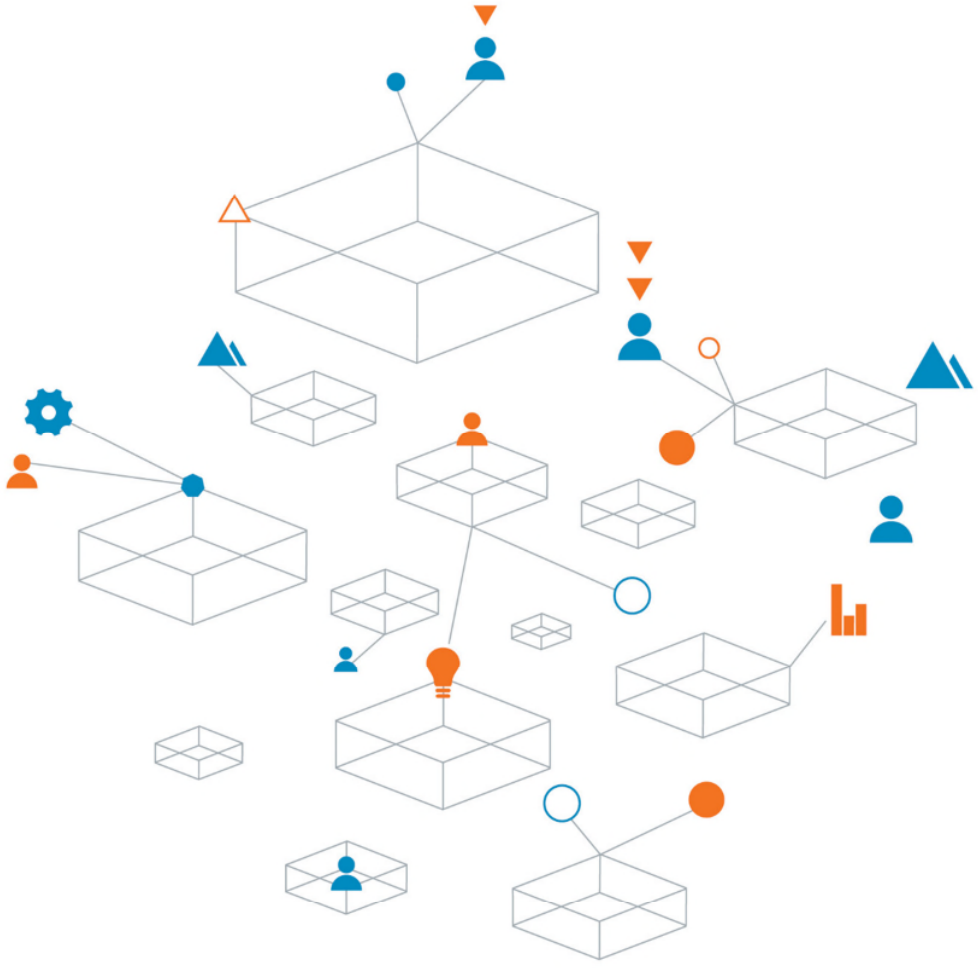
CMT Architects Australia Pty Ltd
21 Canterbury Road, Punchbowl
Geotechnical Desktop Study Report
754-SYDGE233393-AB

12 December 2019



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21 Canterbury Road

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1. Introduction

1.1. General

Coffey Services Australia Pty Ltd (Coffey) was engaged by CMT Architects Australia Pty Ltd (CMT or the "Client") to provide geotechnical and environmental services to support the proposed development at 21 Canterbury Road, Punchbowl (the "site"). Based on discussions with Mr. Antonios Sofios of CMT Architects Australia Pty Ltd (CMT), it is understood that a geotechnical report and an Acid Sulfate Soil Management Plan (ASSMP) are required to support the Development Application (DA) for the proposed development.

This report presents the findings of the Geotechnical Desktop Study only. A Preliminary ASSMP is issued as a separate report (Coffey Document Ref. SYDGE233393-GET-RPT-02).

The location and boundaries of the development site are shown on the Location Plan in Appendix B - Figure 1.

1.2. Background

Coffey understands that CMT propose to lodge a Development Application to Canterbury Bankstown Council for development of the site comprising:

- Demolition of existing structures.
- Construction of a five-storey commercial building in the south of the site including:
  - A two-level basement with the lower level to provide car parking and storage, and the upper level to host a supermarket, seating area, storage rooms and loading zone.
  - A ground floor featuring Club Punchbowl and retail or commercial spaces.
  - A first and second floors with commercial spaces.
- Car parking with up to 200 spaces in the north of the site.
- Landscaping around the new commercial building, site boundary and a garden area in the north-west of the site.

Development plans prepared by CMT are provided in Appendix E.

1.3. Objectives

The objective of this report is to present the findings of a desktop review of available data to characterise ground conditions within the site and inform the scope of geotechnical and contamination investigations required to support the design of the proposed development.

2. Site Information

The site is currently occupied by Club Punchbowl, with at-grade asphalt parking, a two-storey building, vegetation and a transmission tower. It is fronted by Canterbury Road to the south, Punchbowl Road to the east, residential properties to the north, and residential and commercial properties to the west.

Site identification details are outlined in Table 1. The location of the site is shown in Figure 1 attached in Appendix B.

Table 1: Site Information

Item	Description
Address	21 Canterbury Road, Punchbowl. The site is also identifiable as 921 Punchbowl Road, Punchbowl, NSW 2196
Site area	Approximately 1.8 hectares (ha)
Title identification	The legal description of the site is: • A//DP378634 • D//DP382627 • 6//DP5245 • 15//DP132440 • 14//DP132440 • 1//DP236825 The lot boundaries are shown on Figure 1 attached.
Local Government Authority	Canterbury Bankstown Council
Current land use	Commercial property (Club Punchbowl)

A site walkover was carried out on 31 October 2019 by an experienced Geotechnical Engineer from Coffey. The following was noted:

- A two-storey commercial property (Club Punchbowl) was present in the south of the site, which occupied approximately 1ha. The remainder of the site was largely covered with bitumen or concrete for car parking and walkways. The perimeter of the site was partially landscaped with trees and shrubs.
- Dumped waste was evident on the boundaries of the property in the north of the site.
- An open stormwater channel (concrete and brick-lined) runs along the western boundary of Lot A and through the western portion of Lot D. A covered stormwater channel runs across the site in the east-west direction and joins the open channel.
- An electricity pylon and transmission easement were present in the north-west of the site.
- Two groundwater monitoring wells were identified (BH7/GW2 and BH14/GW3) in the west and south-east of the site respectively. The wells were gauged with a dip meter which recorded depths to water of 2.49m below ground level (BGL) and 2.96m BGL respectively. The third well installed by Benviron group was not located. The locations of the wells are shown on the borehole plan in Appendix C.

3. Site Setting

3.1. Topography

The survey plan provided by CMT indicates that the general ground elevations at the site range from approximately 6 m to 8 m AHD, with the surface on site gently sloping towards the stormwater channel junction to the northwest of the existing building. The survey plan provided by CMT is attached as Appendix D. The regional topography is relatively flat and slopes down towards the southwest to Salt Pan Creek.

3.2. Regional Geology

The Sydney Area 1:100,000 and 1:25,000, Coastal Quaternary Geology Map Series indicates that the site is underlain by Quaternary alluvium fill comprising silt, clay, fluvial sand and gravel. The Sydney 1:100,000 Geological Sheet 9130 indicates the site is situated on a boundary between two units: Quaternary alluvium consisting of silty to peaty quartz sand, silt and clay to the west, and Ashfield Shale of the Wianamatta Group, characterized by black to dark grey shale and laminate to the east. The north-western portion of the site and the southwest corner are underlain by Quaternary alluvium and the southeast portion of the site is underlain by Ashfield Shale.

Appendix B – Figure 3 illustrates the site location in relation to these geological units.

3.3. Surface Drainage

A concrete and brick-lined stormwater channel runs along the western boundary of Lot A and through the western portion of Lot D. A connecting channel/culvert traverses the site in the east-west direction and joins the western stormwater channel. This western channel then continues underneath the adjacent property at 23 Canterbury Road, passes through a bridge on Canterbury Road and joins Salt Pan Creek at Gow Street approximately 0.5 km to the southwest. The channel had approximately 1-2 cm of water at the time of the site visit however is expected to vary with rainfall.

3.4. Groundwater

There are no registered groundwater bores within 500 m of site. It is expected groundwater would follow regional topography and flow towards Salt Pan Creek to the west. Benviron Group installed three groundwater monitoring wells around the site during the intrusive site investigation in June 2016. A Coffey geotechnical engineer attended the site on 31 October 2019 and obtained groundwater level measurements in two of the three wells. Monitoring well GW1 in the north of site could not be located due to a significant amount of debris on the pavement. Table 2 summarizes the groundwater level measurements available to date. Collar elevations for the monitoring wells were estimated from the site survey plan provided in Appendix D.

Table 2: Measured Groundwater Levels

Measurement Date	GW1 (7.77 m AHD)		GW2 (6.37 m AHD)		GW3 (7.42 m AHD)	
	Depth (m)	RL (m AHD)	Depth (m)	RL (m AHD)	Depth (m)	RL (m AHD)
1 June 2016	3.6	4.1	3.4	2.97	4.9	2.52
31 October 2019	-	-	2.49	3.88	2.96	4.46

3.5. Soil Landscapes Map

Reference to the Soil Landscapes of Sydney 1:100,000 Sheet 9130 Map and report indicates the soil landscape of the site and its surrounds is predominantly the Birrong Alluvial Landscape, with the southeast and northeast corners belonging to the Blacktown Residual Landscape.

Birrong Alluvial Landscapes are characterised by level to gently undulating alluvial floodplain draining Wianamatta Group shales. Majority of the site is underlain by the Birrong Alluvial soils which consist of silt and clay sized alluvial materials derived from the Wianamatta Group. They typically range from slightly acidic (pH 6.5) to strongly acidic (pH 4.5), increasing acidity with depth. Birrong Alluvial soils are slightly to moderately reactive. The potential for erosion hazard is considered low to moderate.

Blacktown Residual Landscapes are characterized by gently undulating rises on Wianamatta Group shales. Blacktown Residual Soils are present in the southeast and northeast corners of the site and generally consist of brown-black clay and loam residual soils derived from the underlying Wianamatta Group shales. They typically range from slightly acidic (pH 6.5) to strongly acidic (pH 4.0), increasing acidity with depth. Blacktown Residual soils are slightly to moderately reactive and moderately to highly plastic. The potential for erosion hazard is considered low to high.

Appendix B – Figure 4 illustrates the site location in relation to the surrounding soil landscapes.

3.6. Acid Sulfate Soils Risk Map

Reference to Department of Land and Water Conservation Botany Bay Acid Sulfate Soil Risk Map 1997 (2nd Edition) indicates the site is underlain by 'disturbed terrain'. Since the site is situated within the flood plain of Salt Pan Creek, the terrain is likely a filled area which occurred during reclamation of low-lying swamps for urban development. Intrusive site investigations and laboratory testing are required to assess the presence of Acid Sulfate Soils. Refer to Coffey's report SYDGE233393-GET-RPT-02 for further discussion on Acid Sulfate Soils management.

3.7. Utility Assets

Further to a Dial-Before-You-Dig search (DBYD), the following utility asset owners responded as owning assets within or adjacent to the subject site: Ausgrid, Jemena, NBN, Nextgen, Optus, PipeNetworks, Roads and Maritime Services, Sydney Water, and Telstra. The utility asset information is summarised in Table 3.

Table 3: Utility Asset Details

Asset Owner	Asset Type	Location
Ausgrid	Fibre Optic	Not shown within site.
Jemena	Gas Lines	Not shown within site.
NBN	Fibre Optic	Not shown within site.
Nextgen	Fibre Optic	Not shown within site
Optus/Uecomm	Fibre Optic	Not shown within site
PipeNetworks	Telecommunications	Not shown within site
Roads and Maritime Services	Traffic Control Signal / Electrical installation	Not shown within site
Sydney Water	Sewer and stormwater channels	225 mm Salt Glazed Ware (SWG) sewer runs east-west along the northern boundary of Lot 15 and a 150 mm SWG sewer branch runs north-south along the eastern boundary of Lot A. Open stormwater channel runs along the western boundary of Lot A and through the western portion of Lot D. Covered stormwater channel runs east-west along the northern boundary of Lot 14&15.
Telstra	Telecommunications	Telstra plant in shared utility trench. 50 mm PVC conduit extends 40 m west from the cable joining 6-pit at Punchbowl Road at the southeast corner of site.

3.8. Easements

According to drawings provided by CMT there are currently five easements on the site. Refer to Table 4 for details and Appendix G for an Easements Plan.

Table 4: Easement Details

ID	Owner		Location
A	Sydney Water	Easement for drainage in C767645	Easement runs along the western boundary of Lot A and through the western portion of Lot D, as well as east-west along the northern boundary of Lot 15.
A1	Optus	Lease to Optus Mobile in 757102	Eastern portion of Lot 14.
C	Ausgrid	Right of Way and Easement for Electricity Purposes 3.97 wide in 8166752	Southwest corner of site adjacent to western and southern property lines.
S	Ausgrid	Easement for transmission line in G14288	Easement runs northeast to southwest and occupies most of Lot D and the western portion of Lot A.
T	Ausgrid	Easement for transmission line in F9281154	Easement runs northeast to southwest and occupies most of Lot D and the western portion of Lot A.

4. Previous Reports

Coffey viewed the following reports provided by CMT:

- Detailed Site Investigation (DSI), 921 Punchbowl Road, Punchbowl, NSW, Benviron Group, September 2016;
- Overland Flood Study, No. 21 Canterbury Road, Punchbowl, ACOR Consultants (CC) Pty Ltd, September 2016.
- Correspondence, Proposed Residential Development, 21 Canterbury Road, Punchbowl, Club Punchbowl Site, National Project Consultants Pty Ltd, 12 December 2014.

4.1. Benviron Group DSI

A detailed site environmental investigation was conducted by the Benviron Group on behalf of Westwood Pty Ltd in June 2016 (Ref: E881). A total of 31 boreholes were drilled during the intrusive site investigation to depths between 0.5 m and 5.5 m below grade (mbg). Three groundwater monitoring wells were installed to depths of 5.5 m, 4.0 m, and 5.5 m for GW1, GW2 and GW3 respectively.

The typical stratigraphy across the site comprises bitumen pavement or topsoil, underlain by fill, followed by alluvial soil, residual soil, and weathered shale bedrock. The soil materials are summarised below:

- **FILL:** Brown Gravelly Silt with some or trace of sand;
- **ALLUVIAL SOIL:** Brown, orange and grey low plasticity Silty Clay;
- **ALLUVIAL SOIL:** Grey, orange, brown Clayey Silt;
- **RESIDUAL SOIL:** Brown and grey low to medium plasticity Silty Clay with ironstone fragments;
- **BEDROCK:** Brown and dark grey weathered Shale.

Bitumen pavement where present was approximately 0.1 m thick. Fill thickness typically varied between 0.2 m and 0.4 m, except in BH22 where fill reached a thickness of 1.7 m. Alluvial soil was observed in every borehole underlying the fill material to a maximum depth of 2.5 m. Only three of the boreholes extended into the residual soil which was encountered at depths between 1.4 m and 2.1 m. Weathered shale bedrock was encountered at depths of 3.7 m to 5.1 m in the three deeper boreholes. Table 5 presents a summary of materials encountered in the boreholes.

Table 5: Benviron DSI Borehole Summary

Borehole ID	Termination Depth (m)	Fill (m)	Silty Clay (m)	Gravelly Clay (m)	Clayey Silt (m)	Silty Clay (m)	Shale (m)
BH1/GW1	5.5	0.1 – 0.3	0.3 – 1.8	1.8 – 3.5		3.5 – 4.5	4.5 – 5.5
BH2	1.1	0.1 – 0.4	0.4 – 1.1				
BH3	0.9	0.1 – 0.2	0.2 – 0.4		0.4 – 0.9		
BH4	0.9	0.1 – 0.3			0.3 – 0.9		
BH5	0.5	0.1 – 0.3			0.3 – 0.5		
BH6	1.0	0.1 – 0.3			0.3 – 1.0		
BH7/GW2	4.0	0.1 – 0.3			0.3 – 2.1	2.1 – 3.7	3.7 – 4.0
BH8	1.0	0.1 – 0.3			0.3 – 1.0		
BH9	0.6	0.1 – 0.3			0.3 – 0.6		
BH10	0.5	0.1 – 0.3			0.3 – 0.5		
BH11	1.1	0.1 – 0.3			0.3 – 1.1		
BH12	1.3	0.1 – 0.3			0.3 – 1.3		
BH13	1.1	0.1 – 0.3			0.3 – 1.1		
BH14/GW3	5.5	0.1 – 0.3			0.3 – 1.4	1.4 – 5.1	5.1 – 5.5
BH15	1.1	0.1 – 0.3			0.3 – 1.1		
BH16	0.7	0.1 – 0.3			0.3 – 0.7		
BH17	0.5	0.1 – 0.3			0.3 – 0.5		
BH18	1.0	0.1 – 0.3			0.3 – 1.0		
BH19	1.0	0.1 – 0.3	0.3 – 1.0				
BH20	1.0	0.1 – 0.4			0.4 – 1.0		
BH21	0.7	0.1 – 0.3			0.3 – 0.7		
BH22	2.5	0.1 – 1.8			1.8 – 2.5		
BH23	1.0	0.1 – 0.5			0.5 – 1.0		
BH24	1.0	0.1 – 0.5			0.5 – 1.0		
BH25	0.8	0.1 – 0.3			0.3 – 0.8		
BH26	1.0	0.1 – 0.3			0.3 – 1.0		
BH27	1.0	0.1 – 0.3			0.3 – 1.0		
BH28	0.6	0.1 – 0.3			0.3 – 0.6		
BH29	1.0	0.1 – 0.3			0.3 – 1.0		
BH30	1.0	0.1 – 0.3			0.3 – 1.0		
BH31	0.6	0.0 – 0.3	0.3 – 0.6				

4.2. Overland Flood Study

An overland Flood Study Report for the site was prepared by ACOR Consultants (CC) Pty Ltd (ACOR) (Ref. GO160472) in September 2016. The report presents the results of flood behaviour modelling in the vicinity of the site. The report provides figures showing 100 year ARI flood levels, velocities and provisional hazard categories for the pre- and post-development conditions.

Based on these figures, the post-development flood risk hazard around the proposed new building for the 100 year ARI flood is typically low with water reaching elevations of 6.9 m AHD at the south east corner and 7.6 m AHD along the western boundary of the site. The southwest corner of the site is susceptible to a high flood hazard however the impacted area is small and localized.

Coffey understands that the development plan has changed since the flood study was completed. The previous development plans indicate the proposed construction of four new buildings within the northern portion of the site (Lots A, D, and 6), which have been removed from the current development. The absence of the four buildings to the north is not expected to affect the flood risk interpretation around the currently proposed building footprint.

5. Preliminary Recommendations

5.1. Demolition

Prior to the ground excavation for the proposed development, the existing building and car parking will need to be demolished. Demolition works will be undertaken adjacent to the existing buildings located along the eastern boundary of the 23 Canterbury Road property. An assessment of footings/building foundations of the neighbouring structures should be carried out and used to support the development of a demolition methodology prior to starting demolition works.

Continuous monitoring of the adjacent buildings is recommended during demolition. Prior to the commencement of building demolition works, dilapidation surveys of the adjacent structures are also recommended to be carried out.

The demolition and general construction activities will likely impact the Sydney Water assets located on site, specifically the open and covered stormwater channels and sewer main. Coordination with Sydney Water and application for construction permits will be required prior to demolition activities.

It is recommended that a dilapidation survey of the Sydney Water assets is completed prior to construction works, and activities impacting Sydney Water assets are supervised by a geotechnical engineer.

5.2. Impacts to Structures from Excavations

Based on architectural drawings provided by CMT the proposed building will be constructed adjacent to the western property boundary of 21 Canterbury Road. The proposed two-level basement will likely extend a minimum of 6 m below ground. Adjacent structures at 23 Canterbury Road are located within the zone of influence of the excavation, therefore ground movements will need to be carefully monitored and controlled to within acceptable limits during excavation. Dilapidation surveys are recommended to be carried out before and after excavations to assess the condition of the buildings.

5.3. Excavation-Induced Vibrations

Vibration management and monitoring the impact of vibrations on neighbouring structures will need to be included in excavation planning.

5.4. Excavation Conditions

Basement excavation is expected to encounter fill, alluvial soil, residual soil and shale bedrock. Fill, alluvial and residual soils, and very low strength rock could likely be excavated using conventional earth moving plant such as large tracked excavators, equipped with toothed buckets. Low strength or stronger rock may require excavation techniques such as the use of hydraulic rock breakers fitted to excavators. High strength rock may require use of rock saw. Excavation contractors should inspect the engineering borehole logs to make their own judgment as to likely productivity, or suitability of specific plant.

5.5. Excavation-Induced Ground Movements

Excavation of the basement may induce some ground movements in the adjacent properties and services due to removal of lateral support.

When excavated at steep angles, soil and very low to low strength rock generally needs lateral support to remain stable. Documented data shows even when well-constructed shoring is constructed to maintain stability, the vertical and lateral movements that result from the excavation may be 0.1% to 0.3% of the retained height.

Excavation in stronger rock may not need temporary or long-term support to remain stable, but excavated faces can still experience lateral and vertical ground movement due to stress relief depending on the rock structure (joints and defects) and “locked-in” stresses related to geological processes.

The zone of influence for excavation induced ground movements in soil and rock could extend 1.5 to 2 times the excavated depth from the edge of excavation.

5.6. Excavation Support

Unsupported excavations in fill, alluvial and residual soil will require batters in the order of 2 to 1.5 (H):1(V).

The magnitude of excavation-induced ground movements will depend on the ground conditions and lateral pressures they induce, the shoring system adopted, and the construction sequence and workmanship.

The type of retention system used will depend upon the requirements for a stiff and/or watertight wall. For this type of project, Soldier Pile Wall or Contiguous Pile Wall retention systems could be considered.

For depths of excavation in the order of 6 m, it is unlikely that cantilevered pile walls will be adequate to limit adjacent ground movements. To provide additional wall stiffness, pile walls may need to be internally propped or anchored. The use of temporary or permanent anchors under the adjoining streets and properties will require owner permission.

Numerical analysis based on site specific geotechnical investigation is recommended to assess likely ground movements for design of the shoring system.

5.7. Groundwater

Groundwater measurements to date indicate levels of approximately 2-5 m AHD however this range will likely change in response to rainfall, flooding and other factors. Groundwater level is currently above the base of the excavation. If seepage rates into the excavation are low, the basement could be designed as drained using conventional sump and pump methods subjected to appropriate approvals. (The release of groundwater to stormwater is regulated and is subject to regulatory approvals including environmental assessment and approval). If high groundwater inflows occur, the basement may need to be designed as a tanked basement.

5.8. Foundations

Existing information is not sufficient to provide comment on foundation design. Coffey is able to provide recommendations following the geotechnical site investigation detailed below.

5.9. Proposed Intrusive Geotechnical Investigation

As previously proposed by Coffey, it is recommended to carry out an intrusive geotechnical investigation within the footprint of the proposed building. Coffey proposed a drilling program comprising four boreholes to depths of 15 m. No further investigation is proposed in the car park areas. The boreholes will be augered to V-bit refusal and then advanced to depth using NMLC coring techniques to provide information regarding the bedrock mass and intact properties. Standard penetration tests (SPT) would be undertaken at approximately 1.5 m intervals when drilling through the soil profile to assess soil strength parameters.

One groundwater monitoring well will be installed to 15 m depth to provide groundwater information within the bedrock and an additional groundwater sampling location.

Laboratory testing will comprise the following:

- Two Unconfined Compressive Strength (UCS) tests on select rock samples;
- Point Load Strength Index testing of rock core at approximately 1 m intervals (where possible);
- Two sets of Atterberg Limits Tests and Particle Size Distribution (PSD) tests for material classification purposes;
- Two soil aggressivity test suites including pH, electrical conductivity, sulphate, chloride;
- Soil samples will be collected at 0.5 m intervals for analysis of the presence of acid sulfate soils. Up to 32 samples will be screened for pHf and pHfox, then based on these results, SPOCAS (Suspension Peroxide Oxidation Combined Acidity and Sulphur) analysis would be selected for up to 8 samples.

6. Limitations

Appendix A contains a document entitled “Important information about your Coffey report” which forms an integral part of this report and presents additional information about its uses and limitations.

7. References

Chapman, G.A., Murphy, C.L., Tille, P.J., Atkinson, G., and R.J. Morse (2009). Sydney 1:100000 Soil Landscape Series Sheet 9130, 4th edition. Department of Environment, Climate Change and Water.

Chapman, G.A., Murphy, C.L., Tille, P.J., Atkinson, G., and R.J. Morse (2009). Soil Landscapes of the Sydney 1:100000 Sheet Report, 4th edition. Department of Environment, Climate Change and Water.

Murphy, C.L. (1997). Botany Bay 1:25000 Acid Sulfate Soil Risk Map, 2nd edition. Department of Land and Water Conservation.

Troedson, A.L. 2015. Sydney Area 1:100000 and 1:25000, Coastal Quaternary Geology Map Series. Geological Survey of New South Wales, Maitland.

Wilson, G., McDonald, I.D., Roy, P.S. and C. Herbert (1983). Sydney 1:100 000 Geological Sheet 9130, 1st edition. Geological Survey of New South Wales, Sydney.

Appendix A – Important Information About Your Coffey Report

Appendix B – Figures

Appendix C – Benviron DSI Borehole Location Plan

Appendix D – Survey Plan

Appendix E – Development Plan

Appendix F – DBYD

Appendix G – Easements Plan