/11/2018					
Material Source:	Insitu	Insitu	Insitu	Insitu	Insitu					
Material Description:	CLAY	Sandy CLAY	Sandy CLAY	Clayey SAND	Sandy CLAY					
To Be Used As:	Material Analysis	Material Analysis	Material Analysis	Material Analysis	Material Analysis					
Sample Location :	BH01 3.0m	BH02 1.5m	BH03 4.0 - 4.5m	BH04 6.0m	BH05 1.0m					
Layer Depth (mm):	-	-	-	-	-					
Test Depth (mm):	-	-	-	-	-					
Sampling Procedure:	Client Sampled	Client Sampled	Client Sampled	Client Sampled	Client Sampled					
Moisture Content (%):	**26.7**	**17.5**	**18.6**	**19.6**	**12.5**					

Remarks:

ilac-MRA NATA Accreditation No. 12719

Accredited for compliance with ISO/IEC 17025. The results of tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

APPROVED SIGNATORY

M Robinson

Form No.: **CG.319.003**

Issue Date: 16/06/2018

CHADWICK GEOTECHNICS

Dandenong South
ACN 143 009 330
25 Metcalf Street
DANDENONG SOUTH, VIC 3175

Ph: + 61 3 8796 7900
Fax: +61 3 9706 9431

Report No: MAT:S18DS-13563/1
Issue No: 1

Material Test Report

Client: Tonkin & Taylor (Aus) Pty Limited
Address: Ground Floor, 95 coventry Street
SOUTH MELBOURNE VIC 3006
Project: Balaclava Retail Renewal Precinct
Project No.: 1008831.1000
Order No.: **CG Request No.:**
TRN: **Lot No.:**

Accredited for compliance with ISO/IEC 17025 – Testing

The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

Approved Signatory: M. Robinson
(Senior Technician)
12712 Date of Issue: 30/11/2018

Sample Details

Location	Alfred Street
Sample Location	BH02, 2.5m
Field Sample ID	4
Date Sampled	19/11/2018
Source	In-Situ
Material	Sandy Clay
Specification	AS Grading
Sampling Method	AS1289.1.2.1 Clause 6.4 (b)
Sample ID	S18DS-13563

Test Results

Description	Method	Result	Limits
Sample History	AS 1289.1.1	Oven-dried	
Preparation	AS 1289.1.1	Dry Sieved	
Linear Shrinkage (%)	AS 1289.3.4.1	11.0	
Mould Length (mm)		250	
Crumbling		No	
Curling		Yes	
Cracking		Yes	
Liquid Limit (%)	AS 1289.3.1.2	40	
Plastic Limit (%)	AS 1289.3.2.1	11	
Plasticity Index (%)	AS 1289.3.3.1	29	

Comments

N/A

Dandenong South
ACN 143 009 330
25 Metcalf Street
DANDENONG SOUTH, VIC 3175

Ph: + 61 3 8796 7900
Fax: +61 3 9706 9431

Report No: MAT:S18DS-13561/1
Issue No: 1

Material Test Report

Client: Tonkin & Taylor (Aus) Pty Limited
Address: Ground Floor, 95 coventry Street
SOUTH MELBOURNE VIC 3006
Project: Balaclava Retail Renewal Precinct
Project No.: 1008831.1000
Order No.: **CG Request No.:**
TRN: **Lot No.:**

Accredited for compliance with ISO/IEC 17025 – Testing

The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

Approved Signatory: M. Robinson
(Senior Technician)
12712 Date of Issue: 30/11/2018

Sample Details

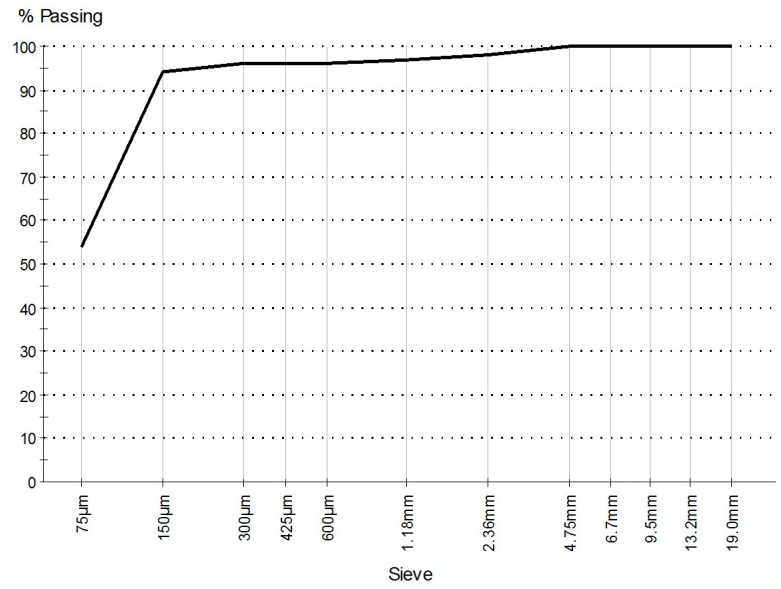
Location	Alfred Street
Sample Location	BH01, 10.5m
Field Sample ID	2
Date Sampled	16/11/2018
Source	In-Situ
Material	Silty Sand
Specification	AS Grading
Sampling Method	AS1289.1.2.1 Clause 6.4 (b)
Sample ID	S18DS-13561

Other Test Results

Description	Method	Result	Limits
Moisture Content (%)	AS 1289.2.1.1	18.3	

Particle Size Distribution

AS 1289.3.6.1



Drying by: Oven
Date Tested: 29/11/2018

Note: Sample Washed

Sieve Size	% Passing	Limits
19.0mm	100	
13.2mm	100	
9.5mm	100	
6.7mm	100	
4.75mm	100	
2.36mm	98	
1.18mm	97	
600µm	96	
425µm	96	
300µm	96	
150µm	94	
75µm	54	

Comments

N/A

www.tonkintaylor.com.au