Douglas Partners
Geotechnics / Environment / Groundwater

Integrated Practical Solutions

Remediation Action Plan

Proposed Residential Development
7 Concord Avenue, Concord West

Prepared for
F.T.D Holdings (Concord West) Pty Ltd
& Floridana Pty Ltd

Project 84964.02
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The undersigned, on behalf of Douglas Partners Pty Ltd, confirm that this document and all attached drawings, logs and test results have been checked and reviewed for errors, omissions and inaccuracies.

	Signature	Date
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Glossary of Terms

ABC	Ambient background concentration
ACL	Added contaminant limit
ACM	Asbestos-containing materials
AEC	Area of environmental concern
AHD	Australian height datum
ANZECC	Australian and New Zealand Conservation Council
ARCP	Asbestos Removal Control Plan
ARMCANZ	Agriculture and Resource Management Council of Australia and New Zealand
AST	Aboveground storage tank
AS	Australian Standard
ASS	Acid sulphate soil
ASSMP	Acid Sulphate Soil Management Plan
bgl	Below ground level
BTEX	Benzene, toluene, ethylbenzene, and xylenes
CEC	Cation exchange capacity
CEMP	Construction Environmental Management Plan
CLM	Contaminated Land Management
CSM	Conceptual site model
DP	Douglas Partners Pty Ltd
DQI	Data quality indicators
DQO	Data quality objectives
DSI	Detailed site investigation
EIL	Ecological investigation level
EPA	Environment Protection Authority
ESL	Ecological screening level
GIL	Groundwater investigation levels
HIL	Heath investigation levels
HSL	Health screening levels
LNAPL	Light non-aqueous phase liquids
m	Metres
mg/kg	Milligrams per kilogram
mg/L	Milligrams per litre
NATA	National Association of Testing Authorities, Australia
NEPC	National Environment Protection Council
NSW	New South Wales
µg/L	Micrograms per litre
OCP	Organochlorine pesticides

OEH	Office of Environment and Heritage
OHS	Occupation Health and Safety
PAEC	Potential areas of environmental concern
PAH	Polycyclic aromatic hydrocarbons
PCB	Polychlorinated biphenyls
POEO	Protection of the Environment Operations
PQL	Practical quantitation limit
PID	Photo-ionisation detector
PPE	Personal protective equipment
PR	Principal's Representative
ppm	Parts per million
QA	Quality assurance
QC	Quality control
RAP	Remediation Action Plan
SMP	Site management plan
TEQ	Toxicity equivalence quotient
TPH	Total petroleum hydrocarbons
TRH	Total recoverable hydrocarbons
UFP	Unexpected Finds Protocol
UST	Underground storage tank
VOC	Volatile organic compounds
WHS	Work health and safety

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7 Concord Avenue, Concord West

1. Introduction

1.1 General

This Remediation Action Plan (RAP) details the work required to remediate 'the site' located at 7 Concord Avenue, Concord West for the proposed residential development. It also details the work required to subsequently validate the success of the remediation. The RAP was commissioned by F.T.D Holdings (Concord West) Pty Ltd & Floridana Pty Ltd to support a development application.

The RAP is based on the information presented in:

- Douglas Partners Pty Ltd (DP), *Report on Detailed Site Investigation for Contamination, Concord Avenue, Concord West,* (reference 84964.01.R.001), November 2015 [DP, 2015].

1.2 Site Identification

Site details are provided in Table 1, and the site boundary and location are shown on Drawing 1, Appendix A.

Table 1: General Site Information

Item	Description
Land Parcel	Lot 1 in Deposited Plan 219742
Site Address	7 Concord Avenue, Concord West
Local Government Authority	City of Canada Bay Council
Total Site Area	15,014 m^2
Adjacent Land Use	East and north: residential North-west: vacant West: Homebush Bay Drive South: commercial

1.3 Proposed Development

According to the Planning Proposal (Antoniades Architects, November 2015), the proposed development of the site is for multistorey residential apartment buildings over one level of common basement car parking covering much of the site. The proposed basement does not extend to any of

the site boundaries. Landscaping, footpaths and driveways are proposed at peripheral areas of the site. Landscaping and visitor parking is proposed between buildings, and will be directly above the proposed basement. An overland flow path (for stormwater), running east to west, will be constructed above the basement car parking level and will cross peripheral landscaping.

The proposed basement level will be at approximately RL -0.8 and -1.5 m. Peripheral ground level landscaping will be at approximately RL 2.3 m and ground level visitor parking will be at approximately RL 2.2 m. According to the site survey plan (Project Surveyors, March 2010) provided by the client, the current site level is at approximately 1.7 m AHD. Therefore, excavations for the proposed basement are anticipated to be to depths of between 2.5 m and 3.5 m below the current ground level. Some filling may be required at peripheral areas of the site. Groundwater was measured at depths of between 0.76 m and 2.16 m below the current ground level (on 22 October 2007), and, therefore some excavation below the groundwater table is expected. [It is noted that surface levels shown in the survey plan provided by the client differ to those presented in DP (2015). Levels presented in DP (2015) were sourced from the survey by S. McN. Bland Pty Ltd, 19 May 2006].

Planning Proposal plans are provided in Appendix A.

2. Objectives and Scope

The remediation goals are to:

- Render the site suitable for the proposed residential land use;
- Maintain records of the remediation works undertaken and validate the success of the remediation;
- Mitigate adverse impacts on surrounding land and waterways during the remediation by the management of dust and water; and
- Maximise the protection of workers involved with remediation and earthworks.

In this regard, the objectives of the RAP are to:

- Establish an appropriate remediation strategy so as to render the site suitable for the proposed development from a contamination perspective;
- Establish the site assessment criteria to be adopted for the remediation of the site and the validation requirements to confirm the successful implementation of the remediation strategy;
- Establish appropriate environmental safeguards required to complete the remediation works in an environmentally acceptable manner; and
- Establish appropriate work health and safety (WHS) procedures required to complete the remediation works in a manner that would not pose a threat to the health of site workers or users.

3. Site Description

A site plan is included as Drawing 1, Appendix A. A site walkover was conducted on 13 August 2015 by a DP environmental engineer for DP (2015). Observations made are described below.

A broadly rectangular, two-storey, mainly brick building occupied the southern two-thirds of the site. The majority of the building was used by Spitfire Paintball for indoor paintball skirmish and indoor karting. The northern end of the building was used by Firmstone for storage of equipment used for concreting. Spitfire Paintball and Firmstone both used office space at the southern end of the building.

Car-parking spaces (on concrete and asphalt surfaces) and strip gardens were located on the southern and eastern sides of the building and were accessible from Station Avenue. Truck access was on the eastern side of the building.

The western part of the site was mainly grassed covered. An area used for wash down of equipment from paintball skirmish had resulted in a muddy and stained surface soil. Small mounds of soil and general waste materials were also observed.

The land immediately to the north of the building was largely unsealed. Waste items including old paint cans, timber and drums were stored in this area.

The northern portion of land was vacant and was separated from the remainder of the site by chain-link fencing.

A disused underground storage tank (UST) was located at the south of the site. No bowsers were present, but the footprint of a former bowser was located approximately 40m to the east of the UST. Drawing 1, Appendix A shows the location of the UST and the bowser footprint. An electrical substation was located at the south of the building.

An above-ground storage tank (AST) was located at the south-west corner of the building. It was understood that the AST was used for heating oil. The AST was on an asphalt surface which was cracked near the building wall. The AST did not have a bund. Associated piping was observed to be above ground. Drawing 1, Appendix A shows the location of the AST.

A cabinet was located at the east of the building for the storage of fuel for the karts. This area was used for the maintenance of the karts.

4. Regional Topography, Geology and Hydrogeology

Regional topographical, geological and hydrogeological information sourced from DP (2014) is summarised below.

The site is relatively level, however, the land to the east slopes up from the site. Powells Creek is approximately 200 m to the west of the site. The inferred groundwater flow at the site is thus is to the west, towards Powells Creek. Rainfall, on the impermeable surfaces (asphalt and concrete) at

the site, is likely to enter stormwater drains. Some of the rainfall at permeable surfaces (garden areas and at the north of the site) is expected to infiltrate soils.

Reference to the Sydney 1:100 000 Geological Sheet indicates that the site lies on the boundary of areas indicated as underlain by man-made fill over alluvial and estuarine sediment including silty to peaty quartz sand, silt, and clay (western side); and Ashfield Shale comprising black to dark-grey shale and laminite (eastern side).

According to the Canada Bay Local Environmental Plan 2013 Acid Sulfate Soils Map (Sheet ASS_002), the site is in a "Class 2" area, where an acid sulphate soils assessment is required if works are undertaken below the natural ground surface or works are likely to lower the groundwater table. According to NSW Acid Sulfate Soil Risk mapping (1994-1998), the site is in an area of "Disturbed Terrain" which may include filled areas, which often occur during reclamation of low-lying swamps for urban development. Investigations are required to assess these areas for acid sulphate soils.

According to NSW Office of Water's website, there are three registered groundwater bores within 500 m of the site, however all three groundwater bores are on the opposite side of Powells Creek to the west. The three bores were used for monitoring purposes, but no soil or groundwater data was provided.

5. Site History Summary

A summary of site history, sourced from DP (2014), is described below.

The site did not appear to have been developed until circa 1964, when Fred Hosking Sales Pty Limited became owners of the site. Field investigations revealed that the site has undergone filling to level the site prior to construction of the existing building. The site was probably used as a printing facility from 1964 to 2010. The building is now used for paintball skirmish, indoor karting and equipment storage.

Council records make reference to the storage of petrol at the site in 1965. This may be in reference to the 9000 L UST that was to be removed as part of factory building extensions in 1990 and also the 2000 gallon (9000 L) UST referred to in WorkCover Dangerous Goods Licence 35/011268 (1973). The bowser for this tank is not present and is assumed to have been removed as part of building extensions (see Drawing 1, Appendix A for the estimated location of this UST and bowser). The other UST (10 000L), still present at the site, was probably filled with sand in 1991. The associated bowser may have been removed at the same time.

According to Council records, in 1986, the western boundary of the site had been buried in "hundreds of tonnes of earth" from roadworks associated with Homebush Bay Drive. In 1989, the north-eastern corner of the site that had been used as a "builder's yard" since 1966, was filled without consent from the Council. In 2002, 10 to 12 empty chemical drums were found at the western boundary of the site but had probably been there for an extended period (5 to 10 years) as the drums were rusted.

A roofed package store was previously present inside the factory building, and was probably used for the storage of chemicals between 1991 and 2010, and perhaps earlier. Chemicals to have been stored in this facility include Isopropanol (400 L), 'Flexol PI', ethanol, paint, acrylic thinners, solvents and petroleum products. Drums noted to have contained resins, starches and solvents were previously stored at the site.

The AST, located at the south-west corner of the factory building, has been used for storage of heating oil. A cabinet is located at the east of the building for the storage of fuel for the karts. Wash down of equipment from paintball skirmish occurs at the west of the site.

Fuel and/or chemicals were also previously stored at the neighbouring land to the south and east.

6. Intrusive Investigation Findings and Conceptual Site Model

Intrusive field investigations were conducted by DP in 2007 and the findings are presented and discussed in DP (2015). Intrusive investigations at the site comprised soil sampling from 25 test bores (103 to 105, 201 to 204, 207 to 222, 228 and 229 as shown on Drawing 1, Appendix A) and groundwater sampling from four installed groundwater monitoring wells (203, 204, 207 and 213 as shown on Drawing 1, Appendix A). A summary of the findings and discussion from DP (2015) is provided below.

6.1 Soil Observations

Test bore logs are provided in Appendix B.

Filling materials observed underneath the building at the site consisted, mainly, of a thin layer of sand (underneath a concrete slab) underlain by clay type fills with smaller proportions of gravel and silt. Filling was observed at depths of up to 1.3 m bgl. However, refusal in filling materials was encountered at three locations (Test Bores 202, 210 and 212). A slight hydrocarbon odour was noted in the filling at Test Bore 209 from 0.5 m to 1.0 m bgl.

Filling materials at the north-eastern corner of the site (at Test Bores 213, 214 and 104) were observed to be a layer of sand, gravel and recycled concrete filling with trace amounts of rootlets and wire; underlain by a clay or gravelly clay type filling to a depth of up to 0.8 m. Three fragments of fibre-cement were noted on the ground surface in the vicinity of Test Bores 104 and 214 at the time of sampling (2007). It is noted that fibre cement-fragments were not observed on the ground surface during the site walkover on 13 August 2015.

At the time of soil sampling, the north-western corner of the site was inaccessible for a drilling rig. Hand tools were used to take a surface filling sample (to a depth of 0.1 m bgl) which was identified to be a silty clay material with trace amounts of gravel, rock pieces, metal pieces, tile fragments and bone. The surface material was underlain by compacted clay filling which could not be penetrated with a hand auger. Refusal was at 0.12 m bgl.

Filling materials observed along the western boundary of the site (at Test Bores 207, 216 and 217) were observed to be clay type fills with some gravel and trace amounts of sand, timber and rootlets to a depth of up to 1.6 m bgl. A fragment of fibre-cement (sample A216/0.3) was collected from Test Bore 216 from a depth of approximately 0.3 m bgl.

Filling materials adjacent to the north of the building (at Test Bores 103, 208 and 215) were identified to consist of sand, gravelly sand, gravelly clay, sandy gravel, clay and sandy clay up to a depth of 1.3 m bgl. Trace amounts of concrete fragments were noted in the filling at the surface at Test Bores 208 and 215. A trace amount of plastic was also noted in the surface filling at Test Bore 208.

Filling materials adjacent the east of the building (at Test Bores 105, and 203, 219 and 220; underneath a concrete slab or asphaltic concrete) were observed to be sand, silty clay, clay, gravelly clay, clayey gravel (roadbase) and sandy gravel materials up to a depth of 1.0 m bgl. Traces of brick pieces were noted in the filling at Test Bore 203, depth 0.2 m to 0.8 m bgl. Some slag and ash was noted in the filling at Test Bore 105 beneath the layer of asphaltic concrete to a depth of 0.3 m bgl.

Test Bore 221 was drilled on a garden surface at the south-west corner of the building at the location of a former bowser. A surface layer of silty sand filling, to a depth of 0.5 m bgl, was observed to be underlain by a gravelly sand filling, to a depth of 1.7 m bgl, identified with a strong hydrocarbon odour from 0.8 m to 1.7 m bgl and stained grey from 1.0 m bgl to 1.7 m bgl. Drilling refusal was on concrete at 1.7 m bgl.

Filling materials (underneath an asphaltic concrete layer) adjacent the south of building (at Test Bores 204, 218, 222 and 229) were observed to be gravelly sand (roadbase), clay, clayey sand, silty clay and sand. The yellow sand filling identified at Test Bore 222, from 0.8 m to 1.0 m bgl, appeared to be a service trench backfill material. The depth of filling (2.6 m bgl) at Test Bore 229 indicated that this sampling location was the likely previous location of a UST.

Natural materials observed to underlie filling typically included a layer of peaty clay (up to 0.9 m thick) underlain by silty clays and, in turn, shale. Typically, the peaty clay layer tended to be relatively soft, as was an underlying layer of silty clay. Silty clays, at greater depths, tended to be relatively stiffer and were usually mottled grey and brown (red or red-brown). Trace amounts of (ironstone) gravel were noted in some of the Test Bores, typically in the relatively stiffer silty clays.

Natural materials at Test Bores 217, 216 and 105 were observed to be slightly different to the typical natural soil profiles at the site, with:

- Trace amounts of gravel and sand noted in the silty clay at Test Bore 217;
- Trace amounts of gravel, sand and rootlets in the silty clay at Test Bore 216; and
- Slightly sandy silty clay with ironstone gravel and a gravely clay observed at Test Bore 105.

6.2 Groundwater Observations

Well construction details are presented in the test bore logs in Appendix B. Measured groundwater depths at each monitoring well are also shown on the bore logs.

Free groundwater was observed whilst augering at numerous test bores. Free groundwater was commonly, but not always, observed in the relatively softer layers of natural soils (typically peaty clay and silty clay).

Measured groundwater depths at monitoring bores on 22 October 2012 varied between 0.75 m (at Test Bore 204) and 2.16 m (at Test Bore 207). The inferred groundwater flow direction is shown on Drawing 1, Appendix A.

Groundwater sampled from Test Bore 213 was noted to have a mild hydrocarbon odour.

6.3 Contaminants in Soil

A summary of analytical results for soil samples, sourced from DP (2015), is shown in Table C1, Appendix C (and results are compared to the assessment criteria discussed in Section 9). A summary of the assessment of analytical results is as follows:

- Concentrations of arsenic, cadmium, chromium, mercury and zinc were within the respective site assessment criteria;
- Concentrations of copper were within the health based assessment criterion, but elevated concentrations were encountered in three filling samples (from Test Bore 105, depth 0.4-0.5 m; Test Bore 222, depth 0.2-0.5 m; and Test Bore 229, depth 0.6-1.0 m);
- Concentrations of lead were within the health and ecological-based site assessment criteria except for the filling sample from Test Bore 221, depth 0.1-0.5 m. Statistical analysis indicated that the elevated lead concentration at this location is not significant;
- Concentrations of nickel were within the health-based assessment criterion, but elevated concentrations were encountered in filling samples from Test Bore 103, depth 0.2-0.3 m; Test Bore 105, depth 0.1-0.5 m; and Test Bore 208, depth 0.0–0.1 m;
- Concentrations of total recoverable hydrocarbons (TRH) above the limit of reporting were recorded in the soil at Test Bore 221. Volatile organic compounds (VOC) including 1,2,4-trimethyl benzene, n-propyl benzene and n-butyl benzene were also recorded in the sample from Test Bore 221, depth 1.2–1.7 m. A hydrocarbon odour and stained filling material was noted at this location. According to historical information, Test Bore 221 was the former location of a petrol bowser;
- Concentrations of TRH C_{15}-C_{28} and TRH C_{29}-C_{36} above the limit of reporting were recorded in a number of samples (other than those from Test Bore 221) at concentrations that may be above the ecological screening levels. The samples include those from Test Bore 105, depth 0.1 - 0.2 m; Test Bore 201, depth 0.2-0.5 m; Test Bore 203, depth 0.2-0.5 m; Test Bore 219, depth 0.2–0.4 m; and Test Bore 229, depth 0.6-1.0 m;
- Concentrations of total polycyclic aromatic hydrocarbons (PAH) were within the health investigation level;
- Concentrations of benzo(a)pyrene TEQ were within the health investigation level except for samples from Test Bore 201, depth 0.2-0.5 m; Test Bore 219, depth 0.2-0.4 m; Test Bore 221, depth 1.2-1.7 m; Test Bore 222, depth 1.0-1.3 m (BD2-111007) and Test Bore 229, depth 0.6-1.0 m. The ecological screening level for benzo(a)pyrene was also exceeded in these samples;

- In addition to the above-mentioned exceedances, the ecological screening level for benzo(a)pyrene was exceeded in filling samples from Test Bore 221, depth 0.1–0.5 m and Test Bore 222, depth 0.2–0.5 m;
- Only the concentrations of naphthalene in the sample from Test Bore 221, depth 1.2–1.7 m exceeded the health screening level. All concentrations of naphthalene were within the ecological screening level;
- Concentrations of organochlorine pesticides (OCP), polychlorinated biphenyls (PCB) and total phenols were within the respective site assessment criteria;
- Asbestos was not recorded above the limit of reporting in analysed soil samples, but was detected in the fibre-cement material sample from the filling at a depth of approximately 0.3 m below the ground surface at Test Bore 216.

6.4 Contaminants in Groundwater

A summary of analytical results for groundwater samples, sourced from DP (2015), is shown in Table C2, Appendix C. Results are compared to groundwater investigation levels (GIL) from ANZECC & ARMCANZ (2000), *National water quality management strategy, Australian and New Zealand guidelines for fresh and marine water quality*, Australian and New Zealand Conservation Council & Agriculture, and Resource Management Council of Australia and New Zealand. Based on the likely receiving waters being Powells Creek (which flows into Homebush Bay), the GIL were based on the protection of, as a minimum of 95%, of species in marine water.

Mercury and chromium were not recorded above the limit of reporting in the groundwater samples collected from the site. Recorded levels of arsenic, cadmium, copper, lead, nickel and zinc were noted in the groundwater samples. The following results were above the adopted GIL:

- Arsenic in samples from Test Bore 203 and Test Bore 207;
- Copper in samples from Test Bore 203, Test Bore 204, GW-207, and Test Bore 213;
- Lead in samples from Test Bore 203 and Test Bore 207;
- Nickel in samples from Test Bore 203, Test Bore 207, and Test Bore 213; and
- Zinc in samples from Test Bore 203, Test Bore 204, Test Bore 207 and Test Bore 213.

The recorded levels of arsenic, copper, lead, nickel and zinc are considered to be likely to represent local diffuse sources of contamination (background) impacts arising from local industry, urban runoff, and road runoff or from service leakage.

TRH, BTEX, VOC, PAH, PCB and OCP were not recorded above the limit of reporting in the analysed groundwater samples collected from the site.

Total phenols were detected in the groundwater samples from Test Bore 204 and Test Bore 207 at levels marginally above the limit of reporting. The source of the phenols is unknown as total phenols were not detected in analysed soil samples.

6.5 Acid Sulfate Soils

Results indicated that acid sulphate soils are present at the site. In particular, the natural soils below the groundwater level are the most susceptible to being acid sulphate soils (ASS).

At the time of preparing this report, an Acid Sulphate Soil Management Plan (ASSMP) (DP reference 82964.02.R.002) was being prepared. The ASSMP should be referenced for the management of ASS at the site as ASS management requirements have not been incorporated into this RAP.

6.6 Conceptual Site Model

A conceptual site model (CSM) is a representation of site-related information regarding contamination sources, receptors and exposure pathways between those sources and receptors. The CSM provides the framework for identifying how the site became contaminated and how potential receptors may be exposed to contamination either in the present or the future i.e. it enables an assessment of the potential source – pathway – receptor linkages (complete pathways).

Table 2 has been sourced from DP (2015) and provides the possible pathways (P1 to P5) between the contamination source (S1) and receptors (R1 to R6).

Table 2: Summary of Potential Complete Pathways

Potential Source	Transport Pathway	Receptor
(S1) Contaminated ground from filling and previous fuel storage	(P1) Ingestion and dermal contact (P2) Inhalation of dust (P3) Inhalation of vapours	(R1) Site users (R3) Construction workers (R4) Maintenance workers
	(P2) Inhalation of dust (P3) Inhalation of vapours	(R2) Adjacent site users
	(P4) Surface water run-off	(R5) Surface water
	(P5) Contact with terrestrial ecology	(R6) Terrestrial ecology

6.7 Recommendations from DP (2015)

It was considered in DP (2014) that remediation will be required for the proposed development and further investigation should be undertaken to fill in data gaps to better determine remediation requirements. The general steps for further investigation and remediation were listed as follows:

Investigation

- Investigate the soil conditions at the north-west part of the site which was previously inaccessible to a drilling rig;

- Excavation of test pits in the vicinity of Test Bores 104 and 214 to assess whether ACM (previously observed on the surface) is present in filling below the surface;
- Excavation of test pits in the vicinity of Test Bore 216 to assess the extent of ACM in filling at this location;
- Further investigation and assessment of soils which are likely to remain (i.e. near the perimeter of the site) including obtaining site specific soil parameters for further ecological assessment; and
- Inspection of surface soils once the building is demolished and floor slabs, hard stands and the AST are removed;

Remediation

- Excavation and removal of the UST, any associated pipework and remediation of any surrounding contaminated soil;
- Excavation and removal of the contaminated soil and any observed pipework in the vicinity of Test Bore 221 (the likely previous location of a bowser);
- Excavation and removal of the contaminated filling at Test Bore 229 (filling used for the tank pit);
- Excavation and removal of any contaminated soil at the previous location of a bowser (near Test Bore 222);
- Excavation and removal of contaminated filling at Test Bore 219;
- Excavation and removal of (any) asbestos contaminated filling;
- Excavation and removal of any other identified soil contamination near the perimeter of the site following further investigation/assessment;
- Validation of the above excavations / remediation areas; and
- Removal of (any) contaminated soils within the proposed excavation area (as part of the general excavation process).

7. Extent and Options for Further Investigation and Remediation

7.1 Areas of Environmental Concern

Based on the findings presented in DP (2015), Table 3 lists known areas of environmental concern (AEC) as well as potential areas of environmental concern (PAEC) where further investigation is recommended.

Table 3: Areas of Environmental Concern and Potential Areas of Environmental Concern

AEC / PAEC	Relevant Location	Issue	Comments
PAEC 1	North-west corner of site (near Test Bore 228)	Potentially contaminated filling not sufficiently investigated.	Surface filling at Test Bore 228 is not contaminated but deeper filling needs to be assessed.
PAEC 2	North-east corner of site in vicinity of Test Bores 104 and 214	ACM previous observed on surface and may exist in filling	Test pits rather than test bores should be used to visually assess filling for ACM
AEC 3	Test Bore 216	ACM observed in filling	Extent of ACM impacted filling has not been delineated or subject to detailed assessment. Test pits rather than test bores should be used for further investigation.
PAEC 4	Near perimeter of site	Soils likely to remain on site may be contaminated from an ecological and health perspectives	Site specific parameters for ecological assessment yet to be obtained. Further assessment required.
PAEC 5	Beneath existing building, hardstands and AST	Potentially contaminated soils (yet to be observed) may be present beneath existing structures	Post-demolition inspections should be undertaken by environmental consultant (as a minimum).
AEC 6	Near Test Bore 204	UST (and any associated pipework and surrounding contaminated soil)	UST probably filled with sand in 1991.
AEC 7	Test Bore 221	Likely previous location of bowser. Soil impacted with lead, PAH, and TRH.	Pipework associated with previous bowser may be in vicinity.
AEC 8	Test Bore 229	Filling used for tank pit is impacted with PAH, copper and TRH.	Former location of UST. Benzo(a)pyrene TEQ contamination requires remediation.
AEC 9	Near Test Bore 222	Previous location of bowser. Soil impacted with copper and PAH.	Pipework associated with previous bowser may be in vicinity.
AEC 10	Test Bore 219	Filling beneath concrete slab impacted with PAH and TRH.	Benzo(a)pyrene TEQ contamination requires remediation.

7.2 Typical Remediation Options Available

A number of remediation / management options were assessed. In accordance with NSW Department Environment and Conservation (DEC), *Contaminated Sites: Guidelines for the NSW Site Auditor Scheme*, 2006, the suitability of the remediation options was examined:

Possible remediation options to achieve the remediation goals are identified as follows:

- No action;

- Treatment (on- or off- site);
- Off-site disposal to an approved / licensed site / waste facility; and
- Physical barrier systems.

7.3 Preferred Remediation Option

Based on the proposed bulk excavation to accommodate the proposed basement, significant volumes of filling and natural soil will need to be disposed off-site for the development. As such, off-site disposal of contaminated soil (as well as existing UST and AST infrastructure) is the preferred option for remediation.

Although not anticipated at the time of preparing this report, on site landfarming of hydrocarbon impacted soils could be utilised in the case the gross contamination of soil limits off-site disposal options. The remediation option of landfarming has been included as a contingency (see Section 13.2).

8. Adopted Remediation Strategy

8.1 Overview and Site Management

The remediation works should be conducted by experienced and appropriately licensed contractors. An experienced environmental consultant will be engaged to inspect the progress of the works and to provide ongoing advice and recommendations as required. The success of the remediation works will be validated by the environmental consultant.

8.1.1 Roles and Responsibilities

Principal and Principal's Representative

The Principal is responsible for the environmental performance of the proposed remediation works, including implementation of acceptable environmental controls during all site works. The Principal will retain the overall responsibility for ensuring this RAP is appropriately implemented. The Principal is to nominate a representative (the Principal's Representative – PR), who is responsible for overseeing the implementation of this RAP. The actual implementation of the RAP will, however, be conducted by the Contractor on behalf of the Principal.

The Principal will also be responsible for acquiring all necessary approvals for the remediation works proposed, including approval from the consent authority.

Principal Contractor (the Contractor) and Site Manager

The Principal Contractor (referred to herein as the Contractor) is foreseen to be the party responsible for the day to day implementation of this RAP and shall fulfil the responsibilities of the Principal Contractor as defined by WorkCover NSW (now SafeWork NSW). It is noted that the Contractor

may appoint appropriately qualified sub-contractors or sub-consultants to assist in fulfilling the requirements of the procedures.

The Contractor will nominate a Site Manager who will be responsible for day to day site management and first response to any unexpected finds encountered during works.

Asbestos Contractor

The Asbestos Contractor will be responsible for undertaking all asbestos removal works where necessary, and will include an employee who is a licensed removalist with a Class A or B licence (issued by WorkCover NSW / Safework NSW) who will be the works supervisor.

The Asbestos Contractor and Contractor can be the same entity.

Environmental Consultant

The Environmental Consultant will provide advice on implementing this RAP and validate that the site has been appropriately remediated. In general terms, the Environmental Consultant will:

- Provide advice to their client as required for the remediation works;
- Undertake all validation assessment work, including inspections, sampling and reporting;
- Provide advice and recommendations arising from inspections/ observations;
- Notify their client with the results of any assessments and any observed non-conformances in a timely manner; and
- Undertake the required assessments for disposal of liquid and solid wastes.

Occupational Hygienist

The Occupational Hygienist will provide advice on WHS issues related to asbestos works. The Occupational Hygienist will be appropriately qualified and for friable asbestos works hold a Class A asbestos assessor's licence in accordance with the WHS Regulation 2011 (NSW).

The Occupational Hygienist will:

- Prepare or review any WHS plans and provide advice requested by the Contractor;
- Undertake airborne asbestos monitoring when required (note air monitoring is mandatory for friable works);
- Provide advice and recommendations on asbestos remediation control methods and other WHS issues arising from the monitoring results and/or inspection findings;
- Notify the client with the results of any assessments or observed non-conformances in a timely manner; and
- Undertake visual clearance inspections and issue final clearance certification.

In certain instances, the Environmental Consultant and Occupational Hygienist may be the same entity. In these situations the attending Consultant / Hygienist should be deemed competent (and

appropriately qualified or licenced) pursuant to each and every applicable Regulation for the works they are carrying out.

8.1.2 Material Tracking and Disposal Records

The Contractor will track all soil materials imported onto or disposed of off the site. These will include the tracking of:

- Off-site disposal records for soils (trucking records, landfill dockets);
- Sources, volumes, dates and location of any imported materials; and
- Estimated volume(s) of any soils imported to or exported from the site.

8.1.3 Minimising Cross Contamination

Prevention of cross contamination during remediation works is vital to the successful remediation of the site. The following measures must be conducted to manage the potential for cross contamination:

- Undertaking all work in accordance with the RAP and the ASSMP;
- Segregating soils with different contaminant profiles/ waste classification/ acid sulphate soil potential during handling works. This includes separation during excavation and loading into trucks and/ or placement of clearly identified, separate stockpiles; and
- Disposing of all liquids, including leachate from soils excavated from beneath the water table and extracted groundwater in accordance with the Protection of the Environment Operations Act 1997 (POEO Act), and as discussed herein.

8.1.4 Programme

The detailed programme and timing of works will depend on the progress of remediation and earthworks, and is the responsibility of the Contractor.

8.2 Prior to Remediation

Prior to remediation works, the following will be conducted:

- A destructive hazardous building material survey prior to demolition of existing structures. All hazardous building materials should be removed and clearances obtained in accordance with the recommendations of the survey and the Occupation Hygienist. Post demolition, the footprints of the buildings should be inspected and validation samples taken if necessary. A surface clearance for asbestos should be obtained from an Occupational Hygienist prior to commencement of excavation;
- During removal of the hardstand, regular systematic inspections by the Environmental Consultant should be conducted for any signs of contamination, potential contamination sources, or local variations in soil conditions which could indicate an unknown underground structure; and

- Signs of concern identified by soil inspections will be investigated by test pitting/ strip trenching as considered appropriate. Any identified contamination or structures considered to be a potential contamination source will be investigated and, if required, remediated in accordance with the Unexpected Finds Protocol (Section 13).

8.3 Investigation and Remediation Works

The investigation and remediation works, described below, have been separated for each AEC and PAEC.

8.3.1 PAEC 1: Filling at North-west Corner of Site

As only the surface filling at the north-west corner of the site has been investigated, the entire filling profile at this part of the site has not been sufficiently investigated. Sampling of the filling profile and underlying natural soil from (a minimum of) one test pit/bore in the vicinity of Test Bore 228 is to be undertaken by the Environmental Consultant. At least one selected filling sample (not from surface filling) is to be analysed for a range of potential contaminants (metals, PAH, TRH, BTEX, OCP, PCB, total phenols and asbestos as a minimum). Analytical results are to be assessed by the Environmental Consultant to determine if further targeted investigation or remediation is required. Advice is to be provided by the Environmental Consultant in this regard.

It is noted that a significant area of the north-west corner of the site is not likely to be subject to bulk excavations for the proposed basement. The proposed test location (at least one) could be positioned within the area that will not be subject to bulk excavation and be utilised as part of the investigation works described in Section 8.3.4.

8.3.2 PAEC 2: Possible ACM at North-east Corner

ACM (fibre-cement) was previously observed on the soil surface at the north-east corner of the site in the vicinity of Test Bores 104 and 214. Visual assessment of the filling for ACM is to be undertaken in this area by the Environmental Consultant. This will be conducted using test pits on an approximate 10 m grid to the base of filling (which is approximately 0.8 m below the surface according to Test Bore logs for Test Bores 104 and 214). Test pits will be logged by the Environmental Consultant.

If asbestos is considered to be present within the filling, advice will be provided by the Environmental Consultant as to its extent and subsequent remediation (or further investigation). Remediation will likely be excavation and off-site disposal of asbestos contaminated filling (similar to that described in Section 8.3.3).

8.3.3 AEC 3: Asbestos in Soil at Test Bore 216

Asbestos was identified in the top 0.5 m of filling at Test Bore 216. The remediation works will comprise:

- Visual assessment of the filling for ACM is to be undertaken in this area by the Environmental Consultant. This will be conducted, by first excavating a test pit at Test Bore 216 to observe the

filling/ soil profile and confirm (or otherwise) the presence of ACM. "Step-out" test pits (from Test Bore 216) will then be excavated at horizontal intervals of approximately 5m in four directions (depending on site constraints) to attempt to determine the extent of the asbestos contaminated filling. Test pits will be excavated to the base of filling (which is approximately 1 m below the ground surface according to the test bore log for Test Bore 216). Test pits will be logged by the Environmental Consultant.

- Excavation and disposal of the asbestos contaminated filling (by the Asbestos Contractor) in accordance with a waste classification to be provided by the Environmental Consultant; and
- Validation of the resulting excavation by the Occupational Hygienist (and the Environmental Consultant if considered necessary by the Environmental Consultant);

Further requirements for the removal of asbestos contaminated soil are provided in Section 12.4.

8.3.4 PAEC 4: Soils Designated to Remain Near Perimeter of Site

As discussed in Section 1.3, the proposed basement excavation will cover much of the site but not extend to the site boundaries. This peripheral area where soil is likely to remain covers approximately 4,500 m^3 and will mainly be used for landscaping. Site specific parameters have not yet been obtained for ecological assessment and, thus, further assessment is required.

Prior to commencing an investigation, the Environmental Consultant is to check with the Principal and/or Contractor that the soil near the periphery is intended to remain on site. The investigation approach listed below may need to be adjusted if this is not the case.

The following is to be undertaken to further assess the peripheral area of the site:

- A total of ten sampling locations are to be positioned near the site boundary to provide coverage of the proposed peripheral landscaped area as well as to complement existing data (presented in DP, 2015). [Sampling from ten locations will result in a total sample density that exceeds the recommended minimum density for a site of 4500 m^3 according to NSW EPA, *Sampling Design Guidelines*, 1995]. Soil samples are to be collected at regular intervals using test pits and/or test bores which will be logged (and sampled) by the Environmental Consultant. Test pits/ bores are be extended to the base of filling (where possible);
- Selected soil samples from each sample location will be analysed for primary contaminants of concern (TRH, BTEX, metals, PAH and asbestos) as well as any other potential contaminants based on observations;
- Selected soil samples will be analysed for soil parameters (pH, CEC and clay content) for ecological assessment purposes; and
- Advice will be provided by the Environmental Consultant as to any (additional) remediation and subsequent validation requirements based on the assessment results.

8.3.5 PAEC 5: Post-demolition Inspections

Following the demolition and removal of buildings, hardstands and the AST (at the south-western corner of the building), the exposed soil surface is to be inspected by the Environmental Consultant to observe for signs of contamination (such as staining, odours or observed potential ACM). In the

case that potential contamination is encountered, further advice is to be provided by the Environmental Consultant in regards to investigation or remediation requirements.

8.3.6 AEC 6: UST Removal

Information presented in DP (2014) suggests that the UST near Test Bore 204 was filled with sand. The following remediation sequence is to be adopted for the removal of this UST and any associated pipes:

- Prior to removal of the UST, it is to be confirmed by dipping that the UST does not contain any residual liquid. In the case that any residual liquid is present, the liquid is to be removed from the tank and disposed appropriately in accordance with Australian Standard (AS 4976 – 2008 *The Removal and Disposal of Petroleum Underground Storage Tanks*). Records of disposal should be provided for the validation report;
- The UST will be exposed and examined for potential leaks and general condition;
- The UST will be removed and the structures disposed of by a qualified contractor in accordance with AS 4976 – 2008. Disposal records should be provided to the environmental consultant for inclusion in the validation report;
- All associated infrastructure (e.g. fuel lines) will be removed and disposed in a similar manner if present;
- Stockpile any sand sourced from inside the UST;
- Excavate and stockpile impacted soils based on direction from the Environmental Consultant;
- Validation samples will be collected from the tank pit by the Environmental Consultant at a minimum rate of one location per side wall and at least one sample at the base. Note that the actual number of samples may vary depending on the size of the tank pit excavation and the degree of contamination and the soil profile encountered;
- Validation samples will be collected from below any removed fuel lines at a rate of one sample per 5 m linear metres of the fuel lines;
- Samples will be collected from the stockpiles for assessment for potential reuse and/or waste classification as appropriate;
- Selected validation samples will be analysed (as a minimum) for the primary contaminants of concern (TRH, BTEX, PAH, lead and phenols) and any other potential contaminants based on observations. Selected stockpile samples will be analysed for heavy metals, TRH, BTEX, PAH, phenols, PCB, OCP and asbestos (at the sample frequency discussed in Section 11.2);
- In the (unlikely) case that stockpiled soil is identified to be grossly contaminated with hydrocarbons which limits off-site disposal options, the remediation option of landfarming may be suggested by the Environmental Consultant. The landfarming contingency is described in Section 13.2;
- Further excavation, with subsequent validation, may be required to 'chase-out' any identified contamination;
- Following validation of the excavation void, the tank pit excavation may be filled with material validated by the Environmental Consultant (see Section 10.1 if soil is to be imported to fill the

pit). Excavated soil designated for off-site disposal will need to be disposed in accordance with the waste classification to be provided by the Environmental Consultant.

8.3.7 AEC 7: Contaminated Soil Removal at Test Bore 221

Soil has been identified to be contaminated with lead, PAH and TRH at Test Bore 221 and is the likely previous location of a bowser. It is unknown if associated fuel lines are currently present. The following remediation sequence is to be adopted for the removal of the contaminated soil and any possible fuel lines:

- Excavate soil from a nominal area of 3 m wide by 3 m long to the base of filling and soil showing signs of contamination (at least to a depth of 1.7 m according to the test bore log for Test Bore 221). The Environmental Consultant is to be present to supervise the extent of the excavation which may need to be expanded based on observations;
- Any fuel lines are to be removed and disposed (if present);
- Excavate impacted soil from along any fuel lines;
- Excavated soil is to be stockpiled based on direction from the Environmental Consultant;
- Validation samples will be collected from the base and walls of the excavation at a minimum rate of one location per side wall per soil profile and one sample at the base. Note that the actual number of samples may vary depending on the size of the excavation;
- Validation samples will be collected from below any removed fuel lines at a rate of one sample per 5 m linear metres of the fuel lines;
- Samples will be collected from the stockpiles for waste classification assessment;
- Selected validation samples will be analysed (as a minimum) for the primary contaminants of concern (TRH, BTEX, PAH, lead and phenols) and any other potential contaminants based on observations. Selected stockpile samples will be analysed for heavy metals, TRH, BTEX, PAH, phenols, PCB, OCP and asbestos (at the sample frequency discussed in Section 11.2);
- In the (unlikely) case that stockpiled soil is identified to be grossly contaminated with hydrocarbons which limits off-site disposal options, the remediation option of landfarming may be suggested by the Environmental Consultant. The landfarming contingency is described in Section 13.2;
- Further excavation, with subsequent validation, may be required to 'chase-out' any identified contamination;
- Following validation of the excavation void, the excavation may be filled with material validated by the Environmental Consultant (see Section 10.1 if soil is to be imported to fill the excavation). Excavated soil designated for off-site disposal will need to be disposed in accordance with the waste classification provided by the Environmental Consultant.

8.3.8 AEC 8: Contaminated Filling at Test Bore 229

Filling at Test Bore 229, the former location of a UST, is impacted with PAH, TRH and (to a lesser extent) copper. According to the test bore log for Test Bore 229, the depth of filling is approximately

2.6 m below the asphalt surface. The remediation sequence is to be adopted for the removal of the contaminated filling:

- Excavate filling from the (presumed) former tank pit. The former tank pit is likely to be approximately 3.5 m long by 2.5 m wide by 2.6 m deep;
- Any observed fuel lines are to be removed and disposed (if present);
- Excavate impacted soil from along any fuel lines;
- Excavated soil is to be stockpiled based on direction from the Environmental Consultant;
- Validation samples will be collected from the base and walls of the excavation at a minimum rate of one per side wall at the depth of concern (0.6 m to 1.0 m below the ground surface) and one sample at the base. Note that the actual number of samples may vary depending on the size of the excavation and observations;
- Validation samples will be collected from below any removed fuel lines at a rate of one sample per 5 m linear metres of the fuel lines;
- Samples will be collected from the stockpiles for waste classification assessment;
- Validation samples will be analysed (as a minimum) for the primary contaminants of concern (TRH, BTEX, lead, copper, PAH, and phenols) and any other potential contaminants based on observations. Selected stockpile samples will be analysed for heavy metals, TRH, BTEX, PAH, phenols, PCB, OCP and asbestos (at the sample frequency discussed in Section 11.2);
- Further excavation, with subsequent validation, may be required to 'chase-out' any identified contamination; and
- Following validation of the excavation void, the excavation may be filled with material validated by the Environmental Consultant (see Section 10.1 if soil is to be imported to fill the excavation). Excavated soil designated for off-site disposal will need to be disposed in accordance with the waste classification provided by the Environmental Consultant.

8.3.9 AEC 9: Previous Location of Bowser Near Test Bore 222

Soil at the location of a previous bowser is noted to be impacted with copper and PAH. It is unknown if associated fuel lines are present. The remediation sequence is to be adopted for the remediation of contaminated soil beneath the previous bowser is as follows:

- Excavate soil from a nominal area of 3 m wide by 3 m long by 1.2 m deep at the previous bowser location at Test Bore 222. The Environmental Consultant is to be present to supervise the extent of the excavation which may need to be expanded based on observations;
- Any fuel lines are to be removed and disposed (if present);
- Excavate impacted soil from along any fuel lines;
- Excavated soil is to be stockpiled based on direction from the Environmental Consultant;
- Validation samples will be collected from the base and walls of the excavation at a minimum rate of one location per side wall per soil profile and one sample at the base. Note that the actual number of samples may vary depending on the size of the excavation;

- Validation samples will be collected from below any removed fuel lines at a rate of one sample per 5 m linear metres of the fuel lines;
- Samples will be collected from the stockpiles for potential re-use or waste classification assessment;
- Selected validation samples will be analysed (as a minimum) for the primary contaminants of concern (TRH, BTEX, PAH, lead, copper and phenols) and any other potential contaminants based on observations. Selected stockpile samples will be analysed for heavy metals, TRH, BTEX, PAH, phenols, PCB, OCP and asbestos at the sample frequency discussed in Section 11.2;
- In the (unlikely) case that stockpiled soil is identified to be grossly contaminated with hydrocarbons which limits off-site disposal options, the remediation option of landfarming may be suggested by the Environmental Consultant. The landfarming contingency is described in Section 13.2;
- Further excavation, with subsequent validation, may be required to 'chase-out' any identified contamination;
- Following validation of the excavation void, the excavation may be filled with material validated by the Environmental Consultant (see Section 10.1 if soil is to be imported to fill the excavation). Excavated soil designated for off-site disposal will need to be disposed in accordance with the waste classification provided by the Environmental Consultant.

8.3.10 AEC 10: Contaminated Filling at Test Bore 219

The upper layer of filling (beneath the concrete slab) at Test Bore 219 is impacted with PAH and TRH. The upper layer of filling, based on the test pit log for Test Bore 219, is to a depth of 0.4 m below the concrete surface. The remediation sequence for the removal of this contaminated soil is as follows:

- Excavate soil from a nominal area of 5 m wide by 5 m long to a depth of 0.5 m below the concrete surface. The Environmental Consultant is to be present to supervise the extent of the excavation which may need to be expanded based on observations;
- Excavated soil is to be stockpiled based on direction from the Environmental Consultant;
- Validation samples will be collected from the base and walls of the excavation at a minimum rate of one location per side wall and one sample at the base. Note that the actual number of samples may vary depending on the size of the excavation;
- Samples will be collected from the stockpile(s) for waste classification assessment;
- Selected validation samples will be analysed (as a minimum) for the primary contaminants of concern (TRH and PAH) and any other potential contaminants based on observations. Selected stockpile samples will be analysed for heavy metals, TRH, BTEX, PAH, phenols, PCB, OCP and asbestos (at the sample frequency discussed in Section 11.2).
- Further excavation, with subsequent validation, may be required to 'chase-out' any identified contamination;
- Following validation of the excavation void, the excavation may be filled with material validated by the Environmental Consultant (see Section 10.1 if soil is to be imported to fill the excavation).

Excavated soil will need to be disposed off-site in accordance with the waste classification provided by the Environmental Consultant.

9. Remediation Acceptance Criteria

The remediation works will be validated as meeting an acceptable standard for the proposed land use. The validation will be undertaken by the Environmental Consultant by means of visual inspection, field screening, analysis of samples and review of any available plans, as discussed below.

This section provides remediation acceptance criteria (RAC), which will be used to judge the success or otherwise of the remediation by the Environmental Consultant, and are based on a variety of considerations, including field observations and laboratory results.

Analytical results from laboratory testing will be assessed against the (Tier 1) investigation and screening levels sourced from Schedule B1 of the National Environment Protection Council, *National Environment Protection (Assessment of Site Contamination) Measure 1999*, as amended 2013 (NEPC, 2013). This guideline has been endorsed by the NSW EPA under the *Contaminated Land Management* (CLM) *Act* 1997. Schedule B of NEPC (2013) provides investigation and screening levels for commonly encountered contaminants which are applicable to generic land uses and include consideration of, where relevant, the soil type and the depth of contamination. The investigation and screening levels are not intended to be used as clean up levels. They establish concentrations above which further appropriate investigation (e.g. Tier 2 or Tier 3) should be undertaken.

The following sub-sections outline the relevant investigation and screening levels adopted for soils and groundwater as documented in the NEPC (2013).

9.1 Soils

9.1.1 Health-based Investigation Levels

Table 4 shows the health investigation levels (HIL) that have been adopted as site assessment criteria for assessing the human health risk from a contaminant via all relevant pathways of exposure. As the site is proposed to be developed into multistorey residential apartment buildings with one level of common basement car-parking that covers most of the site, HIL have been adopted from Column B (Residential within minimal opportunities for soil access; includes dwellings with fully and permanently paved yard space such as high-rise buildings and apartments). The table does not contain the complete list of HIL provided in NEPC (2013).

Table 4: Health Investigation Levels

Contaminant	HIL – Residential B (mg/kg)
Metals	
Arsenic	500
Cadmium	150
Chromium (VI)	500
Copper	30 000
Lead	1200
Mercury (inorganic)	120
Nickel	1200
Zinc	60 000
PAH	
Carcinogenic PAH (as Benzo(a)pyrene TEQ)	4
Total PAH	400
OCP	
DDT+DDE+DDD	600
Aldrin + Dieldrin	10
Chlordane	90
Endosulfan	400
Endrin	20
Heptachlor	10
HCB	15
Methoxychlor	500
Phenols	
Phenol	45 000
Pentachlorophenol	130
Cresols	4700
Other Organics	
PCB	1

9.1.2 Health Screening Level for Vapour Intrusion

Table 5 shows the health screening levels (HSL) for petroleum hydrocarbon compounds adopted for the assessment and are based on the exposure to petroleum hydrocarbons through the dominant vapour inhalation exposure pathway only (i.e. not direct contact to soils). The HSL have been adopted from Column HSL A and HSL B (Low – high rise residential). The HSL derivation has assumed a slab-on-ground construction for building structures, and, therefore is only considered relevant to parts of the site with building structures (yet to be constructed). It is noted that less conservative HSL may be applicable as much of the site will be covered by a basement for car-parking which is considered a non-residential use and, thus, the HSL for land use category D (commercial/industrial) can be applied if considered appropriate. The most conservative HSL (from

Column HSL A and HSL B) are listed in Table 5. Although the soils at the site mainly comprise clays, sand and silt were also identified, thus the most conservative HSL for the three soil types have been listed in Table 5.

Table 5: Soil Health Screening Levels for Vapour Intrusion

Contaminant	HSL A & HSL B Low-high Rise Residential (mg/kg)
	Depth 0 m to <1 m
Toluene	160
Ethylbenzene	55
Xylenes	40
Naphthalene	3
Benzene	0.5
TPH C_6-C_{10} less BTEX	40
TPH >C_{10}-C_{16} less Naphthalene	110

HSL for direct contact which were developed for exposure through dermal contact incidental oral ingestion and dust inhalation, have not been listed as they are unlikely to become drivers for further investigation, remediation or site management.

9.1.3 Ecological Investigation Levels

Ecological Investigation Levels (EILs) have been developed and discussed in NEPC (2013) for selected metals and organic compounds and are applicable for assessing risk to terrestrial ecosystems. EILs depend on specific soil physiochemical properties and land use scenarios and generally apply to the top 2 m of soil, which essentially corresponds to the root zone and habitation zone of many species. The EIL is determined for a contaminant using the following formula:

EIL = ABC + ACL, where

ABC = Ambient Background Concentration
ACL = Added Contaminant Limit

The ABC of a contaminant is the soil concentration in a specific locality that is the sum of naturally occurring background levels and the contaminants levels that have been introduced from diffuse or non-point sources (e.g. motor vehicle emissions). ACLs are based on the soil characteristics of pH, CEC and clay content. It is noted that the collection of soil characteristics data has been included as part of this RAP to establish site specific EIL.

EIL will not be used as assessment criteria for soil beneath proposed building structures (i.e. the basement car park) as these parts of the site will not encourage the establishment of terrestrial ecology. EIL will apply to peripheral areas of the site where landscaping will be established as these areas will have ecological value.

The adopted EIL are shown in Table 6 where derived from Tables 1B(1) to 1B(5), Schedule B1 of NEPC (2013). The following site specific data and assumptions have been used to determine the EILs:

- A protection level of 80% has been adopted, as recommended for residential land uses;
- Given the likely source of soil contaminants (i.e. historical site use/fill) the contamination is considered as "aged" (>2 years); and
- ABC will be for a 'high traffic volume' for an 'old suburb' in NSW.

Table 6: Ecological Investigation Levels (EIL)

Analyte		EIL (mg/kg)	Comments
Metals	Arsenic	100	Generic EIL
	Copper	tbc [1]	-
	Nickel	tbc [1]	-
	Chromium III	tbc [1]	-
	Lead	1260	ABC of 160 mg/kg based on 25th percentiles from Olszowy et al. 1995
	Zinc	tbc [1]	-
PAH	Naphthalene	170	Generic EIL
OCP	DDT	180	Generic EIL

Notes:
1 To be confirmed by testing for site soil characteristic (pH, CEC and clay content).

9.1.4 Ecological Screening Levels

Ecological Screening Levels (ESL) are used to assess the risk of selected petroleum hydrocarbon compounds, BTEX and benzo(a)pyrene to terrestrial ecosystems. ESLs apply to the top 2 m of the soil profile, which essentially corresponds to the root zone and habitation zone of many species. ESL will not be used as assessment criteria for soil beneath proposed building structures (i.e. the basement car park) as these parts of the site will not encourage the establishment of terrestrial ecology. ESL will apply to peripheral areas of the site where landscaping will be established as these areas will have ecological value.

The adopted ESLs, from the urban residential and public open space ESLs in Table 1B(6), Schedule B1 of NEPC (2013), are shown in Table 7. The most conservative ESLs are shown in Table 7 from both 'fine' and 'coarse' soil textures given that various soil types were encountered, although tested soils were primarily clays which are considered to be 'fine' in texture.

Table 7: Ecological Screening Levels (ESL)

Analyte	ESL (mg/kg)	Comments
TRH C_6-C_{10} less BTEX	180	Low reliability ESL
TRH >C_{10}-C_{16}	120	Low reliability ESL
TRH >C_{16}-C_{34}	300	-
TRH >C_{34}-C_{40}	2800	-
Benzene	50	-
Toluene	85	-
Ethylbenzene	70	-
Xylenes	45	-
Benzo(a)pyrene	0.7 [1]	Low reliability ESL

Notes:

1 Environment Canada, *Canadian Soil Quality Guidelines for the Protection of Environmental and Health*: *Polycyclic Aromatic Hydrocarbons*, 2010 states that the environmental health SQG is 20 mg/kg for residential sites and it replaces the previous provisional SGQ of 0.7 mg/kg which was the reference value for the establishment of the ESL. The ESL is, therefore, considered an overly conservative value as an assessment criterion but has been listed in the absence of another NSW EPA endorsed guideline value.

9.1.5 Management Limits

In addition to appropriate consideration and application of the HSL and ESL, there are additional considerations which reflect the nature and properties of petroleum hydrocarbons, including:

- Formation of observable light non-aqueous phase liquids (LNAPL);
- Fire and explosion hazards;
- Effects on buried infrastructure e.g. penetration of, or damage to, in-ground services.

Management Limits to avoid or minimise these potential effects have been adopted in NEPC (2013) as interim Tier 1 guidance. The adopted Management Limits, from Table 1B(7), Schedule B1 of NEPC (2013) are shown in the following Table 8. The more conservative Management Limits are shown for from both 'fine' and 'coarse' soil textures given that various soil types were encountered, although the majority of tested soils at the site were considered to be 'fine' in texture.

Table 8: Management Limits

Contaminant	Management Limit (mg/kg)
TRH C_6 – C_{10}	700
TRH >C_{10}-C_{16}	1000
TRH >C_{16}-C_{34}	2500
TRH >C_{34}-C_{40}	10 000

9.1.6 Asbestos in Soil

Presence or absence of asbestos at a limit of reporting of 0.1 g/kg will be adopted in the absence of a detailed asbestos assessment. In the case that a detailed assessment for asbestos is undertaken (where soils containing asbestos may remain onsite), the adopted health screening levels (Residential B) from NEPC (2013) are:

- Bonded asbestos containing materials (ACM): 0.04% w/w;
- Fibrous asbestos (FA) and asbestos fines (AF): 0.001%; and
- All forms of asbestos: no visible asbestos for surface soil.

9.1.7 Potential Impacts on Groundwater

Any soils with potential residual impacts which are to remain on the site will be assessed with respect to the potential contamination risks to groundwater. The scope of this assessment will vary depending on the contaminant of potential concern and the location of the impacted soil. The assessment may include a review of the potential for impacts based on the total concentrations present, the likelihood of migration of water through the soils and/or leachability testing.

9.2 Groundwater

As remediation of groundwater is not required, based on findings of the PSI and SSI, site assessment criteria for groundwater contaminants are not provided herein. If, at a later stage, further assessment of groundwater is considered warranted, GILs will be adopted from ANZECC & ARMCANZ (2000).

It is noted that the generic HSLs for vapour intrusion presented in Schedule B1 of NEPC (2013) are not considered to be appropriate for the assessment of vapour intrusion from groundwater as the floor of the proposed basement will be within 2 m of the groundwater table (or below the groundwater table).

9.3 Classification for Off-site Disposal

All soils to be disposed off-site will be assessed and classified in accordance with the POEO Act (1997). For disposal to landfill, the relevant guidelines are the EPA *Waste Classification Guidelines* 2014.

9.4 Contaminants with No Assessment Criteria

Where screening guidance is not provided in NEPC (2013) for a specific analyte, the practical quantitation limit (PQL) will be used as the initial screening criteria.

If concentrations are recorded above the PQL, reference criteria will be sourced from other national and international guidance as relevant and used to determine the significance of the analyte.

Details of the reference criteria will be provided where used.

10. Soil Management

10.1 Importation of Soil

As bulk excavations will result in off-site disposal of soil, importing of significant volumes of soil onto the site is not expected.

If soils are to be imported onto the site they must meet the following requirements (from a contamination perspective):

- The soils must be legally able to be imported onto the site in accordance with the *Protection of the Environment Operations (Waste) Regulation* 2014 and any required Council approvals;
- The soils must meet the Site Assessment Criteria (Section 9);
- The soils must be classified as Virgin Excavated Natural Material (VENM), Excavated Natural Material (ENM) or other materials legally able to be imported onto the site based on a Resource Recovery Order. Soils must be assessed in accordance with the EPA requirements. For VENM this generally includes having no signs of concern, metal concentrations at background levels and organic compounds below appropriate laboratory limits of reporting. For non-VENM materials the EPA requirements would generally include assessment in accordance with the appropriate resource recovery order; and
- The material must be inspected during importation by the Contractor, and any materials not meeting the description given in the provided documentation or displaying signs of contamination will be rejected.

Prior to the importation of soil, advice from the Environmental Consultant should be sought to confirm that the material meets the above requirements.

10.2 Stockpiling of Contaminated Material

Stockpiles should be managed to minimise the risk of dust generation, erosion and leaching. The measures required to achieve this will depend on the materials in the stockpile and the length of time the stockpile is to remain on site, but should include:

- Restrict the height of stockpiles to reduce dust generation;
- Construct erosion and sediment control measures;
- Cover stockpiles of asbestos impacted soils to be left on site for more than a day;
- Cover stockpiles of chemically contaminated soils to be left on site for a continuous non-work period of more than one night (e.g. a long weekend), or if windy conditions are expected;

- Keep temporary stockpiles moist, by using water spray where required; and
- Manage the potential for leaching from stockpiles (where required) by placing on a low permeability base and/ or validating the base of the stockpile following its removal. Where this is a potential issue, specific advice should be sought from the Environmental Consultant.

10.3 Waste Disposal

All off-site disposal of wastes, where required, will be undertaken in accordance with the POEO Act.

Any soils removed from the site will be classified in accordance with either:

- The EPA *Waste Classification Guidelines* 2014; or
- A General or Specific Order under the *Protection of the Environment Operations (Waste) Regulation* 2014.

No soils will leave the site without a formal waste classification.

10.3.1 Assessment of Soil

A waste classification/ resource recovery order assessment will be required for any soils to be disposed off-site. Assessment works will be undertaken by the Environmental Consultant based on previous analytical data, field observation and additional testing results. This will include an assessment of acid sulphate soil (ASS) which is present in some materials at the site (refer to the ASSMP).

The process of assessment will comprise:

- Inspection for signs of concern (e.g. asbestos-containing materials, staining, odours);
- Determination of the source of the material to determine what previous results may be relevant;
- Additional testing and analysis where necessary based and the material type/ condition. Any testing will need to characterise the subject material appropriately (e.g. including sampling from depth in stockpiles); and
- Provision of a report to the Contractor and Principal clearly stating the classification of the subject material.

Based on the results the Environmental Consultant will provide advice on the appropriate disposal options for the material.

10.3.2 Spoil Contingency Plan

This plan caters for the storage, treatment and disposal of excavated spoil which fails to meet the criteria for direct disposal to a landfill (i.e. Hazardous Waste). Any suspected Hazardous Waste materials should have their classification confirmed by the Environmental Consultant, including additional sampling and analysis as appropriate, prior to implementing this contingency plan.

Hazardous Waste (if encountered) will be handled as follows:

- Materials of the same spoil category/ contamination issue will be carefully excavated and placed as separate stockpiles at demarcated and contained locations. The categorisation would be done on the basis of on-site observations and the contaminant exceedances detected;
- Stockpiles of excavated materials will be appropriately bunded (e.g. with sandbags) and covered with anchored geotextile or impermeable plastic sheeting, or alternatively placed in an appropriate container e.g. waste skip, with appropriate cover. Materials considered to have the potential to produce contaminated leachate will be stockpiled in an area with an appropriate leachate collection system;
- Sampling and analysis of segregated stockpiles will be conducted to determine the concentrations of the target parameters in the excavated materials (e.g. leachability of the contaminants of concern, treatability studies);
- Should the sampling and testing confirm the Hazardous Waste category, a treatment methodology will be determined, which may to treat the material for re-use on-site or to a suitable standard for landfill disposal;
- If the material is to be disposed off-site, appropriate applications will be made to the EPA. It is foreseen that treatment and management of Hazardous Wastes to be disposed off-site would be conducted by a specialised contractor. Agreement as to the appropriateness of the treatment and disposal method for materials must be obtained from the EPA, and disposal consent must be sought from the Hazardous Waste Regulation Unit of the EPA prior to the removal of such wastes from the site; and
- An appropriately licensed Hazardous Waste remediation contractor will be appointed to manage the waste and remove from site in accordance with the methodology agreed with the EPA.

10.3.3 Loading and Transport of Spoil

All transport of waste and disposal of materials must be conducted in accordance with the requirements of the POEO Act. All licences and approvals required for disposal of the material will be obtained prior to removal of the materials from the site.

Removal of waste materials from the site shall only be carried out by a licensed contractor holding appropriate licence, consent and/ or approvals to dispose of the waste materials according to the assigned waste classification and the corresponding requirements outlined in the EPA *Waste Classification Guidelines* 2014, and with the appropriate approvals obtained from the EPA, if required.

Details of all soils removed from the site (including VENM) shall be documented by the Contractor with copies of weighbridge slips, trip tickets and consignment disposal confirmation (where appropriate) provided to the Environmental Consultant and the PR. A site log shall be maintained by the Contractor to track disposed loads against on-site origin.

Transport of spoil shall be via a clearly delineated, pre-defined haul route. The proposed waste transport route will be notified to the local Council and truck dispatch shall be logged and recorded by the Contractor for each load leaving the site.

10.3.4 Disposal of Material

All materials excavated and removed from the site shall be disposed in accordance with the POEO Act to a facility/ site legally able to accept the material. Copies of all necessary approvals from the receiving site shall be given to the PR prior to any contaminated material being removed from the site. A record of the disposal of materials will be maintained.

All relevant analysis results, as part of waste classification reports, shall be made available to the Contractor and proposed receiving site/ waste facility to enable selection of a suitable disposal location. Holding arrangements, treatment and disposal requirements for excavated materials which fail to meet the landfill disposal guideline levels are discussed in Section 10.3.2.

Copies of all consignment notes for the transport, receipt and disposal of all materials will be maintained as part of the site log.

11. Validation Plan and Sampling Plan

11.1 Data Quality Objectives and Indicators

The validation assessment will be conducted in accordance with Data Quality Objectives (DQOs) and Quality Assurance/Quality Control (QA/QC) procedures to ensure the repeatability and reliability of the results.

The validation assessment will be planned in accordance with the following DQOs:

- State the Problem;
- Identify the Decision;
- Identify Inputs to the Decision;
- Define the Boundary of the Assessment;
- Develop a Decision Rule;
- Specify Acceptable Limits on Decision Errors; and
- Optimise the Design for Obtaining Data.

A checklist of Data Quality Indicators (DQI) in accordance with NEPC (2013) Schedule B2 will be completed as part of the validation assessment. The DQIs are:

- Documentation completeness;
- Data completeness;
- Data comparability and representativeness; and
- Data precision and accuracy.

Based on a fulfilment of the DQOs and DQIs an assessment of the overall data quality will be presented in the validation assessment report.

11.2 Soil Sampling Frequencies

The soil sampling frequency will depend on the volume or area to be assessed and the previous results. Sample frequencies for validation of remediation at each PAEC and AEC have been provided in Section 8.3. Otherwise, the following sampling frequencies will be used for validation works and may be reduced for larger volumes or areas:

Excavations

Small to medium excavations (base <500 m^2):

- Base of excavation: one sample per 25-50 m^2 or part thereof. Where high local variation is expected, a minimum of three samples will be collected.
- Sides of excavation: one sample per 10 m length or part thereof. Additional samples will be collected at depths of concern where there is more than one depth of concern.

Large excavations (base ≥500 m^2):

- Base of excavation: sampling on a grid at a density in accordance with the EPA *Contaminated Sites: Sampling Design Guidelines* (1995) or a minimum of 10 samples. In sub-areas with any specific signs of concern, a higher sampling density may be required.
- Sides of excavation: one sample per 20 m length or part thereof. Additional samples will be collected at depths of concern where there is more than one depth of concern.

Stockpiles

Samples will be collected from stockpiles at various depths to characterise the full depth of the stockpile.

Validation/ assessment of stockpiled soils (note that the actual frequency will be determined based on volume, contamination risk and homogeneity of the material):

- Stockpiles ≤250 m^3: one sample per 25 m^3 or a minimum of three samples;
- Stockpiles 250 – 1,000 m^3: one sample per 50-100 m^3, or a minimum of 10 samples; and
- Stockpiles >2,500 m^3: one sample per 100-250 m^3, or a minimum of 12 samples.

Base of Stockpiles / Treatment Areas

Where grossly contaminated soils are stored or treated (e.g landfarmed) on bare soils, the footprint of the stockpile / treatment area will be sampled at a frequency of one sample per 25-50 m^2 or part thereof.

11.3 Field Sampling Methods

11.3.1 Soils

The following general sampling methodology is to be implemented for soil sampling:

- Preparing records of samples, including sample date, location, description, signs of concern, and any field results;
- Sampling from surface or from the utilised plant using disposable sampling equipment or stainless steel hand tools;
- Decontaminating all re-useable sampling equipment prior to collecting each sample using a 3% solution of phosphate free detergent (Decon 90) and distilled water;
- Transferring samples into laboratory-prepared glass jars with Teflon-lined lid, and capping immediately (for chemical analytes);
- Labelling sample containers with individual and unique identification, including project number and sample number;
- Collecting of an additional replicate set of samples in sealed plastic bags for visual identification, volatiles screening using a photoionisation detector (PID), and/or records purposes;
- Placing the glass jars for chemical analysis into a cooled, insulated and sealed container for transport to the laboratory; and
- Using chain-of-custody documentation so that sample tracking and custody can be cross-checked at any point in the transfer of samples from the field to hand-over to the laboratory.

11.3.2 Water

It is noted that water sampling has not been proposed for validation sampling; however, in the case that water samples are to be collected, the following general sampling methodology is to be implemented for water sampling:

- Preparing record of samples, including sample date, location, description, signs of concern, and any field results;
- Decontaminating all re-useable sampling equipment prior to collecting each sample using a 3% solution of phosphate free detergent (Decon 90) and distilled water;
- Immediate placement of sample in laboratory prepared sample containers and capping;
- Labelling sample containers with individual and unique identification, including project number and sample number;
- Placing the samples into a cooled, insulated and sealed container for transport to the laboratory; and
- Using chain-of-custody documentation so that sample tracking and custody can be cross checked at any point in the transfer of samples from the field to hand-over to the laboratory.

If a groundwater monitoring well is to be sampled, micro-purging of the well using a low flow pump until field parameters (such as pH, temperature, dissolved oxygen, EC and redox) have stabilised should be undertaken prior to sampling.

11.4 Field Quality Control and Quality Assurance

QA/QC procedures will be adopted to assess the repeatability and reliability of the results.

Field QA/QC testing will include the following:

- 5% sample inter-laboratory analysis, analysed for the same suite as primary sample;
- 5% sample intra-laboratory analysis, analysed for the same suite as primary sample;
- Rinsate samples (where re-useable sampling equipment is used), analysed for the suite of analytes analysed by the majority of the primary samples;
- Trip spike samples tested for BTEX where volatile contaminants are of concern (one per batch of samples tested); and
- Trip blank samples tested for BTEX where volatile contaminants are of concern (one per batch of samples tested).

11.5 Laboratory Analysis

Laboratory analysis of samples will be undertaken by laboratories with NATA accreditation for the analyte being tested. The laboratory will undertake in-house QA/QC procedures.

Samples will be analysed for the contaminants of concern identified for the sampling purpose. These contaminants will be identified based on available laboratory results from previous testing, field observations and the objective of the analysis.

11.6 Validation Reporting and Supporting Documents

The following documents will need to be reviewed as part of the validation assessment, and will need to be provided by the referenced companies and/or personnel.

The Contractor is to provide:

- Records of any liquid waste removal and disposal, including disposal dockets;
- Disposal dockets: for any soil materials disposed off-site, the contractor will supply records of: transportation, spoil disposal location, receipt provided by the receiving waste facility (where available);
- Imported materials records: records for any soil imported onto the site, including source site, classification reports; and
- Records relating to any unexpected finds and contingency plans implemented.

The Occupational Hygienist will prepare or obtain the following documents:

- Airborne asbestos monitoring records;
- Interim visual clearance certificates during asbestos removal (if applicable); and
- A written final clearance certificate.

The Environmental Consultant will prepare or obtain the following documents:

- Chain-of-Custody documentation;
- Letters/ memos as required to provide instruction or information to the Principal and Contractor; and
- A final validation report.

The final validation assessment report will be prepared for the site by the Environmental Consultant in accordance with NSW Office of Environment and Heritage (OEH) *Contaminated Sites Guidelines for Consultants Reporting on Contaminated Sites* (reprinted 2011) and other appropriate guidance documentation. The validation report shall detail the methodology, results and conclusion of the assessment and make a clear statement regarding the suitability of the site for the proposed land use.

12. Site Management Plan

12.1 Standard Site Management Plan Requirements

It is the responsibility of the Contractor to develop a site management plan(s) (SMP) detailing site management, environmental management and work health and safety (WHS) (including site emergency response) plans for the site. It is noted that at this stage, the design plans and relevant approvals for the project have not been finalised. Therefore, prior to commencement of any remediation works, the SMP that is developed by the contractor, must include the details of the remediation scheduling, contact details of relevant personnel for the project (including contact details for community liaison) and management plans for construction and implementation of the project.

Works will comply with all legislative requirements including, but not limited to, those set out under the following Acts (and their subsequent amendments and regulations):

- Environmentally Hazardous Chemicals Act, 1985;
- Hazardous Chemicals Act, 1985;
- Environmental Offences and Penalties Act, 1989;
- Agricultural and Veterinary Chemicals Act, 1994;
- Protection of the Environment Operations Act, 1997 (POEO Act);
- Contaminated Land Management Act, 1997 (CLM Act);
- Pesticide Act, 1999;
- Work Health and Safety Act, 2011 (WHS Act);

- OHS Amendment (Dangerous Goods) Act, 2003 (including OHS Amendment (Dangerous Goods) Regulation 2005); and
- POEO Amendment Act, 2005 (including POEO Amendment (Scheduled Activities and Waste) Regulation 2008).

12.2 Site Operations

Remediation works will be restricted to the hours as may be set in the Consent Conditions.

It is the site owner's/ project proponent's responsibility to ensure appropriate personnel are appointed to manage and conduct the remediation and validation works. This will include:

- The Principal's Representative, (PR) who is responsible for overseeing the implementation of this RAP;
- The Contractor, who will be responsible for conducting the remediation works and managing the site; and
- The Environmental Consultant, who will be responsible for providing advice as required for the remediation works and undertaking the validation works in accordance with this RAP.

The PR will be responsible for preparing a list of contacts for the works. The Contractor will be responsible for preparing a list of contacts, including emergency contacts for the site operations and provision of signage at the site to allow the public to contact nominated site personnel out of hours.

Prior to the commencement of site remediation works, the following interim controls will be in place:

- The construction of permanent fences around the subject area meeting appropriate specifications to prevent unauthorised entry; and
- Any pits or unstable areas on site that may generate potential WHS or operational risk will be demarcated and taped off, with appropriate rectification action undertaken (e.g. backfilling of pits as soon as practicable to prevent undue injuries to workers etc.).

12.3 Environmental Management

The work will be undertaken with all due regard to the minimisation of environmental effects and to meet all statutory requirements. The contractor will have in place a Construction Environmental Management Plan (CEMP) for the work which covers, as necessary, the following items:

- Site stormwater management;
- Acid sulphate soil management (refer to the ASSMP);
- Soil management;
- Noise and vibration control;
- Dust control;
- Odour control; and

- Contingency measures for environmental incidents.

The contractor will also be responsible to ensure that the site works comply with the following conditions:

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

12.4 Specific Requirements for Asbestos

In addition to the overarching SMP, the WHS Act and associated Regulation has specific requirements for asbestos works. The Occupational Hygienist is responsible for providing advice on Regulatory requirements for asbestos removal works and the Asbestos Contractor is responsible for implementing these requirements. A summary of the WHS requirements with respect to asbestos is provided below.

12.4.1 Notification

SafeWork NSW must be notified by the Asbestos Contractor 5 days in advance of any licensable asbestos works.

The Asbestos Contractor must, before commencing the licensed asbestos removal work, inform the person with management of control of the workplace that asbestos removal works are to be conducted and the date the work will commence.

The person with management or control of the workplace must then ensure the following are informed:

- The person's workers and any other persons at the workplace;
- The person who commissioned the asbestos removal work; and
- Any person conducting a business or undertaking at or adjacent to the workplace and any other adjacent occupied buildings.

12.4.2 Occupational Hygienist

An Occupational Hygienist who is independent of the Asbestos Contractor is to be engaged by the Principal or Principal Contractor to provide WHS advice, air monitoring and asbestos clearances.

12.4.3 WHS Plans

The Asbestos Contractor will prepare the following plans complying with Regulatory requirements, including the WHS Regulation (2011), the Code of Practice 'How to Safely Remove Asbestos' and SafeWork NSW requirements:

- Safe Works Method Statement (SWMS): which will be specific to individual tasks undertaken at the site; and
- Asbestos Removal Control Plan (ARCP) which must be prepared for all licensable asbestos removal works.

12.4.4 Licensed Contractor and Training

All licensed asbestos removal works must be undertaken by an Asbestos Contractor with a Class A or B license issued by SafeWork NSW. For friable (Class A) works a certified supervisor must be present at all times, for bonded (non-friable) works > 10 m^2 (Class B) a certified supervisor must be readily available to the certified removalist workers.

All asbestos workers at the site must be appropriately trained and certified in asbestos removal works in accordance with the WHS Regulation 2011. In addition they must be trained at each workplace & every asbestos removal job prior to the works commencing and in the ARCP.

The licensed asbestos removalist must keep records of all training works.

12.4.5 Fencing and Signage

Prior to the commencement of the asbestos works, the area will be delineated by erecting barricades and affixing warning signs. The type of barricade should be in keeping with the risk and warning signs shall be specific to asbestos removal hazards and be clearly placed at all main entry points.

12.4.6 Restriction of Access

Access to the asbestos works area will be restricted to:

- Workers engaged in asbestos removal work;
- Other persons associated with the asbestos removal work; and
- Anyone allowed under the WHS Regulation or another law to be in the asbestos removal area.

12.4.7 Airborne Asbestos Monitoring

Monitoring for airborne asbestos fibres is to be carried out by the independent Occupational Hygienist or Class A asbestos assessor during the asbestos works in accordance with the WHS Regulation (2011) and Guidance Note on the Membrane Filter Method for Estimating Airborne Asbestos Dust 2nd Ed [NOHSC; 3003 (2005)]. The Occupational Hygienist will be responsible for determining when air monitoring is required, an appropriate scope of monitoring and communicate the results promptly to the Asbestos Contractor.

12.4.8 Personal Protective Equipment

The following personal protective equipment (PPE), in addition to standard construction PPE, should be worn during works involving the handling and/or removal of soils impacted by asbestos:

- Half-face P1/P2 respirator;
- Disposable coveralls (rated type 5, cat 3 or equivalent);
- Gloves; and
- Safety glasses or safety goggles.

12.4.9 Decontamination

The Asbestos Contractor must set up decontamination facilities that are appropriate for the specific works to be undertaken and prior to the commencement of the works. The facilities must be provided to decontaminate:

- The asbestos removal area;
- Any plant used in the asbestos removal area;
- Workers carrying out asbestos removal work; and
- Other persons who have access to the asbestos removal area.

12.4.10 Clearance Inspection and Certificate

Upon completion of all asbestos removal works, the Occupational Hygienist is to undertake a visual clearance inspection. When they are satisfied the works area and immediate surrounding areas are free from any visible asbestos contamination (and any air monitoring results are below 0.01f/ml) then a final clearance certificate is issued.

12.5 Disposal of Waters

Any water requiring disposal will be assessed and managed as follows:

- Assessment of water quality by the Environmental Consultant. This will include a review of potential for the water to be impacted by various contaminants and acid sulphate soils, possible disposal options, and determination of a suitable sampling and analysis program. The Environmental Consultant will provide written advice of the results to the PR and Contractor, including comments on potential disposal options;
- Determination of the appropriate disposal method by the PR based on the above results. Treatment may be required prior to disposal. In general, disposal options for liquids include:
    - On-site absorption;
    - Disposal to stormwater;
    - Disposal to sewer under a Trade Waste Agreement. This method of disposal would require a Trade Waste Agreement with Sydney Water;

  - Disposal as a liquid waste to a licensed liquid waste contractor in accordance with the POEO Act, 1997; and
  - On-site treatment followed by disposal by one of the above methods;
- Disposal of the water in accordance with the POEO Act. Record of the disposal will be kept by the Contractor and provided to the PR and Environmental Consultant.

12.6 Specific Requirements for Chemical Contaminants

The risk to workers during construction works from the chemical contaminants is considered to be generally low. However as with all contaminated soils, measures should be undertaken to minimise the potential exposure of workers to contamination. These include:

- Minimising dermal contact with contaminated soil/ water;
- Minimising ingestion with contaminated soil/ water, including of dust; and
- Minimising inhalation of vapours from with contaminated soil/ water.

The above can be achieved by the use of appropriate PPE and good hygiene (e.g. washing hands prior to eating/ upon completion of work).

13. Unexpected Finds Protocol and Contingency Plan

13.1 Unexpected Finds Protocol

All site personnel will be inducted into their responsibilities under this Unexpected Finds Protocol (UFP), which should be included in the Contractors SMP.

All site personnel are required to report the following to the Site Manager if observed during the course of their works:

- Signs of unexpected environmental concern, e.g. presence of unexpected fibre cement, petroleum, or other chemical odours, unnatural staining, potential contamination sources (such as buried drums or tanks) or chemical spills.

Should signs of concern be observed, the Contractor will, as soon as practical:

- Place barricades around the affected area and cease work in that area;
- Notify authorities needed to obtain emergency response for any health or environmental concerns (e.g. fire brigade);
- Notify the PR of the occurrence;
- Notify any of the authorities that the Contractor is legally required to notify (e.g. EPA, Council); and
- Notify the Environmental Consultant.

The PR will notify any of the authorities which the Principal is legally required to notify (e.g. EPA, Council).

The Environmental Consultant will inspect the issue of concern and determine the nature of the issue, whether it comprises an AEC, and the appropriate approach to assessing or (if appropriate) managing the issue. If contamination is found and remediation action is considered necessary, a remediation strategy for the AEC will be prepared by the Environmental Consultant. If the AEC or proposed remediation strategy is significantly different than that detailed in the RAP, the Consent Authority or Private Certifier (as applicable) will be provided notification of the proposed works.

13.2 Landfarming Contingency

'Landfarming' is a form of bioremediation which can be utilised for treating certain types of contamination in soils. The establishment of a landfarm(s) to treat soil contaminated with petroleum hydrocarbons has not been included as part of the planned remediation. It is, however, included as a contingency in the case that soil grossly contaminated with petroleum hydrocarbons is encountered and offsite disposal options are limited due to the gross contamination.

NSW EPA, *Best Practice Note: Landfarming,* 2014 describes the control measures the EPA believes should be applies to minimise environmental impacts from the process.

Below describes the landfarming methodology that may be undertaken following further advice from the Environmental Consultant:

- A treatment area will be designated for the stockpiling and bioremediation of petroleum impacted soil. The treatment area is to be located away from sensitive receptors (e.g. creeks, drainage lines and adjacent site users);
- Water run-on should be avoided by the use of bunds or ditches which divert stormwater away from the treatment area. Measures for leachate collection from the treatment area and prevention of the leachate entering groundwater will need to be implemented;
- Contaminated soils are to be spread within the treatment area to a height of less than 0.5 m;
- Light conditioning of spread soils may need to be used to keep them moist and minimise dust and vapour generation;
- If significant odours are detectable outside the treatment area, covering of the material and/ or use of an odour suppressant (e.g BioSolve) will need to be implemented to manage these odours;
- The Contractor is to turn the spread soil on a regular basis (nominally twice a week) to aerate the soils and assist in the break-down of petroleum hydrocarbons;
- The Environmental Consultant will periodically check the progress of treatment (based on visual and olfactory observations as well as by using a PID);
- If considered appropriate to speed up the land farming process, additional nutrient, organic matter or commercial product may be added;
- Once the Environmental Consultant notes that signs of contamination have significantly lessened, soil samples will be collected by the Environmental Consultant (at the frequency

described in Section 11.2 for stockpiles). Samples will be analysed for the contaminants of concern;

- Depending on the assessment of analytical results, the Environmental Consultant will advise if continued landfarming is required, or if the soil is suitable to re-used onsite or disposed in accordance with a waste classification. In the case that continued landfarming is undertaken, the Environmental Consultant will continue to assess the progress of the treatment through inspections and sampling until the treatment is determined to be sufficient to meet the desired outcome;
- Once the landfarming of soil has been completed and the soil has been removed from the treatment area, surface soil samples will be collected from stockpile footprint (unless the treatment area was on hardstand such as concrete or asphalt). Samples will be analysed for contaminants of concern. If any samples exceed the site assessment criteria, the extent of the material represented by those samples will need to be chased out and the resulting excavation validated by additional soil sampling. The contaminated material can either be remediated in the treatment area or disposed off-site (in accordance with a waste classification). If the materials are remediated in the treatment area, the area will need to be re-validated following the remediation.

14. Conclusion

It is considered that the site can be rendered suitable for the proposed development subject to appropriate remediation and management in accordance with this RAP.

The success of the remediation will need to be validated as detailed herein.

At the time of preparing this report, the ASSMP was being prepared and should be referenced for (additional) requirements for the management of ASS.

15. Limitations

Douglas Partners (DP) has prepared this report for this project at 7 Concord Avenue, Concord West, NSW in accordance with DP's proposal SYD151632 dated 9 December 2015 and acceptance received on 10 December 2015 from Jenny Rudolph of Elton Consulting (planning consultants) on behalf of F.T.D. Holdings (Concord West) Pty Ltd & Floridana Pty Ltd. The work was carried out under DP's Conditions of Engagement. This report is provided for the exclusive use of F.T.D. Holdings (Concord West) Pty Ltd & Floridana Pty Ltd for this project only and for the purposes as described in the report. It should not be used by or relied upon for other projects or purposes on the same or other site or by a third party. Any party so relying upon this report beyond its exclusive use and purpose as stated above, and without the express written consent of DP, does so entirely at its own risk and without recourse to DP for any loss or damage. In preparing this report DP has necessarily relied upon information provided by the client and/or their agents.

The recommendations provided in the report are based on the sub-surface conditions previously encountered on the site only at the specific sampling and/or testing locations, and then only to the

depths investigated and at the time the work was carried out. Sub-surface conditions can change abruptly due to variable geological processes and also as a result of human influences.

DP's advice is based upon the conditions encountered during the previous investigations. The accuracy of the advice provided by DP in this report may be affected by undetected variations in ground conditions across the site between and beyond the sampling and/or testing locations, which have been limited by restrictions on intrusive investigations at the time of investigation. The advice may also be limited by budget constraints imposed by others or by site accessibility.

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

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

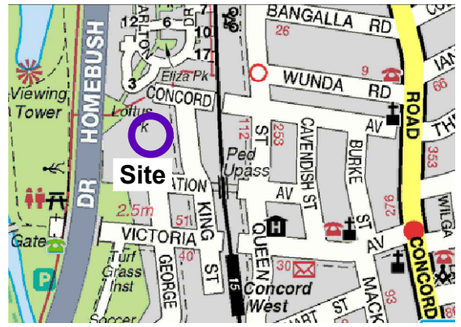
The contents of this report do not constitute formal design components such as are required, by the Health and Safety Legislation and Regulations, to be included in a Safety Report specifying the hazards likely to be encountered during construction and the controls required to mitigate risk.

Douglas Partners Pty Ltd

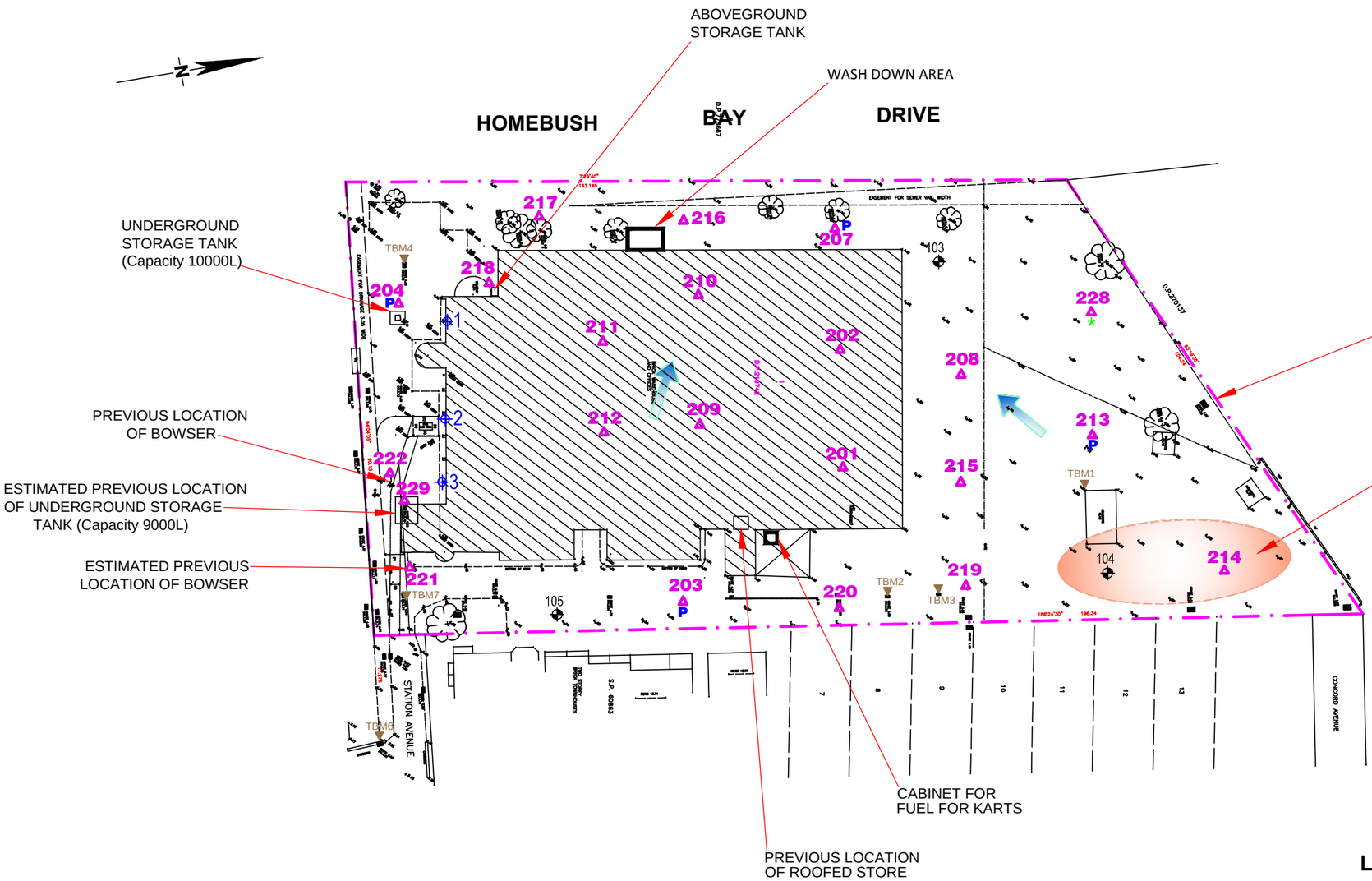
Appendix A

Drawing

& Planning Proposal



Locality Plan



LEGEND

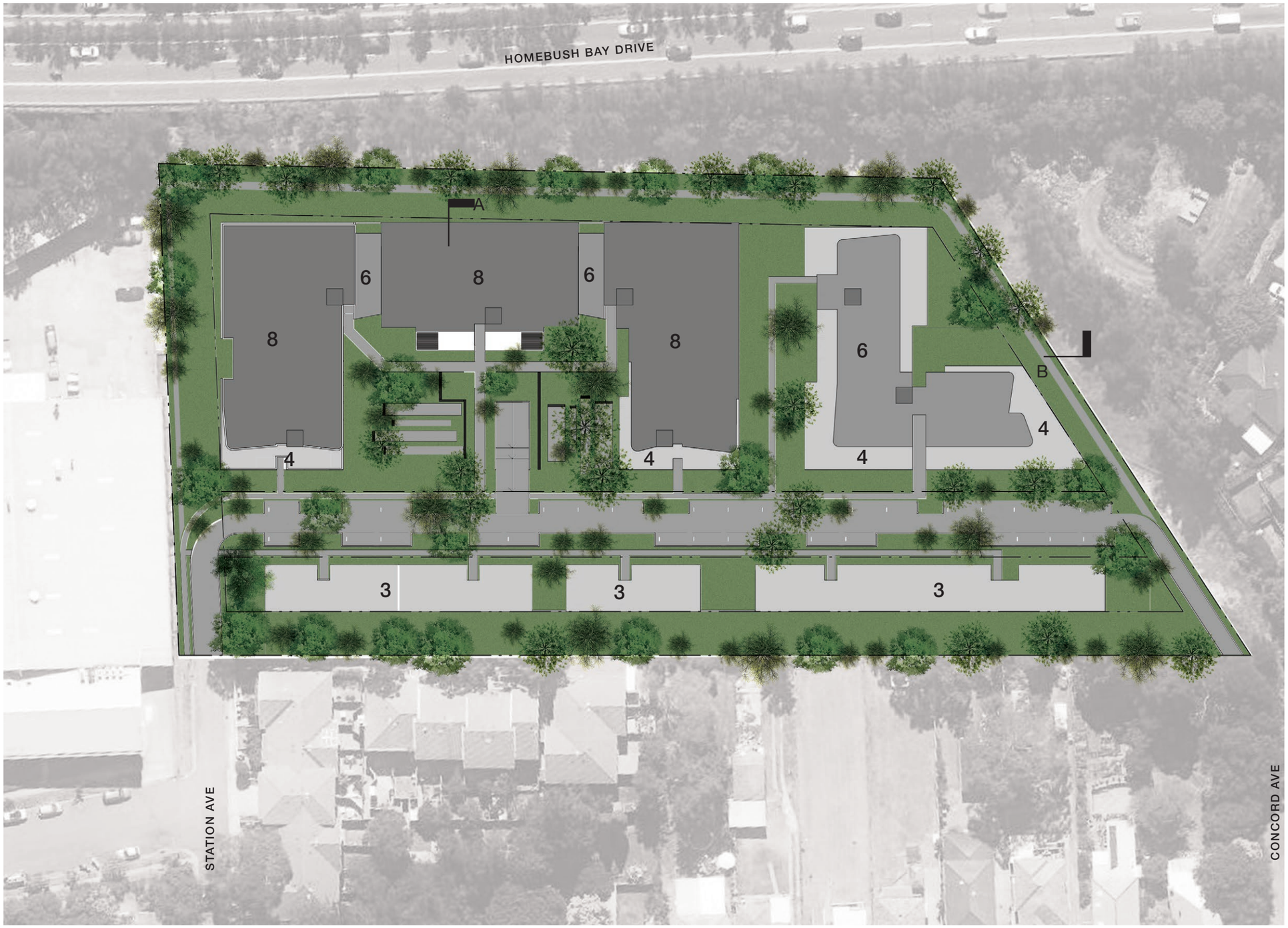
- PREVIOUS TEST BORE LOCATION (1990)
- TEST BORE LOCATION
- TEST BORE LOCATION
- * HAND AUGER ONLY AT TEST BORE 228
- INFERRED GROUNDWATER FLOW DIRECTION
- TEMPORARY BENCH MARK (TBM)
- P PIEZOMETER INSTALLED AT TEST BORE LOCATION

0 10 20 30 40 50 75 100m

1:1000 @ A3

Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT: F.T.D. Holdings (Concord West) Pty Ltd & Floridana Pty Ltd		TITLE: **Location of Test Bores and Site Features**	PROJECT No: 84964.02
OFFICE: Sydney	DRAWN BY: PSCH	**Remediation Action Plan, Proposed Residential Development**	DRAWING No: 1
SCALE: 1:1000 @ A3	DATE: 2.11.2015	**7 Concord Avenue, CONCORD WEST**	REVISION: 0



Numbers Indicate Building Storeys

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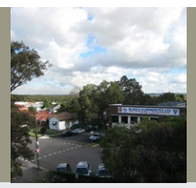
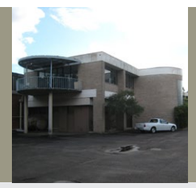
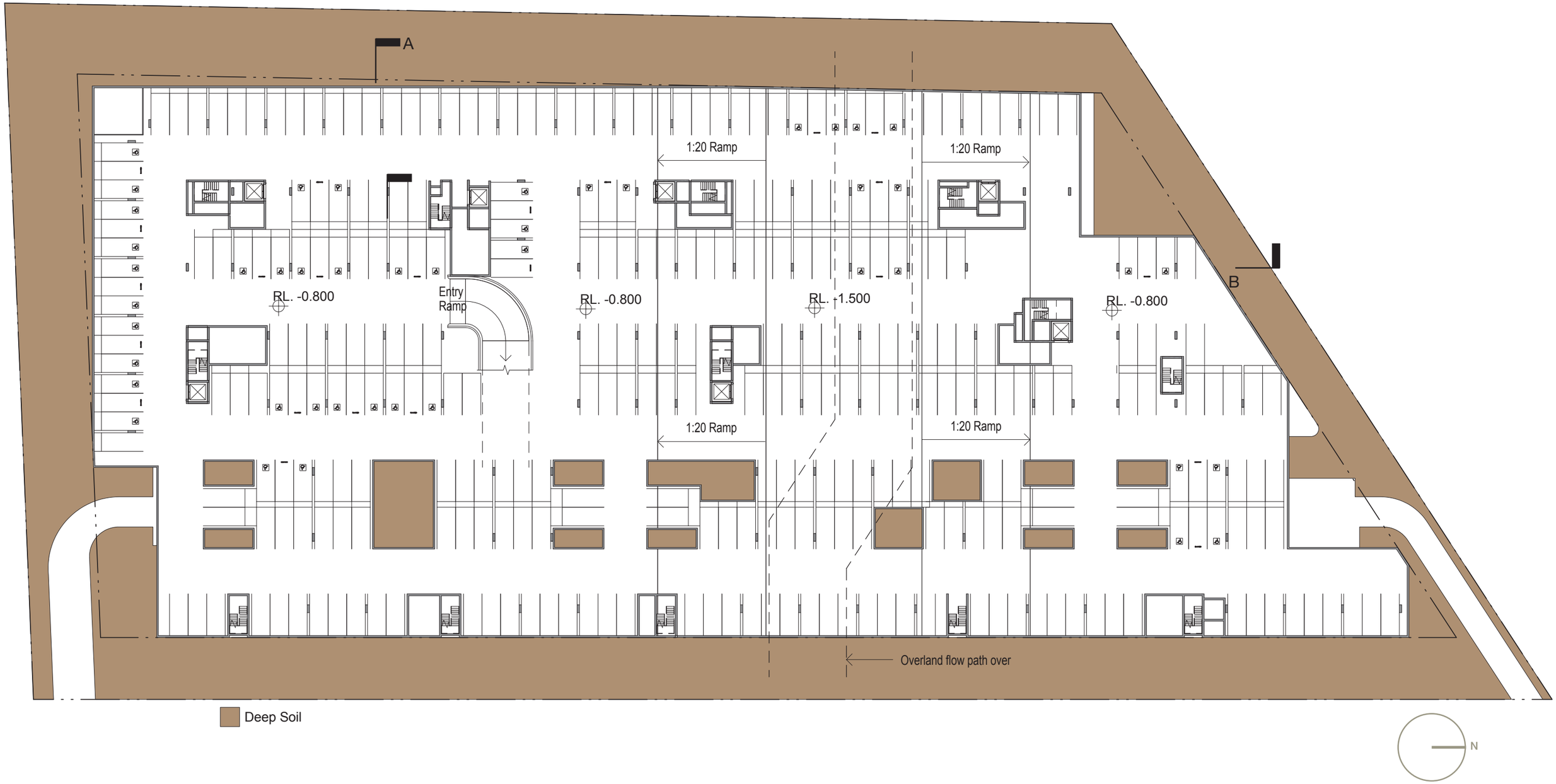
Suite 1, L2, 24 Bay Street, Double Bay NSW 2028
Tel : 9328 3339 Fax : 9328 3369
www.antoniades.com.au ACN 129 731 559





7 CONCORD AVE, CONCORD WEST
PLANNING PROPOSAL
November 2015

SITE PLAN



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BASEMENT PLAN

BICYCLE PATH

A

RL. 2.500

RL. 2.500

BUILDING 1

RL. 2.300

RL. 2.500

OVERLAND
FLOW PATH
UNDER

RL. 2.500

BUILDING 2

B

CENTRAL
COURTYARD

RL. 2.300

RL. 2.300

VISITOR PARKING

VISITOR PARKING

RL. 2.200

VISITOR PARKING

OVERLAND
FLOW PATH
UNDER

BUILDING 3

1 Bed
1 Bed +
2 Bed
2 Bed +
3 Bed
Studio

N

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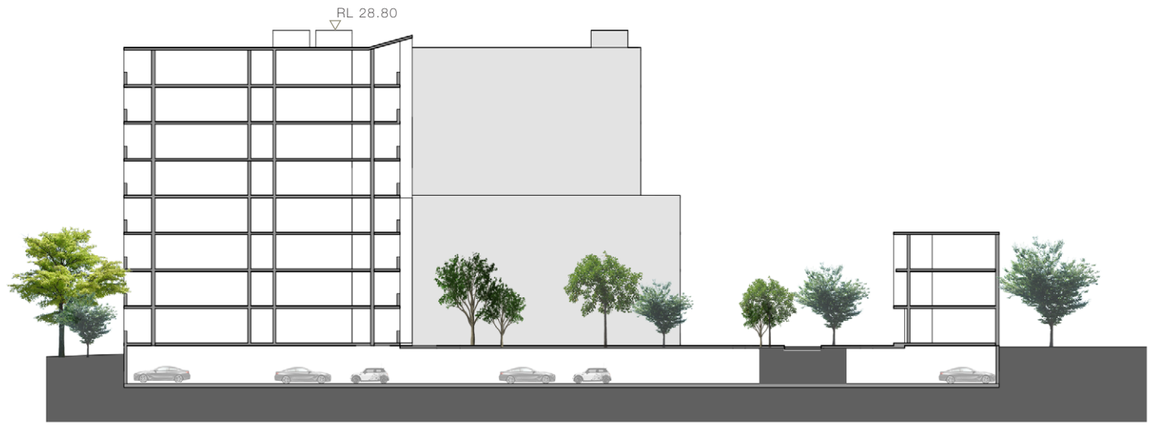
GROUND FLOOR PLAN



SECTION A

SECTION B

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PLANNING PROPOSAL

November 2015

SECTIONS

Appendix B

Test Bore Logs

& Notes about this Report

About this Report

Douglas Partners

Introduction

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

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

Copyright

Borehole and Test Pit Logs

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

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

Groundwater

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

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

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

Reports

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

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

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

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

About this Report

Site Anomalies

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

Information for Contractual Purposes

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

Site Inspection

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

Sampling

Sampling is carried out during drilling or test pitting to allow engineering examination (and laboratory testing where required) of the soil or rock.

Disturbed samples taken during drilling provide information on colour, type, inclusions and, depending upon the degree of disturbance, some information on strength and structure.

Undisturbed samples are taken by pushing a thin-walled sample tube into the soil and withdrawing it to obtain a sample of the soil in a relatively undisturbed state. Such samples yield information on structure and strength, and are necessary for laboratory determination of shear strength and compressibility. Undisturbed sampling is generally effective only in cohesive soils.

Test Pits

Test pits are usually excavated with a backhoe or an excavator, allowing close examination of the in-situ soil if it is safe to enter into the pit. The depth of excavation is limited to about 3 m for a backhoe and up to 6 m for a large excavator. A potential disadvantage of this investigation method is the larger area of disturbance to the site.

Large Diameter Augers

Boreholes can be drilled using a rotating plate or short spiral auger, generally 300 mm or larger in diameter commonly mounted on a standard piling rig. The cuttings are returned to the surface at intervals (generally not more than 0.5 m) and are disturbed but usually unchanged in moisture content. Identification of soil strata is generally much more reliable than with continuous spiral flight augers, and is usually supplemented by occasional undisturbed tube samples.

Continuous Spiral Flight Augers

The borehole is advanced using 90-115 mm diameter continuous spiral flight augers which are withdrawn at intervals to allow sampling or in-situ testing. This is a relatively economical means of drilling in clays and sands above the water table. Samples are returned to the surface, or may be collected after withdrawal of the auger flights, but they are disturbed and may be mixed with soils from the sides of the hole. Information from the drilling (as distinct from specific sampling by SPTs or undisturbed samples) is of relatively low reliability, due to the remoulding, possible mixing or softening of samples by groundwater.

Non-core Rotary Drilling

The borehole is advanced using a rotary bit, with water or drilling mud being pumped down the drill rods and returned up the annulus, carrying the drill cuttings. Only major changes in stratification can be determined from the cuttings, together with some information from the rate of penetration. Where drilling mud is used this can mask the cuttings and reliable identification is only possible from separate sampling such as SPTs.

Continuous Core Drilling

A continuous core sample can be obtained using a diamond tipped core barrel, usually with a 50 mm internal diameter. Provided full core recovery is achieved (which is not always possible in weak rocks and granular soils), this technique provides a very reliable method of investigation.

Standard Penetration Tests

Standard penetration tests (SPT) are used as a means of estimating the density or strength of soils and also of obtaining a relatively undisturbed sample. The test procedure is described in Australian Standard 1289, Methods of Testing Soils for Engineering Purposes - Test 6.3.1.

The test is carried out in a borehole by driving a 50 mm diameter split sample tube under the impact of a 63 kg hammer with a free fall of 760 mm. It is normal for the tube to be driven in three successive 150 mm increments and the 'N' value is taken as the number of blows for the last 300 mm. In dense sands, very hard clays or weak rock, the full 450 mm penetration may not be practicable and the test is discontinued.

The test results are reported in the following form.

- In the case where full penetration is obtained with successive blow counts for each 150 mm of, say, 4, 6 and 7 as:

  4,6,7
  N=13

- In the case where the test is discontinued before the full penetration depth, say after 15 blows for the first 150 mm and 30 blows for the next 40 mm as:

  15, 30/40 mm

The results of the SPT tests can be related empirically to the engineering properties of the soils.

Dynamic Cone Penetrometer Tests / Perth Sand Penetrometer Tests

Dynamic penetrometer tests (DCP or PSP) are carried out by driving a steel rod into the ground using a standard weight of hammer falling a specified distance. As the rod penetrates the soil the number of blows required to penetrate each successive 150 mm depth are recorded. Normally there is a depth limitation of 1.2 m, but this may be extended in certain conditions by the use of extension rods. Two types of penetrometer are commonly used.

- Perth sand penetrometer - a 16 mm diameter flat ended rod is driven using a 9 kg hammer dropping 600 mm (AS 1289, Test 6.3.3). This test was developed for testing the density of sands and is mainly used in granular soils and filling.
- Cone penetrometer - a 16 mm diameter rod with a 20 mm diameter cone end is driven using a 9 kg hammer dropping 510 mm (AS 1289, Test 6.3.2). This test was developed initially for pavement subgrade investigations, and correlations of the test results with California Bearing Ratio have been published by various road authorities.

Soil Descriptions

Douglas Partners

Description and Classification Methods

The methods of description and classification of soils and rocks used in this report are based on Australian Standard AS 1726, Geotechnical Site Investigations Code. In general, the descriptions include strength or density, colour, structure, soil or rock type and inclusions.

Soil Types

Soil types are described according to the predominant particle size, qualified by the grading of other particles present:

Type	Particle size (mm)
Boulder	>200
Cobble	63 - 200
Gravel	2.36 - 63
Sand	0.075 - 2.36
Silt	0.002 - 0.075
Clay	<0.002

The sand and gravel sizes can be further subdivided as follows:

Type	Particle size (mm)
Coarse gravel	20 - 63
Medium gravel	6 - 20
Fine gravel	2.36 - 6
Coarse sand	0.6 - 2.36
Medium sand	0.2 - 0.6
Fine sand	0.075 - 0.2

The proportions of secondary constituents of soils are described as:

Term	Proportion	Example
And	Specify	Clay (60%) and Sand (40%)
Adjective	20 - 35%	Sandy Clay
Slightly	12 - 20%	Slightly Sandy Clay
With some	5 - 12%	Clay with some sand
With a trace of	0 - 5%	Clay with a trace of sand

Definitions of grading terms used are:

- Well graded - a good representation of all particle sizes
- Poorly graded - an excess or deficiency of particular sizes within the specified range
- Uniformly graded - an excess of a particular particle size
- Gap graded - a deficiency of a particular particle size with the range

Cohesive Soils

Cohesive soils, such as clays, are classified on the basis of undrained shear strength. The strength may be measured by laboratory testing, or estimated by field tests or engineering examination. The strength terms are defined as follows:

Description	Abbreviation	Undrained shear strength (kPa)
Very soft	vs	<12
Soft	s	12 - 25
Firm	f	25 - 50
Stiff	st	50 - 100
Very stiff	vst	100 - 200
Hard	h	>200

Cohesionless Soils

Cohesionless soils, such as clean sands, are classified on the basis of relative density, generally from the results of standard penetration tests (SPT), cone penetration tests (CPT) or dynamic penetrometers (PSP). The relative density terms are given below:

Relative Density	Abbreviation	SPT N value	CPT qc value (MPa)
Very loose	vl	<4	<2
Loose	l	4 - 10	2 -5
Medium dense	md	10 - 30	5 - 15
Dense	d	30 - 50	15 - 25
Very dense	vd	>50	>25

Soil Descriptions

Soil Origin

It is often difficult to accurately determine the origin of a soil. Soils can generally be classified as:

- Residual soil - derived from in-situ weathering of the underlying rock;
- Transported soils - formed somewhere else and transported by nature to the site; or
- Filling - moved by man.

Transported soils may be further subdivided into:

- Alluvium - river deposits
- Lacustrine - lake deposits
- Aeolian - wind deposits
- Littoral - beach deposits
- Estuarine - tidal river deposits
- Talus - scree or coarse colluvium
- Slopewash or Colluvium - transported downslope by gravity assisted by water. Often includes angular rock fragments and boulders.

Rock Strength

Rock strength is defined by the Point Load Strength Index ($Is_{(50)}$) and refers to the strength of the rock substance and not the strength of the overall rock mass, which may be considerably weaker due to defects. The test procedure is described by Australian Standard 4133.4.1 - 1993. The terms used to describe rock strength are as follows:

Term	Abbreviation	Point Load Index $Is_{(50)}$ MPa	Approx Unconfined Compressive Strength MPa*
Extremely low	EL	<0.03	<0.6
Very low	VL	0.03 - 0.1	0.6 - 2
Low	L	0.1 - 0.3	2 - 6
Medium	M	0.3 - 1.0	6 - 20
High	H	1 - 3	20 - 60
Very high	VH	3 - 10	60 - 200
Extremely high	EH	>10	>200

* Assumes a ratio of 20:1 for UCS to $Is_{(50)}$

Degree of Weathering

The degree of weathering of rock is classified as follows:

Term	Abbreviation	Description
Extremely weathered	EW	Rock substance has soil properties, i.e. it can be remoulded and classified as a soil but the texture of the original rock is still evident.
Highly weathered	HW	Limonite staining or bleaching affects whole of rock substance and other signs of decomposition are evident. Porosity and strength may be altered as a result of iron leaching or deposition. Colour and strength of original fresh rock is not recognisable
Moderately weathered	MW	Staining and discolouration of rock substance has taken place
Slightly weathered	SW	Rock substance is slightly discoloured but shows little or no change of strength from fresh rock
Fresh stained	Fs	Rock substance unaffected by weathering but staining visible along defects
Fresh	Fr	No signs of decomposition or staining

Degree of Fracturing

The following classification applies to the spacing of natural fractures in diamond drill cores. It includes bedding plane partings, joints and other defects, but excludes drilling breaks.

Term	Description
Fragmented	Fragments of <20 mm
Highly Fractured	Core lengths of 20-40 mm with some fragments
Fractured	Core lengths of 40-200 mm with some shorter and longer sections
Slightly Fractured	Core lengths of 200-1000 mm with some shorter and loner sections
Unbroken	Core lengths mostly > 1000 mm

Rock Descriptions

Rock Quality Designation

The quality of the cored rock can be measured using the Rock Quality Designation (RQD) index, defined as:

$$\text{RQD \%} = \frac{\text{cumulative length of 'sound' core sections} \geq \text{100 mm long}}{\text{total drilled length of section being assessed}}$$

where 'sound' rock is assessed to be rock of low strength or better. The RQD applies only to natural fractures. If the core is broken by drilling or handling (i.e. drilling breaks) then the broken pieces are fitted back together and are not included in the calculation of RQD.

Stratification Spacing

For sedimentary rocks the following terms may be used to describe the spacing of bedding partings:

Term	Separation of Stratification Planes
Thinly laminated	< 6 mm
Laminated	6 mm to 20 mm
Very thinly bedded	20 mm to 60 mm
Thinly bedded	60 mm to 0.2 m
Medium bedded	0.2 m to 0.6 m
Thickly bedded	0.6 m to 2 m
Very thickly bedded	> 2 m

Symbols & Abbreviations

Douglas Partners

Introduction

These notes summarise abbreviations commonly used on borehole logs and test pit reports.

Drilling or Excavation Methods

C	Core Drilling
R	Rotary drilling
SFA	Spiral flight augers
NMLC	Diamond core - 52 mm dia
NQ	Diamond core - 47 mm dia
HQ	Diamond core - 63 mm dia
PQ	Diamond core - 81 mm dia

Water

▷	Water seep
▽	Water level

Sampling and Testing

A	Auger sample
B	Bulk sample
D	Disturbed sample
E	Environmental sample
U_{50}	Undisturbed tube sample (50mm)
W	Water sample
pp	pocket penetrometer (kPa)
PID	Photo ionisation detector
PL	Point load strength Is(50) MPa
S	Standard Penetration Test
V	Shear vane (kPa)

Description of Defects in Rock

The abbreviated descriptions of the defects should be in the following order: Depth, Type, Orientation, Coating, Shape, Roughness and Other. Drilling and handling breaks are not usually included on the logs.

Defect Type

B	Bedding plane
Cs	Clay seam
Cv	Cleavage
Cz	Crushed zone
Ds	Decomposed seam
F	Fault
J	Joint
Lam	lamination
Pt	Parting
Sz	Sheared Zone
V	Vein

Orientation

The inclination of defects is always measured from the perpendicular to the core axis.

h	horizontal
v	vertical
sh	sub-horizontal
sv	sub-vertical

Coating or Infilling Term

cln	clean
co	coating
he	healed
inf	infilled
stn	stained
ti	tight
vn	veneer

Coating Descriptor

ca	calcite
cbs	carbonaceous
cly	clay
fe	iron oxide
mn	manganese
slt	silty

Shape

cu	curved
ir	irregular
pl	planar
st	stepped
un	undulating

Roughness

po	polished
ro	rough
sl	slickensided
sm	smooth
vr	very rough

Other

fg	fragmented
bnd	band
qtz	quartz

Symbols & Abbreviations

Graphic Symbols for Soil and Rock

General


Asphalt


Road base


Concrete


Filling

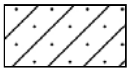
Soils


Topsoil

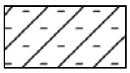

Peat


Clay

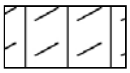

Silty clay

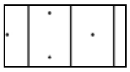

Sandy clay

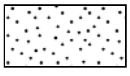

Gravelly clay

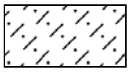

Shaly clay

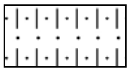

Silt


Clayey silt


Sandy silt

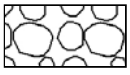

Sand

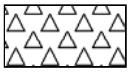

Clayey sand


Silty sand


Gravel


Sandy gravel


Cobbles, boulders

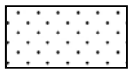

Talus

Sedimentary Rocks

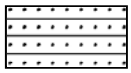

Boulder conglomerate

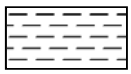

Conglomerate


Conglomeratic sandstone

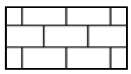

Sandstone


Siltstone


Laminite

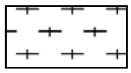

Mudstone, claystone, shale

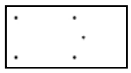

Coal


Limestone

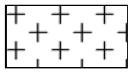
Metamorphic Rocks

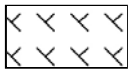

Slate, phyllite, schist

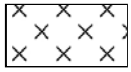

Gneiss

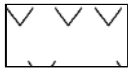

Quartzite

Igneous Rocks


Granite


Dolerite, basalt, andesite


Dacite, epidote


Tuff, breccia


Porphyry

BOREHOLE LOG

CLIENT: Fred Hoskings Pty Ltd
PROJECT: Investigation For Future Development
LOCATION: Station Avenue, Concord West

SURFACE LEVEL: 4.4 AHD
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 103
PROJECT No: 45146
DATE: 18 Sep 07
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear D - Drill Break)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
	0.3	FILLING - well compacted, brown and grey gravelly sand filling with some clay, humid							A			
		FILLING - variably compacted, red, yellow brown, grey gravelly clay filling with some ironstone gravel and timber pieces at 1.0-1.3m depth, damp							A			
	1.3	PEATY CLAY - soft, black peaty clay, moist							S			12,6,3 N = 9
	1.9	SILTY CLAY - stiff to very stiff, light grey mottled orange silty clay, moist							A			
									S			2,4,7 N = 11
									S			5,8,10 N = 18
		- saturated from 4.3m				▼			S			3,8,7 N = 15
	4.9	SHALE - extremely low strength, grey mottled orange shale						Note: Unless otherwise stated, rock is fractured along rough ironstained planar bedding planes or joints dipping 0°- 10°	S			16/130mm refusal
	5.95	SHALE - extremely low to very low strength, extremely to highly weathered, grey brown shale						5.95-7.6m: extremely to highly weathered, obscuring discontinuities	C	100	0	
	7.6	SHALE - low to medium strength, moderately to slightly weathered, highly fractured to fractured, grey brown shale						7.72m: B0°- 5°, 10mm clay 7.78m: J85° smooth 8.04m: J30° smooth 8.4m: J30°	C	100	41	PL(A) = 0.3MPa PL(A) = 0.3MPa
	9.0	Bore discontinued at 9.0m						8.85-8.95m: fragmented				

RIG: Multi-Access Rig **DRILLER:** Traccess **LOGGED:** Boyd/Islam **CASING:** HQ to 6.0m

TYPE OF BORING: Solid flight auger (100mm) to 5.95m; NMLC-Coring to 9.0m

WATER OBSERVATIONS: Free groundwater observed at 4.3m whilst augering

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials: GRB
Date: 16/10/07

Douglas Partners
Geotechnics · Environment · Groundwater

BOREHOLE LOG

CLIENT: Fred Hoskings Pty Ltd
PROJECT: Investigation For Future Development
LOCATION: Station Avenue, Concord West

SURFACE LEVEL: 4.3 AHD
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 104
PROJECT No: 45146
DATE: 18 Sep 07
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding, J - Joint, S - Shear, D - Drill Break)	Type	Core Rec. %	RQD %	Test Results & Comments
4.3	0.4	FILLING - well compacted, brown and grey recycled concrete, gravel and sand filling, humid							A			
	0.8	FILLING - poorly compacted, red brown mottled grey gravelly clay filling with some concrete fragments, humid							A*			
	1	SILTY CLAY - stiff to very stiff, light grey mottled orange and red slightly sandy silty clay, humid							S			2,4,6 N = 10
	2								S			6,10,12 N = 22
	3											
1	3.2	SHALE - extremely low to very low strength, grey mottled orange shale						Note: Unless otherwise stated, rock is fractured along rough, ironstained planar bedding planes or joints dipping 0°- 10°	S			12,20,5/20mm *refusal*
0	4.3	SHALE - medium strength, fresh stained, fractured, grey brown shale with some sandstone laminae						4.3-5.19m: B0° ironstained & clay veneer 5.1m: J25° 5.35m: J25° 5.6m: J40° 5.77m: J20° 5.8m: J20° 5.9m: J45° 6.1m: J20° 6.16-6.56m: J70°- 90°	C	100	77	PL(A) = 0.8MPa PL(A) = 0.7MPa
-3	6.6	SHALE - high strength, fresh, slightly fractured, dark grey shale						6.56m: J30° smooth 6.68-6.85m: J80° 7.26m: J75°				PL(A) = 1.4MPa
-4	7.5	Bore discontinued at 7.5m										

RIG: Multi-Access Rig **DRILLER:** Traccess **LOGGED:** Boyd/Islam **CASING:** HQ to 4.3m

TYPE OF BORING: Solid flight auger (100mm) to 4.3m; NMLC-Coring to 7.5m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: *Duplicate sample Z-180907 collected

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U$_x$	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials: GRB
Date: 16/10/07

Douglas Partners
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BOREHOLE LOG

CLIENT: Fred Hoskings Pty Ltd
PROJECT: Investigation For Future Development
LOCATION: Station Avenue, Concord West

SURFACE LEVEL: 4.4 AHD
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 105
PROJECT No: 45146
DATE: 18 Sep 07
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding, J - Joint, S - Shear, D - Drill Break)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
	0.03	ASPHALTIC CONCRETE							A			
	0.3	FILLING - well compacted, dark grey slightly clayey, sandy gravel filling (roadbase). Gravel of slag with some ash, humid							A			
	1.0	FILLING - variably compacted, brown gravelly clay filling, with a trace of brick fragments, moist										
	1.5	SILTY CLAY - stiff, light grey slightly sandy silty clay with ironstone gravel, wet							S			2,5,7 N = 12
	2.0	GRAVELLY CLAY - soft, brown black gravelly clay, saturated (possibly peat layer)							A			
		SILTY CLAY - very stiff, light grey slightly sandy silty clay, moist										
									S			9,18,16 N = 34
								Note: Unless otherwise stated, rock is fractured along rough ironstained planar bedding planes or joints dipping 0°- 10°	S			7,9,9 N = 18
	3.9	SHALE - extremely low strength, grey mottled orange shale										
	4.15	SHALE- medium strength, moderately to slightly weathered, highly fractured to fractured, grey brown shale with some sandstone laminae						4.15-4.6m: B0° ironstained 4.67m: J25° healed 4.81m: J35° 5.34m: J40° 5.64m: J60° 6.04m: J35° 6.12-6.30m: J75°- 85° rough, irregular 6.33-6.50m: J25°- 35° with micro faults 6.76m: J45° 6.81m: J50° 6.92m: J85° 7.15m: J45° 7.43m: B0° 10mm clay	C	100	66	PL(A) = 0.5MPa PL(A) = 0.8MPa PL(A) = 1.4MPa
	6.5	SHALE - high strength, fresh, slightly fractured, grey shale with some sandstone laminae							C	100	100	
									C	100	98	PL(A) = 1.3MPa
	7.58	Bore discontinued at 7.58m										

RIG: Multi-Access Rig **DRILLER:** Traccess **LOGGED:** Boyd/Islam **CASING:** HQ to 4.4m

TYPE OF BORING: Solid flight auger (100mm) to 4.2m; NMLC-Coring to 7.58m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U$_x$	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials: GRB
Date: 16/10/07

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BOREHOLE LOG

CLIENT: Fred Hosking Pty Ltd
PROJECT: Phase 1 and 2 Contamination Assessment
LOCATION: 7 Concord Avenue & 202-210 George Street Concord West

SURFACE LEVEL: 4.52 AHD^
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 201
PROJECT No: 45146A
DATE: 09 Oct 07
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	0.15	CONCRETE							
		FILLING - brown clay filling with some sand, silt and trace gravel		A	0.2		PID=2ppm		
					0.5				
	0.8	PEATY CLAY - soft, black peaty clay with trace gravel, moist							
	1.0	SILTY CLAY - soft, brown silty clay, with trace ironstone gravel, moist		A	1.0		PID<1ppm		
					1.5				
		- *saturated from 2.0m to 2.5m*						▼	
	2.5	SILTY CLAY - stiff to very stiff, mottled brown and grey silty clay, moist		A	2.5		PID=2ppm		
					2.8				
	3.0	Bore discontinued at 3.0m - target depth reached							

RIG: Bobcat **DRILLER:** S Gregor **LOGGED:** DW **CASING:** Uncased

TYPE OF BORING: Concrete coring (150mm diameter) to 0.15m then 100mm diameter solid flight auger

WATER OBSERVATIONS: Free groundwater observed at 2.0m whilst augering

REMARKS: ^Benchmark obtained from survey plan provided by client
Important Note: Soil strengths were determined subjectively in the field and are not to be used for geotechnical purposes

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials: RV
Date: 15/10/07

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BOREHOLE LOG

CLIENT: Fred Hosking Pty Ltd
PROJECT: Phase 1 and 2 Contamination Assessment
LOCATION: 7 Concord Avenue & 202-210 George Street Concord West

SURFACE LEVEL: 4.48 AHD^
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 202
PROJECT No: 45146A
DATE: 09 Oct 07
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
		CONCRETE							
	0.14	FILLING - brown sandy clay filling, with trace silt and gravel			0.2				
				A			PID<1ppm		
					0.5				
				A			PID=2ppm		
	1.0	Bore discontinued at 1.0m - refusal on concrete			1.0				

RIG: Bobcat **DRILLER:** S Gregor **LOGGED:** DW **CASING:** Uncased

TYPE OF BORING: Concrete coring (150mm diameter) to 0.14m then 100mm diameter solid flight auger

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: ^Benchmark obtained from survey plan provided by client

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials: D.W
Date: 25/10/07

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BOREHOLE LOG

CLIENT: Fred Hosking Pty Ltd
PROJECT: Phase 1 and 2 Contamination Assessment
LOCATION: 7 Concord Avenue & 202-210 George Street Concord West

SURFACE LEVEL: 4.42 AHD^
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 203
PROJECT No: 45146A
DATE: 09 Oct 07
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	0.07	ASPHALTIC CONCRETE							Gatic cover; Concrete
	0.15	FILLING - brown and grey clayey gravel filling with some sand (roadbase)							
		FILLING - light brown silty clay filling, with trace gravel and brick pieces		A	0.2		PID<1ppm		Bentonite
					0.5				
	0.8	PEATY CLAY - soft, black peaty clay with trace rootlets, moist		A	0.8		PID=2ppm		
	1.0	SILTY CLAY - soft, grey silty clay with trace gravel, moist to wet		A	1.0		PID=3ppm	22-10-07	
	1.3	SILTY CLAY - stiff to very stiff, mottled red and grey silty clay with trace ironstone gravel, moist			1.3				
					1.5				Backfilled with gravel
				A*			PID<1ppm		
					2.0				
					2.5				Machine slotted PVC screen
				A			PID<1ppm		
					3.0				
									End cap
	4.3	Bore discontinued at 4.3m - refusal on weathered shale							

RIG: Bobcat **DRILLER:** S Gregor **LOGGED:** DW **CASING:** Uncased

TYPE OF BORING: Concrete coring (150mm diameter) to 0.07m then 100mm diameter solid flight auger

WATER OBSERVATIONS: Free groundwater observed at 1.1m whilst augering. Groundwater measured at 1.16m bgl on 22/10/07

REMARKS: *BD1-091007 blind replicate 1.5-1.0m. ^Benchmark obtained from survey plan provided by client
Important Note: Soil strengths were determined subjectively in the field and are not to be used for geotechnical purposes

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U$_x$	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials:
Date: 25/10/07

Douglas Partners
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BOREHOLE LOG

CLIENT: Fred Hosking Pty Ltd
PROJECT: Phase 1 and 2 Contamination Assessment
LOCATION: 7 Concord Avenue & 202-210 George Street Concord West

SURFACE LEVEL: 4.39 AHD^
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 204
PROJECT No: 45146A
DATE: 09 Oct 07
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	0.05	ASPHALTIC CONCRETE							Gatic cover
		FILLING - brown gravelly sand filling with trace silty clay and concrete pieces (roadbase)		A	0.1		PID<1ppm		Concrete
	0.3	FILLING - mottled brown and grey clay filling, with trace gravel			0.3				
					0.5				Bentonite
				A			PID=3ppm	▼ 22-10-07	
	1.0	PEATY CLAY - soft, black peaty clay with trace of organic matter, moist		A	1.0		PID<1ppm		Backfilled with gravel
	1.2	SILTY CLAY - soft, grey silty clay, moist		A	1.2		PID=2ppm		
	1.4	SILTY CLAY - soft, grey silty clay with some shell fragments, wet to saturated		A	1.4 1.5		PID=2ppm		
									Machine slotted PVC screen
	1.9	SILTY CLAY - stiff to very stiff, brown and grey silty clay, with trace sand and gravel, moist		A	1.9		PID<1ppm		
					2.2				
	2.5	Bore discontinued at 2.5m - refusal on weathered shale							End cap

RIG: Bobcat **DRILLER:** S Gregor **LOGGED:** DW **CASING:** Uncased

TYPE OF BORING: 100mm diameter solid flight auger

WATER OBSERVATIONS: Free groundwater observed at 1.4m whilst augering. Groundwater measured at 0.76m bgl on 22/10/07

REMARKS: ^Benchmark obtained from survey plan provided by client
Important Note: Soil strengths were determined subjectively in the field and are not to be used for geotechnical purposes

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials: D.W
Date: 25/10/07

Douglas Partners
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BOREHOLE LOG

CLIENT: Fred Hosking Pty Ltd
PROJECT: Phase 1 and 2 Contamination Assessment
LOCATION: 7 Concord Avenue & 202-210 George Street Concord West

SURFACE LEVEL: 4.28 AHD^
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 207
PROJECT No: 45146A
DATE: 09 Oct 07
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
		FILLING - brown silty clay filling, with some gravel and trace sand and rootlets (grass surface)		A	0.0		PID<1ppm		Gatic cover; Concrete
				A	0.5		PID=1ppm		Bentonite
	1.0	FILLING - brown clay filling		A	1.0		PID<1ppm		Backfilled with gravel
	1.6	PEATY CLAY - soft, black peaty clay, moist			1.5				
	1.7	SILTY CLAY - stiff to very stiff, mottled red brown and grey silty clay, moist		A*	1.7		PID=1ppm	22-10-07	
					2.0				Machine slotted PVC screen
					3.0		- *insufficient soil from* auger to sample from depths of 3.0m & 4.0m		
	4.3	Bore discontinued at 4.3m - target depth reached							End cap

RIG: Bobcat **DRILLER:** S Gregor **LOGGED:** DW **CASING:** Uncased

TYPE OF BORING: 100mm diameter solid flight auger

WATER OBSERVATIONS: No free groundwater observed whilst augering. Groundwater measured at 2.16m bgl on 22/10/07

REMARKS: *BD3-091007 blind replicate of 207/1.7-2.0m. ^Benchmark obtained from survey plan provided by client
Important Note: Soil strengths were determined subjectively in the field and are not to be used for geotechnical purposes

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U,	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⫧ Water level

CHECKED
Initials: DW
Date: 25/10/07

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BOREHOLE LOG

CLIENT: Fred Hosking Pty Ltd
PROJECT: Phase 1 and 2 Contamination Assessment
LOCATION: 7 Concord Avenue & 202-210 George Street Concord West

SURFACE LEVEL: 4.47 AHD^
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 208
PROJECT No: 45146A
DATE: 10 Oct 07
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
		FILLING - grey sandy gravel filling, with some concrete pieces, trace plastic and roots		A	0.0		PID=1ppm		
	0.2				0.1				
		FILLING - yellow brown sandy clay filling, with trace gravel		A	0.2		PID<1ppm		
					0.5				
				A			PID<1ppm		
					1.0				
	1.1	SILTY CLAY - soft, dark grey and brown silty clay, moist to wet			1.1			▼	
				A			PID=3ppm		
	1.6	Bore discontinued at 1.6m - target depth reached			1.6				

RIG: Bobcat **DRILLER:** S Gregor **LOGGED:** DW **CASING:** Uncased

TYPE OF BORING: 100mm diameter solid flight auger

WATER OBSERVATIONS: Free groundwater observed at 1.1m whilst augering

REMARKS: ^Benchmark obtained from survey plan provided by client
Important Note: Soil strengths were determined subjectively in the field and are not to be used for geotechnical purposes

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U,	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials:
Date: 25/10/07

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BOREHOLE LOG

CLIENT: Fred Hosking Pty Ltd
PROJECT: Phase 1 and 2 Contamination Assessment
LOCATION: 7 Concord Avenue & 202-210 George Street Concord West

SURFACE LEVEL: 4.53 AHD^
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 209
PROJECT No: 45146A
DATE: 10 Oct 07
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	0.15	CONCRETE							
	0.2	FILLING - yellow sand filling			0.2				
		FILLING - brown grey clay filling, with trace sand and gravel		A			PID=1ppm		
		- slight hydrocarbon odour from 0.5m to 1.0m			0.5				
				A			PID=3ppm		
	1				1.0				1
	1.2	PEATY CLAY - soft, black peaty clay, moist			1.2				
		- slight odour of organic matter		A			PID=3ppm		
					1.5				
	1.7	SILTY CLAY - stiff to very stiff, mottled red and grey silty clay, moist			1.7				
				A			PID=2ppm		
	2 2.0	Bore discontinued at 2.0m			2.0				2
		- target depth reached							
	3								3
	4								4

RIG: Bobcat **DRILLER:** S Gregor **LOGGED:** DW **CASING:** Uncased

TYPE OF BORING: Concrete coring (150mm diameter) to 0.15m then 100mm diameter solid flight auger

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: ^Benchmark obtained from survey plan provided by client
Important Note: Soil strengths were determined subjectively in the field and are not to be used for geotechnical purposes

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U,	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep
		⧗	Water level

CHECKED
Initials:
Date: 25/10/07

Douglas Partners
Geotechnics · Environment · Groundwater

BOREHOLE LOG

CLIENT: Fred Hosking Pty Ltd
PROJECT: Phase 1 and 2 Contamination Assessment
LOCATION: 7 Concord Avenue & 202-210 George Street Concord West

SURFACE LEVEL: 4.57 AHD^
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 210
PROJECT No: 45146A
DATE: 10 Oct 07
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
		CONCRETE							
	0.16	FILLING - grey sandy clay filling, with trace gravel			0.2				
				A			PID=2ppm		
					0.7				
				A			PID<1ppm		
	1.2	Bore discontinued at 1.2m - refusal on ironstone probably in filling			1.2				

RIG: Bobcat **DRILLER:** S Gregor **LOGGED:** DW **CASING:** Uncased

TYPE OF BORING: Concrete coring (150mm diameter) to 0.16m then 100mm diameter solid flight auger

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: ^Benchmark obtained from survey plan provided by client

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep
		⫧	Water level

CHECKED
Initials:
Date: 25/10/07

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BOREHOLE LOG

CLIENT: Fred Hosking Pty Ltd
PROJECT: Phase 1 and 2 Contamination Assessment
LOCATION: 7 Concord Avenue & 202-210 George Street Concord West

SURFACE LEVEL: 4.49 AHD^
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 211
PROJECT No: 45146A
DATE: 10 Oct 07
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	0.16	CONCRETE							
		FILLING - yellow sand filling		A	0.2		PID<1ppm		
	0.4				0.4				
		FILLING - brown grey clay filing, with trace sand and gravel			0.5				
				A			PID=2pm		
	1.3				1.0				
		PEATY CLAY - soft, black peaty clay, moist - slight odour of organic matter		A	1.3		PID=3ppm		
	1.7				1.5				
		SILTY CLAY - stiff to very stiff, red and grey silty clay		A	1.7		PID=2ppm		
	2.0	Bore discontinued at 2.0m - target depth reached			2.0				

RIG: Bobcat **DRILLER:** S Gregor **LOGGED:** DW **CASING:** Uncased

TYPE OF BORING: Concrete coring (150mm diameter) to 0.16m then 100mm diameter solid flight auger

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: ^Benchmark obtained from survey plan provided by client
Important Note: Soil strengths were determined subjectively in the field and are not to be used for geotechnical purposes

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U,	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials: D.W
Date: 25/10/07

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BOREHOLE LOG

CLIENT: Fred Hosking Pty Ltd
PROJECT: Phase 1 and 2 Contamination Assessment
LOCATION: 7 Concord Avenue & 202-210 George Street Concord West

SURFACE LEVEL: 4.57 AHD^
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 212
PROJECT No: 45146A
DATE: 10 Oct 07
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	0.15	CONCRETE							
		FILLING - yellow sand filling			0.2				
	0.35	FILLING - brown and grey clay filling, with some sand and gravel		A			PID=2ppm		
	0.5	FILLING - concrete rubble filling?			0.5		- no auger returns at 0.5m-0.7m		
	0.7	Bore discontinued at 0.7m - refusal on concrete rubble filling?							

RIG: Bobcat **DRILLER:** S Gregor **LOGGED:** DW **CASING:** Uncased

TYPE OF BORING: Concrete coring (150mm diameter) to 0.15m then 100mm diameter solid flight auger

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: ^Benchmark obtained from survey plan provided by client

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials:
Date: 25/10/07

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BOREHOLE LOG

CLIENT: Fred Hosking Pty Ltd
PROJECT: Phase 1 and 2 Contamination Assessment
LOCATION: 7 Concord Avenue & 202-210 George Street Concord West

SURFACE LEVEL: 4.22 AHD^
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 213
PROJECT No: 45146A
DATE: 10 Oct 07
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	0.0				0.0				Gatic cover
		FILLING - grey sand filling, with some concrete fragments and trace gravel and wire		A			PID<1ppm		Concrete
	0.2	FILLING - grey and brown clay filling, with trace gravel			0.2				
				A			PID<1ppm		Bentonite
					0.5				Backfilled with gravel
	0.7	PEATY CLAY - soft, black peaty clay, moist to wet			0.7				
				A			PID=2ppm		
1					1.0				1
	1.1	SILTY CLAY - stiff to very stiff, red brown and grey silty clay, damp			1.1			22-10-07	
				A*			PID=2ppm		
					1.5				
				A			PID<1ppm		Machine slotted PVC screen
2					2.0				2
		- trace gravel from 2.6m to 2.7m							End cap
	2.7	SHALE - *extremely low to very low strength, grey brown* shale							
	2.9	Bore discontinued at 2.9m - refusal on weathered shale							
3									3
4									4

RIG: Bobcat **DRILLER:** S Gregor **LOGGED:** DW **CASING:** Uncased

TYPE OF BORING: 100mm diameter solid flight auger

WATER OBSERVATIONS: No free groundwater observed whilst augering. Groundwater measured at 1.08m bgl on 22/10/07

REMARKS: *BD2-101007 blind replicate of 213/1.1-1.5m. ^Benchmark obtained from survey plan provided by client
Important Note: Soil strengths were determined subjectively in the field and are not to be used for geotechnical purposes

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials: A.W
Date: 25/10/07

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BOREHOLE LOG

CLIENT: Fred Hosking Pty Ltd
PROJECT: Phase 1 and 2 Contamination Assessment
LOCATION: 7 Concord Avenue & 202-210 George Street Concord West

SURFACE LEVEL: 4.4 AHD^
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 214
PROJECT No: 45146A
DATE: 10 Oct 07
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	0.0	FILLING - grey sand filling with some clay and concrete fragments, trace gravel and rootlets		A	0.0		PID=1ppm		
	0.2	FILLING - brown clay filling with trace gravel, sand and rootlets		A	0.2		PID<1ppm		
					0.5				
	0.8	PEATY CLAY - soft, black peaty clay - very slight organic matter odour		A	0.8		PID=2ppm		
	1.2	SILTY CLAY - stiff, grey silty clay, humid		A	1.0 1.2		PID=3ppm		
	1.5	Bore discontinued at 1.5m - target depth reached			1.5				

RIG: Bobcat **DRILLER:** S Gregor **LOGGED:** DW **CASING:** Uncased

TYPE OF BORING: 100mm diameter solid flight auger

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: ^Benchmark obtained from survey plan provided by client
Important Note: Soil strengths were determined subjectively in the field and are not to be used for geotechnical purposes

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U,	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials: DW
Date: 25/10/07

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BOREHOLE LOG

CLIENT: Fred Hosking Pty Ltd
PROJECT: Phase 1 and 2 Contamination Assessment
LOCATION: 7 Concord Avenue & 202-210 George Street Concord West

SURFACE LEVEL: 4.51 AHD^
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 215
PROJECT No: 45146A
DATE: 10 Oct 07
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	0.1	FILLING - grey sand filling with some gravel, concrete fragments and trace clay			0.1				
		FILLING - grey sand filling, with some gravel and clay		A			PID=1ppm		
	0.3	FILLING - brown and grey clay filling, with trace sand			0.3				
					0.5				
				A			PID<1ppm		
					1.0				
	1.1	PEATY CLAY - soft, black peaty clay, moist			1.1				
	1.2			A	1.2		PID=1ppm		
		SILTY CLAY - stiff, grey and red silty clay, moist							
				A			PID<1ppm		
	1.7	Bore discontinued at 1.7m - target depth reached			1.7				

RIG: Bobcat **DRILLER:** S Gregor **LOGGED:** DW **CASING:** Uncased

TYPE OF BORING: 100mm diameter solid flight auger

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: ^Benchmark obtained from survey plan provided by client
Important Note: Soil strengths were determined subjectively in the field and are not to be used for geotechnical purposes

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U,	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧗ Water level

CHECKED
Initials: D.C
Date: 25/10/07

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BOREHOLE LOG

CLIENT: Fred Hosking Pty Ltd
PROJECT: Phase 1 and 2 Contamination Assessment
LOCATION: 7 Concord Avenue & 202-210 George Street Concord West

SURFACE LEVEL: 4.38 AHD^
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 216
PROJECT No: 45146A
DATE: 10 Oct 07
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	0.0	FILLING - mottled orange brown and grey clay filling with trace of sand, fibre cement fragment, timber and rootlets		A	0.0		PID<1ppm A216/0.3m fibre cement sample from 0.3m		
	0.5	FILLING - grey clay filling, with trace of gravel		A	0.3		PID=3ppm		
	1.0	SILTY CLAY - soft, grey silty clay with trace gravel, sand and rootlets, moist (possibly filling)		A	0.5		PID=2ppm		
		- wet to saturated from 1.5m to 2.4m - organic matter odour from 1.5m to 2.0m		A	1.0		PID=3ppm	▼	
	2.4	SILTY CLAY - stiff, mottled red and grey silty clay, with trace of gravel		A	1.5		PID=1ppm		
	3.0	Bore discontinued at 3.0m - target depth reached		A	2.0		PID=2ppm		
					2.5				
					3.0				

RIG: Bobcat **DRILLER:** S Gregor **LOGGED:** DW **CASING:** Uncased

TYPE OF BORING: 100mm diameter solid flight auger

WATER OBSERVATIONS: Free groundwater observed at 2.0m whilst augering

REMARKS: ^Benchmark obtained from survey plan provided by client
Important Note: Soil strengths were determined subjectively in the field and are not to be used for geotechnical purposes

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U,	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials:
Date: 25/10/07

Douglas Partners
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BOREHOLE LOG

CLIENT: Fred Hosking Pty Ltd
PROJECT: Phase 1 and 2 Contamination Assessment
LOCATION: 7 Concord Avenue & 202-210 George Street Concord West

SURFACE LEVEL: 4.42 AHD^
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 217
PROJECT No: 45146A
DATE: 10 Oct 07
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
		FILLING - brown and grey clay filling, with some gravel and trace of sand		A	0.0		PID<1ppm		
				A	0.5		PID=2ppm		
	1.0	SILTY CLAY - moist, brown silty clay, with trace of gravel and sand		A	1.0		PID=3ppm		
		- wet at 1.8m			1.5			▼	
	2.0	SILTY CLAY - stiff, mottled red and grey silty clay, moist		A*	2.0		PID=4ppm		
	2.3	Bore discontinued at 2.3m - target depth reached			2.3				

RIG: Bobcat **DRILLER:** S Gregor **LOGGED:** DW **CASING:** Uncased

TYPE OF BORING: 100mm diameter solid flight auger

WATER OBSERVATIONS: Free groundwater observed at 1.8m whilst augering

REMARKS: *BD3-101007 blind replicate of 217/2.0-2.3m. ^Benchmark obtained from survey plan provided by client
Important Note: Soil strengths were determined subjectively in the field and are not to be used for geotechnical purposes

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials: D. V
Date: 25/10/07

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BOREHOLE LOG

CLIENT: Fred Hosking Pty Ltd
PROJECT: Phase 1 and 2 Contamination Assessment
LOCATION: 7 Concord Avenue & 202-210 George Street Concord West

SURFACE LEVEL: 4.44 AHD^
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 218
PROJECT No: 45146A
DATE: 10 Oct 07
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	0.05	ASPHALTIC CONCRETE							
		FILLING - mottled grey, brown and red clay filling with some sand, trace gravel and roots		A	0.1		PID=3ppm		
	0.25				0.2				
		FILLING - yellow brown sand filling, with some gravel and trace of clay			0.4				
				A			PID=3ppm		
	0.7				0.7				
		FILLING - brown clay filling, with trace gravel		A*			PID<1ppm		
1	1.0				1.0				1
		PEATY CLAY - soft, black peaty clay, moist		A			PID=2ppm		
	1.2				1.2				
		SILTY CLAY - soft, dark grey silty clay, moist			1.3				
				A			PID=2ppm		
					1.5				
	1.7								
		SILTY CLAY - stiff, mottled grey and brown silty clay, damp							
2					2.0				2
				A			PID=2ppm		
	2.2				2.2				
		Bore discontinued at 2.2m - target depth reached							
3									3
4									4

RIG: Bobcat **DRILLER:** S Gregor **LOGGED:** DW **CASING:** Uncased

TYPE OF BORING: 100mm diameter solid flight auger

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: *BD4-101007 blind replicate of 218/0.7-1.0m. ^Benchmark obtained from survey plan provided by client
Important Note: Soil strengths were determined subjectively in the field and are not to be used for geotechnical purposes

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials: DW
Date: 25/10/07

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BOREHOLE LOG

CLIENT: Fred Hosking Pty Ltd
PROJECT: Phase 1 and 2 Contamination Assessment
LOCATION: 7 Concord Avenue & 202-210 George Street Concord West

SURFACE LEVEL: 4.42 AHD^
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 219
PROJECT No: 45146A
DATE: 11 Oct 07
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	0.15	CONCRETE							
		FILLING - brown clay filling, with some gravel and trace sand		A	0.2		PID<1ppm		
	0.4	FILLING - mottled brown and grey clay filling, with trace of gravel			0.4				
				A	0.5		PID=2ppm		
	0.9	PEATY CLAY - soft, black peaty clay, moist - slight organic matter odour		A	0.9		PID=4ppm		
	1.1	SILTY CLAY - soft, grey silty clay, moist			1.1				
	1.2	SILTY CLAY - stiff, mottled grey and brown silty clay, with trace of gravel, moist			1.2				
				A			PID=2ppm	▼	
		- wet at 1.5m to 1.7m							
	1.7	Bore discontinued at 1.7m - target depth reached			1.7				

RIG: Bobcat **DRILLER:** S Gregor **LOGGED:** DW **CASING:** Uncased

TYPE OF BORING: Concrete coring (120mm diameter) to 0.15 then 100mm diameter solid flight auger

WATER OBSERVATIONS: Free groundwater observed at 1.5m whilst augering

REMARKS: ^Benchmark obtained from survey plan provided by client
Important Note: Soil strengths were determined subjectively in the field and are not to be used for geotechnical purposes

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials: D. W
Date: 25/10/07

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BOREHOLE LOG

CLIENT: Fred Hosking Pty Ltd
PROJECT: Phase 1 and 2 Contamination Assessment
LOCATION: 7 Concord Avenue & 202-210 George Street Concord West

SURFACE LEVEL: 4.3 AHD^
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 220
PROJECT No: 45146A
DATE: 11 Oct 07
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	0.17	CONCRETE							
4	0.3	FILLING - dark grey sand filling, with some clay and trace gravel		A	0.2		PID<1ppm		
		FILLING - mottled brown and grey clay filling, with trace gravel		A	0.3		PID<1ppm		
	0.6	PEATY CLAY - soft, black clay, moist - organic matter odour		A	0.5		PID=2ppm		
	0.8	SILTY CLAY - soft, brown and grey silty clay, moist			0.6				
	1	- wet at 1.0m to 1.3m		A	0.8		PID=1ppm	▼	1
3	1.3	SILTY CLAY - stiff, mottled red brown and grey clay, with trace ironstone gravel			1.3				
				A*	1.5		PID=1ppm		
	1.9	Bore discontinued at 1.9m - target depth reached			1.9				2
2	2								
	3								3
1									
	4								4
0									

RIG: Bobcat **DRILLER:** S Gregor **LOGGED:** DW **CASING:** Uncased

TYPE OF BORING: Concrete coring (150mm diameter) to 0.17 then100mm diameter solid flight auger

WATER OBSERVATIONS: Free groundwater observed at 1.0m whilst augering

REMARKS: *BD1-111007 blind replicate of 220/1.5-1.9m. ^Benchmark obtained from survey plan provided by client
Important Note: Soil strengths were determined subjectively in the field and are not to be used for geotechnical purposes

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U,	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials: D. V
Date: 25/10/07

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BOREHOLE LOG

CLIENT: Fred Hosking Pty Ltd
PROJECT: Phase 1 and 2 Contamination Assessment
LOCATION: 7 Concord Avenue & 202-210 George Street Concord West

SURFACE LEVEL: 4.45 AHD^
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 221
PROJECT No: 45146A
DATE: 11 Oct 07
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	0.1	FILLING - brown silty sand filling with trace clay, gravel and rootlets (garden surface)			0.1				
		FILLING - brown gravelly sand filling with trace of silt, clay and timber		A			PID=2ppm		
					0.5				
		- strong hydrocarbon odour from 0.8m to 1.7m							
	1	- stained grey from 1.0m to 1.7m			1.0			▼	1
				A			PID=8ppm		
					1.2				
				A			PID=9ppm		
	1.7	Bore discontinued at 1.7m - refusal on unknown object			1.7				
	2								2
	3								3
	4								4

RIG: Bobcat **DRILLER:** S Gregor **LOGGED:** DW **CASING:** Uncased

TYPE OF BORING: 100mm diameter solid flight auger

WATER OBSERVATIONS: Free groundwater observed at 1.0m whilst augering

REMARKS: ^Benchmark obtained from survey plan provided by client

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U$_x$	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials:
Date: 25/10/07

Douglas Partners
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BOREHOLE LOG

CLIENT: Fred Hosking Pty Ltd
PROJECT: Phase 1 and 2 Contamination Assessment
LOCATION: 7 Concord Avenue & 202-210 George Street Concord West

SURFACE LEVEL: 4.43 AHD^
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 222
PROJECT No: 45146A
DATE: 11 Oct 07
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	0.05	ASPHALTIC CONCRETE							
	0.15	FILLING - brown clayey sand, with trace of gravel							
		FILLING - brown, orange and grey clay filling, with some gravel and trace sand		A	0.2		PID=3ppm		
					0.5				
	0.8	FILLING - yellow sand filling, with trace clay		A	0.8		PID=2ppm		
	1.0	SILTY CLAY - soft, grey silty clay, moist		A*	1.0		PID=2ppm	▼	
		- wet at 1.2m to 1.3m							
	1.3	SILTY CLAY - stiff, mottled grey and brown clay, humid		A	1.3		PID=4ppm		
	1.5	Bore discontinued at 1.5m - target depth reached			1.5				

RIG: Bobcat **DRILLER:** S Gregor **LOGGED:** DW **CASING:** Uncased

TYPE OF BORING: 100mm diameter solid flight auger

WATER OBSERVATIONS: Free groundwater observed at 1.2m whilst augering

REMARKS: *BD2-111007 blind replicate of 222/1.0-1.3m. ^Benchmark obtained from survey plan provided by client
Important Note: Soil strengths were determined subjectively in the field and are not to be used for geotechnical purposes

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U,	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials: N.V
Date: 25/10/07

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BOREHOLE LOG

CLIENT: Fred Hosking Pty Ltd
PROJECT: Phase 1 and 2 Contamination Assessment
LOCATION: 7 Concord Avenue & 202-210 George Street Concord West

SURFACE LEVEL: 4.47 AHD^
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 228
PROJECT No: 45146A
DATE: 15 Oct 07
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	0.1	FILLING - brown silty clay filling, with some sand and trace gravel, cobble sized rock pieces, metal pieces, tile fragments and bone		A	0.0		PID<1ppm		
	0.12	FILLING - mottled grey and yellow clay filling, with some rock fragments			0.1				
		Bore discontinued at 0.12m - refusal in filling							

RIG: Hand tools **DRILLER:** DW **LOGGED:** DW **CASING:** Uncased

TYPE OF BORING: Hand auger

WATER OBSERVATIONS: No free groundwater observed

REMARKS: ^Benchmark obtained from survey plan provided by client

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U,	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials:
Date: 25/10/07

Douglas Partners
Geotechnics • Environment • Groundwater

BOREHOLE LOG

CLIENT: Fred Hosking Pty Ltd
PROJECT: Phase 1 and 2 Contamination Assessment
LOCATION: 7 Concord Avenue & 202-210 George Street Concord West

SURFACE LEVEL: 4.4 AHD^
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 229
PROJECT No: 45146A
DATE: 30 Oct 07
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	0.05	ASPHALTIC CONCRETE							
	0.15	FILLING - brown gravelly sand filling, with trace of clay (roadbase)							
		FILLING - mottled grey, black and brown clay filling, with trace of rootlets		A	0.2		PID<1ppm		
					0.5				
	0.6	FILLING - grey clayey sand filling		A	0.6		PID=2ppm	▼	
					1.0				
	1.1	FILLING - grey silty clay filling		A	1.1		PID<1ppm		
					1.5				
	1.7	FILLING - mottled grey and red-brown silty clay filling		A	1.7		PID=2ppm		
					2.0				
	2.6	SILTY CLAY - grey mottled brown silty clay, humid		A	2.6		PID=1ppm		
	2.9	Bore discontinued at 2.9m - refusal in shale			2.9				

RIG: Bobcat **DRILLER:** S Gregor **LOGGED:** DW **CASING:** Uncased

TYPE OF BORING:

WATER OBSERVATIONS: Free groundwater observed at 0.7m whilst augering

REMARKS: ^Benchmark obtained from survey plan provided by client
Important Note: Soil strengths were determined subjectively in the field and are not to be used for geotechnical purposes

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U,	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials: D.W
Date: 7/11/07

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Appendix C

Summary of Previous Laboratory Results

Table C1: Summary of Results of Soil Analysis (All results in mg/kg unless otherwise stated)

Test Bore / Sample depth (m)	Soil Type	Heavy Metals								Polycyclic Aromatic Hydrocarbons				Total Recoverable Hydrocarbons									BTEX				Organochlorine Pesticides										PCBs (total)	Phenols (total)	Volatile Organic Compounds (other than BTEX and naphthalene)				Asbestos (fibres)
		Arsenic	Cadmium	Chromium (III + VI)	Copper	Lead	Mercury	Nickel	Zinc	Benzo(a)pyrene	Benzo(a)pyrene TEQ	Naphthalene	Total PAHs	TRH C6-C9	TRH C10-C14	TRH C15-C28	TRH C29-C36	TRH C6-C10 less BTEX	TRH >C10-C16 less Naphthalene	TRH C6-C10	TRH >C10-C16	TRH >C16-C34	TRH >C34-C40	Benzene	Toluene	Ethylbenzene	Total Xylene	DDT	DDT+DDE+DDD	Aldrin + Dieldrin	Chlordane	Endosulfan (total)	Endrin	Heptachlor	HCB	Methoxychlor			n-propyl benzene	1,2,4-trimethyl benzene	n-butyl benzene	All other VOC	
103/0.2-0.3	F	<4	<1	19	65	13	<0.1	100	62	0.1	<0.5	<0.1	0.3	<25	<50	<100	<100	-	-	-	-	-	-	<1	<1	<1	<3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
103/0.5-0.6	F	8.2	<1	18	21	30	<0.1	7.3	33	<0.05	<0.5	<0.1	NIL (+)VE	<25	<50	<100	<100	-	-	-	-	-	-	<1	<1	<1	<3	<0.1	<0.3	<0.2	<0.2	<0.3	<0.1	<0.1	<0.1	<0.1	<0.7	<5	-	-	-	-	-
104/0.5-0.6	F	5.8	<1	26	19	37	<0.1	17	41	0.6	0.8	<0.1	5.7	<25	<50	<100	<100	-	-	-	-	-	-	<1	<1	<1	<3	<0.1	<0.3	<0.2	<0.2	<0.3	<0.1	<0.1	<0.1	<0.1	<0.7	<5	-	-	-	-	ND
Z-180907	F	6.1	<1	29	20	35	<0.1	18	41	1	1.3	<0.1	13.8	<25	<50	<100	<100	-	-	-	-	-	-	<1	<1	<1	<3	-	-	-	-	-	-	-	-	-	-	<5	-	-	-	-	-
105/0.1-0.2	F	<4	<1	10	47	7.2	<0.1	54	46	<0.05	<0.5	<0.1	NIL (+)VE	<25	<50	160	170	-	-	-	-	-	-	<1	<1	<1	<3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
105/0.4-0.5	F	12	<1	17	180	69	<0.1	15	120	0.1	<0.5	<0.1	0.7	<25	<50	<100	<100	-	-	-	-	-	-	<1	<1	<1	<3	<0.1	<0.3	<0.2	<0.2	<0.3	<0.1	<0.1	<0.1	<0.1	<0.7	<5	-	-	-	-	ND
201/0.2-0.5	F	<4	<1	26	57	72	0.12	8.4	100	5.6	7.4	0.3	85.1	<25	<50	290	160	-	-	-	-	-	-	<0.5	<0.5	<1	<3	<0.1	<0.3	<0.2	<0.2	<0.3	<0.1	<0.1	<0.1	<0.1	<0.7	<5	-	-	-	-	ND
202/0.5-1.0	F	4.6	<1	14	22	330	0.13	6.8	160	0.7	0.9	<0.1	7.8	<25	<50	<100	<100	-	-	-	-	-	-	<0.5	<0.5	<1	<3	<0.1	<0.3	<0.2	<0.2	<0.3	<0.1	<0.1	<0.1	<0.1	<0.7	<5	-	-	-	-	-
203/0.2-0.5	F	7.4	<1	12	44	35	0.1	24	78	<0.05	<0.5	<0.1	NIL (+)VE	<25	<50	250	170	-	-	-	-	-	-	<0.5	<0.5	<1	<3	<0.1	<0.3	<0.2	<0.2	<0.3	<0.1	<0.1	<0.1	<0.1	<0.7	<5	-	-	-	-	ND
204/0.5-1.0	F	5.5	<1	17	15	54	<0.1	3.1	9	<0.05	<0.5	<0.1	NIL (+)VE	<25	<50	<100	<100	-	-	-	-	-	-	<0.5	<0.5	<1	<3	<0.1	<0.3	<0.2	<0.2	<0.3	<0.1	<0.1	<0.1	<0.1	<0.7	<5	-	-	-	-	-
204/1.4-1.5	N	65	<1	19	18	24	<0.1	5.6	16	<0.05	<0.5	<0.1	NIL (+)VE	<25	<50	<100	<100	-	-	-	-	-	-	<0.5	<0.5	<1	<3	-	-	-	-	-	-	-	-	-	-	-	<1	<1	<1	<PQL	-
207/0.5-1.0	F	9.8	<1	16	25	27	<0.1	4.6	26	<0.05	<0.5	<0.1	NIL (+)VE	<25	<50	<100	<100	-	-	-	-	-	-	<0.5	<0.5	<1	<3	<0.1	<0.3	<0.2	<0.2	<0.3	<0.1	<0.1	<0.1	<0.1	<0.7	<5	-	-	-	-	-
207/1.0-1.5	F	10	<1	15	21	27	<0.1	6.4	32	<0.05	<0.5	<0.1	0.3	<25	<50	<100	<100	-	-	-	-	-	-	<0.5	<0.5	<1	<3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
208/0.0-0.1	F	<4	<1	27	39	41	<0.1	36	74	0.7	0.9	<0.1	6.8	<25	<50	<100	<100	-	-	-	-	-	-	<0.5	<0.5	<1	<3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND
208/0.5-1.0	F	5.7	<1	8.4	18	54	<0.1	2.3	14	0.1	<0.5	<0.1	1	<25	<50	<100	<100	-	-	-	-	-	-	<0.5	<0.5	<1	<3	<0.1	<0.3	<0.2	<0.2	<0.3	<0.1	<0.1	<0.1	<0.1	<0.7	<5	-	-	-	-	-
209/0.5-1.0	F	5.5	<1	10	20	130	<0.1	8.2	61	0.3	<0.5	<0.1	3.5	<25	<50	<100	<100	-	-	-	-	-	-	<0.5	<0.5	<1	<3	<0.1	<0.3	<0.2	<0.2	<0.3	<0.1	<0.1	<0.1	<0.1	<0.7	<5	<1	<1	<1	<PQL	-
210/0.7-1.2	F	5.2	<1	13	17	21	<0.1	8.8	37	<0.05	<0.5	<0.1	NIL (+)VE	<25	<50	<100	<100	-	-	-	-	-	-	<0.5	<0.5	<1	<3	<0.1	<0.3	<0.2	<0.2	<0.3	<0.1	<0.1	<0.1	<0.1	<0.7	<5	-	-	-	-	ND
211/0.5-1.0	F	6.5	<1	15	7.4	31	<0.1	1.6	6.6	<0.05	<0.5	<0.1	NIL (+)VE	<25	<50	<100	<100	-	-	-	-	-	-	<0.5	<0.5	<1	<3	<0.1	<0.3	<0.2	<0.2	<0.3	<0.1	<0.1	<0.1	<0.1	<0.7	<5	-	-	-	-	-
212/0.2-0.5	F	<4	<1	2.4	<1	2	<0.1	1.6	3.8	0.05	<0.5	<0.1	0.25	<25	<50	<100	<100	-	-	-	-	-	-	<0.5	<0.5	<1	<3	<0.1	<0.3	<0.2	<0.2	<0.3	<0.1	<0.1	<0.1	<0.1	<0.7	<5	-	-	-	-	-
213/0.0-0.2	F	6.6	<1	14	42	82	<0.1	27	250	0.7	0.9	<0.1	5.7	<25	<50	140	120	-	-	-	-	-	-	<0.5	<0.5	<1	<3	<0.1	<0.3	<0.2	<0.2	<0.3	<0.1	<0.1	<0.1	<0.1	<0.7	<5	-	-	-	-	ND
213/0.2-0.5	F	6.4	<1	11	22	62	0.13	2.2	28	<0.05	<0.5	<0.1	NIL (+)VE	<25	<50	<100	<100	-	-	-	-	-	-	<0.5	<0.5	<1	<3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
214/0.0-0.2	F	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND
214/0.2-0.5	F	8.1	<1	25	7.3	27	<0.1	2.9	13	<0.05	<0.5	<0.1	NIL (+)VE	<25	<50	<100	<100	-	-	-	-	-	-	<0.5	<0.5	<1	<3	<0.1	<0.3	<0.2	<0.2	<0.3	<0.1	<0.1	<0.1	<0.1	<0.7	<5	-	-	-	-	-
215/0.1-0.3	F	10	<1	16	21	41	<0.1	9.4	25	<0.05	<0.5	<0.1	NIL (+)VE	<25	<50	<100	<100	-	-	-	-	-	-	<0.5	<0.5	<1	<3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND
215/0.5-1.0	F	6.8	<1	13	12	37	<0.1	2.5	11	<0.05	<0.5	<0.1	NIL (+)VE	<25	<50	<100	<100	-	-	-	-	-	-	<0.5	<0.5	<1	<3	<0.1	<0.3	<0.2	<0.2	<0.3	<0.1	<0.1	<0.1	<0.1	<0.7	<5	-	-	-	-	-
216/0.0-0.5	F	13	<1	25	31	41	<0.1	13	67	0.3	<0.5	<0.1	3.7	<25	<50	<100	<100	-	-	-	-	-	-	<0.5	<0.5	<1	<3	<0.1	<0.3	<0.2	<0.2	<0.3	<0.1	<0.1	<0.1	<0.1	<0.7	<5	-	-	-	-	ND
A216/0.3	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**AD**
216/0.5-1.0	F	13	<1	13	28	32	<0.1	19	130	<0.05	<0.5	<0.1	NIL (+)VE	<25	<50	<100	<100	-	-	-	-	-	-	<0.5	<0.5	<1	<3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
217/0.0-0.5	F	9.4	<1	17	23	28	<0.1	14	66	<0.05	<0.5	<0.1	0.5	<25	<50	<100	<100	-	-	-	-	-	-	<0.5	<0.5	<1	<3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND
217/2.0-2.3	N	8.7	<1	13	16	28	<0.1	1.4	3.3	<0.05	<0.5	<0.1	NIL (+)VE	<25	<50	<100	<100	-	-	-	-	-	-	<0.5	<0.5	<1	<3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BD3-101007	N	<4	<1	10	15	20	<0.1	1.5	4.7	<0.05	<0.5	<0.1	NIL (+)VE	<25	<50	<100	<100	-	-	-	-	-	-	<0.5	<0.5	<1	<3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
218/0.4-0.7	F	18	<1	30	26	62	<0.1	4.9	39	0.06	<0.5	<0.1	0.46	<25	<50	<100	<100	-	-	-	-	-	-	<0.5	<0.5	<1	<3	<0.1	<0.3	<0.2	<0.2	<0.3	<0.1	<0.1	<0.1	<0.1	<0.7	<5	<1	<1	<1	<PQL	-
218/0.7-1.0	F	7.2	<1	15	12	41	<0.1	2.2	9.6	<0.05	<0.5	<0.1	NIL (+)VE	<25	<50	<100	<100	-	-	-	-	-	-	<0.5	<0.5	<1	<3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BD4-101007	F	8.6	<1	24	9.3	40	<0.1	2.2	9.8	<0.05	<0.5	<0.1	NIL (+)VE	<25	<50	<100	<100	-	-	-	-	-	-	<0.5	<0.5	<1	<3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
219/0.2-0.4	F	7.7	<1	12	49	120	<0.1	13	85	12	16	2.5	166.1	<25	<50	590	290	-	-	-	-	-	-	<0.5	<0.5	<1	<3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND
219/0.5-0.9	F	4.3	<1	11	30	25	<0.1	7.7	49	0.2	<0.5	<0.1	2.3	<25	<50	<100	<100	-	-	-	-	-	-	<0.5	<0.5	<1	<3	<0.1	<0.3	<0.2	<0.2	<0.3	<0.1	<0.1	<0.1	<0.1	<0.7	<5	-	-	-	-	-
220/0.3-0.5	F	10	<1	15	28	60	<0.1	12	55	0.08	<0.5	<0.1	0.68	<25	<50	<100	<100	-	-	-	-	-	-	<0.5	<0.5	<1	<3	<0.1	<0.3	<0.2	<0.2	<0.3	<0.1	<0.1	<0.1	<0.1	<0.7	<5	-	-	-	-	-
221/0.1-0.5	F	12	<1	19	73	1800	<0.1	25	220	2	2.4	1.5	16.8	<25	170	<100	<100	-	-	-	-	-	-	<0.5	<0.5	<1	<3	<0.1	<0.3	<0.2	<0.2	<0.3	<0.1	<0.1	<0.1	<0.1	<0.7	<5	-	-	-	-	ND
221/1.2-1.7	F	12	<1	12	50	190	0.11	12	160	5.1	6.8	3.2 & 5.1	60.4	83	240	240	190	-	-	-	-	-	-	<0.5	<0.5	<1	<3	-	-	-	-	-	-	-	-	-	-	-	4.8	6.5	1.7	<PQL	-
222/0.2-0.5	F	7.5	<1	12	350	66	<0.1	20	300	1.2	1.6	<0.1	13.8	<25	<50	<100	<100	-	-	-	-	-	-	<0.5	<0.5	<1	<3	<0.1	<0.3	<0.2	<0.2	<0.3	<0.1	<0.1	<0.1	<0.1	<0.7	<5	-	-	-	-	ND
222/1.0-1.3	N	67	<1	18	38	36	<0.1	6.5	32	0.5	0.7	<0.1	5.8	<25	<50	<100	<100	-	-	-	-	-	-	<0.5	<0.5	<1	<3	-	-	-	-	-	-	-	-	-	-	-	<1	<1	<1	<PQL	-
BD2-111007	N	29	0.2	17	59	34	0.07	6	63	4	5.6	<0.5	44	<10	<50	190	320	-	-	-	-	-	-	<0.2	<0.5	<0.5	<1.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
228/0.0-0.1	F	14	<1	18	54	90	0.14	20	180	0.5	0.7	<0.1	6.7	<25	<50	<100	<100	-	-	-	-	-	-	<0.5	<0.5	<0.5	<3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	ND
229/0.6-1.0	F	9.8	<1	15	200	97	0.17	14	280	32	46	<0.1	369.8	<25	<50	1400	990	-	-	-	-	-	-	<0.5	<0.5	<1	<3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
229/1.1-1.5	F	40	<1	14	20	24	<0.1	3.7	8.8	<0.05	<0.5	<0.1	NIL (+)VE	<25	<50	<100	<100	-	-	-	-	-	-	<0.5	<0.5	<1	<3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Site Assessment Criteria																																											
Health Investigation Level: Residential B		500	150	500 for Cr (VI)	30000	1200	120	1200	60000	-	4	-	400	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	600	10	90	400	20	10	15	500	1	-	-	-	-	-	**-**
Health Screening Level (B) for Vapour Intrusion: Low - High Residential		-	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-	40	110	-	-	-	-	0.5	160	55	40	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ecological Investigation Level: Residential		100	-	tbc for Cr (III)	tbc	1260	-	tbc	tbc	-	-	170	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	180	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ecological Screening Level: Residential		-	-	-	-	-	-	-	-	0.7	-	-	-	-	-	-	-	180	-	-	120	300	2800	50	85	70	45	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Management Limit		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	700	1000	2500	10000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Notes

F	Filling
N	Natural
M	Material
ND	No asbestos detected at limit of reporting (0.1g/kg)
AD	Asbestos detected
tbc	To be confirmed based on further investigation
	Exceedance of ecological criteria or elevated concentration which may exceed ecological criteria
	Exceedance of health-based criteria
	Exceedance of health-based criteria and possibly ecological criteria
PQL	Practical Quantitation Limit
Z-180907	Blind replicate sample of 104/0.5-0.6
BD3-101007	Blind replicate sample of 217/2.0-2.3
BD4-101007	Blind replicate sample of 218/0.7-1.0
BD2-111007	Blind replicate sample of 222/1.0-1.3
A216/0.3	Material sample from Test Bore 213, depth 0.3m
-	Not tested / Not applicable
TEQ	Toxicity Equivalent Quotient

Table C2: Summary of Results of Groundwater Analysis (All results in µg/L unless otherwise stated)

Sample ID (Test Bore)	Sample date	Metals (dissolved)								Polycylic Aromatic Hydrocarbons (PAH)						Total Recoverable Hydrocarbons (TRH)										BTEX					Other Volatile Organic Compounds	PCB				Organochlorine Pesticides (OCP)											Total Phenolics
		Arsenic	Cadmium	Chromium (III + VI)	Copper	Lead	Mercury	Nickel	Zinc	Naphthalene	Benzo(a)pyrene	Anthracene	Phenanthrene	Fluoranthrene	All other PAH	TRH C6-C9	TRH C10-C14	TRH C15-C28	TRH C29-C36	TRH C6-C10 less BTEX	TRH >C10-C16 less Naphthalene	TRH C6-C10	TRH >C10-C16	TRH >C16-C34	TRH >C34-C40	Benzene	Toulene	Ethylbenzene	o-xylene	m+p-xylene		Arochlor 1067	Arochlor 1242	Arochlor 1248	Arochlor 1254	Heptachlor	Chlordane	Aldrin	DDE	DDT	Dieldrin	Endrin	Methoxychlor	Endosulfan	All other OCP	
Analytical Results																																													
GW-203	17-Oct-07	**3.2**	0.7	<1	**7.4**	**12**	<0.5	**32**	**85**	<1	<1	<1	<1	<1	<PQL	<10	<50	<100	<100	-	-	-	-	-	-	<1	<1	<1	<1	<2	<PQL	<2	<2	<2	<2	<0.2	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	<PQL	<50
BD1-171007	17-Oct-07	**3**	0.5	<1	**4.1**	**10**	<0.5	**36**	**61**	-	-	-	-	-	-	<10	<50	<100	<100	-	-	-	-	-	-	<1	<1	<1	<1	<2	-	<2	<2	<2	<2	<0.2	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	<PQL	-
GW-204	17-Oct-07	1.9	0.3	<1	**1.8**	1.3	<0.5	4.1	**21**	<1	<1	<1	<1	<1	<PQL	<10	<50	<100	<100	-	-	-	-	-	-	<1	<1	<1	<1	<2	<PQL	<2	<2	<2	<2	<0.2	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	<PQL	**62**
GW-207	17-Oct-07	**14**	0.4	<1	**2.5**	**8.5**	<0.5	**140**	**150**	<1	<1	<1	<1	<1	<PQL	<10	<50	<100	<100	-	-	-	-	-	-	<1	<1	<1	<1	<2	<PQL	<2	<2	<2	<2	<0.2	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	<PQL	**60**
GW-213	17-Oct-07	1.9	0.5	<1	**2.8**	4.2	<0.5	**10**	**21**	<1	<1	<1	<1	<1	<PQL	<10	<50	<100	<100	-	-	-	-	-	-	<1	<1	<1	<1	<2	<PQL	<2	<2	<2	<2	<0.2	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.4	<PQL	<50
Groundwater Investigation Levels		2.3 for As (III) 4.5 for As (V)	0.7	27 for Cr(III) 4.4 for Cr(VI)	1.3	4.4	0.1	7	15	50	0.1	0.01	0.6	1	-	-	-	-	-	-	-	-	-	-	-	500	-	-	-	-	-	-	0.3	-	0.01	-	-	-	-	-	-	0.004	-	0.005	-	- *

Notes:

NL	Not Limiting
PQL	Pratical quantitation limit
Bold	Exceeds GIL or screening criteria
-	not defined/ not analysed/ not applicable
*	Limit of reporting used as the GIL