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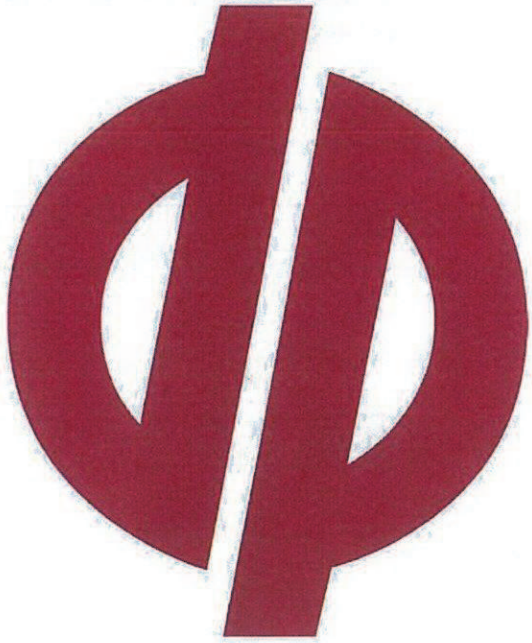
Report on Detailed Site Investigation

Proposed Divestment
Park Road, Seven Hills, NSW

Prepared for
Blacktown City Council

Project 76798.00
June 2017



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Executive Summary

This report presents the results of a Detailed Site Investigation (DSI) undertaken for Park Road, Seven Hills, NSW. The Site is currently used as a liquid waste treatment facility and is operated by Blacktown City Council (BCC).

It is understood that BCC are considering options for the future divestment of the Site. As such, BCC requires that a contamination assessment be undertaken for planning purposes. The purpose of this assessment was to evaluate the contamination status of the Site and its suitability, from a contamination standpoint, for a continued industrial land use. The current investigation comprised a site history review, site walkover, drilling of boreholes, establishment of three groundwater monitoring bores, collection and analysis of both soil and groundwater samples, and assessment of laboratory results against the adopted site assessment criteria.

The site history review indicated that the site and surrounding areas have undergone significant development since 1961 with the site now comprising a liquid waste treatment facility and an asphalt carpark. The Site is located within an industrial precinct of Seven Hills. During the site walkover, the liquid waste treatment facility was still in use, the majority of the balance of the Site consisted of an asphalt wearing course, two small grass-covered areas were observed at the site and recyclable white goods were observed on the surface of the site.

Seven boreholes were drilled as part of the DSI with one soil sample collected from each analysed for contaminants of concern. Three of the seven boreholes were converted to groundwater monitoring bores for the collection and analysis of groundwater samples. Concentrations of contaminants of concern collected in soil samples were within the adopted site assessment criteria. Asbestos was identified within the filling material located at the Site.

Concentrations of heavy metals collected in groundwater samples were recorded above the adopted site assessment criteria. As the Site is located within an urban catchment, it is considered that the heavy metal concentrations are typical of the regional groundwater quality rather than from direct impacts of the liquid waste treatment facility.

Based on the findings of this DSI, it is considered likely that site can be made suitable for the continued commercial/industrial use following further investigation and/or remediation of the asbestos impacted filling surrounding BH3.

A Remediation Action Plan or Work Method Statement will need to be prepared to facilitate the remediation and validation process.

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Report on Detailed Site Investigation
Proposed Divestment
Park Road, Seven Hills

1. Introduction

This report presents the results of a Detailed Site Investigation (DSI) undertaken for Park Road, Seven Hills, NSW (referred to herein as 'the Site' and is as shown on Drawing 1 – Appendix A). The Site is currently used as a liquid waste treatment facility and is operated by Blacktown City Council (BCC).

It is understood that BCC are considering options for the future divestment of the Site. As such, BCC requires that a contamination assessment be undertaken for planning purposes.

The investigation comprised the drilling of boreholes and the extension of three bores to below the observed water table for the installation of groundwater monitoring wells, followed by laboratory testing and analysis of selected soil and groundwater samples and reporting. Details of the work undertaken and the results obtained are given within this report.

The purpose of this assessment was to evaluate the contamination status of the Site and its suitability, from a contamination standpoint, for a continued industrial land use.

2. Scope of Work

The scope of works comprised:

- Review of site geology, hydrogeology and topography, including a search of the Department of Primary Industries Water (DPI Water) database of registered groundwater bores;
- Review of historical aerial photography obtained through the Land Information Section of the Department of Planning;
- Review of SafeWork database records for any Storage of Hazardous Chemicals or other approval that may indicate contaminating activities (as required);
- Search of the NSW EPA public registers established under the *Contaminated Land Management Act* 1997 (CLM) and the *Protection of the Environment Operations Act* 1997 (POEO);
- A site walkover to identify areas/issues of environmental concern and to assess the Site condition;
- Drilling of seven boreholes across the Site to a maximum depth of 7.5 m, 0.5 m into natural soil, or prior refusal;
- Collection of soil samples from seven boreholes at approximate depth ranges of 0 - 0.1 m, 0.3 - 0.5 m and, where filling was encountered, from regular depth intervals based on field observation;

- Extension of three test bores to a maximum depth of 7.5 m or 2 m below encountered groundwater level with a truck mounted drill rig utilising solid flight auger and rotary air blast drilling for the installation of groundwater wells;
- Levelling of test bores to 0.03 m accuracy;
- Field sampling and laboratory analysis in compliance with standard environmental protocols, including a Quality Assurance / Quality Control (QA/QC) plan consisting of 10% replicate sampling and appropriate Chain-of-Custody procedures and in-house laboratory QA/QC testing;
- Laboratory analysis of selected soil samples for the following common contaminants at a NATA accredited laboratory for:
  - metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, zinc);
  - total petroleum hydrocarbons (TPH);
  - monocyclic aromatic hydrocarbons (Benzene, Toluene, Ethylbenzene and Xylene – BTEX);
  - polycyclic aromatic hydrocarbons (PAH);
  - phenols;
  - organochlorine pesticides (OCP), organophosphorous pesticides (OPP) and polychlorinated biphenyls (PCB); and
  - asbestos.
- Development of the three new groundwater monitoring wells by removing a minimum of three bore volumes or until the bore is dry followed by the collection of groundwater samples at least five days after well development;
- Collection of groundwater samples from installed groundwater wells using a low flow purge technique to minimise the loss of volatiles. Field parameters of pH, electrical conductivity, dissolved oxygen and redox potential were measured prior to sampling, after stabilisation of the field parameters;
- Analysis of three groundwater samples at a NATA accredited laboratory for metals, TRH, BTEX, PAH, OCP, OPP, PCB, total phenols, Oil and Grease and VOCs;
- Interpretation of results in accordance with current NSW EPA endorsed guidelines; and
- Preparation of this report detailing the methodology and results of the assessment and assessing the suitability of the Site for the proposed land use.

3. Site Description

3.1 Site Description

The Site is identified as Lot 3 in Deposited Plan 226547, within the local government area of Blacktown City Council and comprises approximately 0.2 hectares. The Site location and boundaries are shown on Drawing 1, Appendix A.

The Site levels generally fall to the south east with the highest point being approximately 37.5 m (relative to Australian Height Datum [AHD]) and the lowest point being approximately 35.5 m AHD.

A Site walkover was completed by a DP Environmental Scientist on 16 December 2016.

At the time of the investigation, the Site was utilised as a liquid waste treatment facility which comprised a pumping out area and associated corrugated iron structures located within the south western corner of the Site. Anecdotal evidence obtained from a BCC representative during the Site Walkover indicated that the Site is currently being use for the treatment of liquid waste and subsequent discharge into the local sewer system. Some recyclable white goods were observed on the surface in the north western corner of the Site. The majority of the remainder of the Site consisted of an asphalt carpark with some trees located along the northern and eastern boundary.

The Site is bounded to the north, east and west by industrial land and the south by Park Road, beyond which is industrial land.

3.2 Geology and Hydrogeology

Reference to the Penrith 1:100 000 Soils Landscape Sheet indicates that the Site is underlain by the Luddenham soil landscape (mapping unit lu), characterised by gently undulating to rolling low hills with narrow ridges, hillcrests and valleys. Yellow, dark and red podzolic soils are characteristic of the area. Characteristics include moderately reactive, highly plastic subsoil and high soil erosion hazard.

Reference to the Penrith 1:100 000 Geology Sheet indicates that the Site is underlain by Ashfield Shale (mapping unit Rwa) of the Wianamatta Group from the Middle Triassic period. This formation typically comprises claystone and siltstone.

Additional reference to the Map of Salinity Potential in Western Sydney, indicates that the Site is located in an area of "*moderate salinity potential*" *where "saline areas may occur .... which have not yet been identified or may occur if risk factors change adversely*".

These classifications are based on the landform and geology and it is noted that due to the resolution at the scale of the mapping, it is not possible to delineate the zone boundaries with precision.

A review of site topography indicates that the Site drains to the south. It is expected that groundwater will follow the topographic slope.

Investigation of urban salinity - case studies from western Sydney, UrbanSalt 2005 Conference Paper, Parramatta (McNally, 2005) describes some general features of the hydrogeology of Western Sydney which are relevant to this Site. The shale terrain of much of Western Sydney is known for saline groundwater, resulting either from the release of connate salt in shales of marine origin or from the accumulation of windblown sea salt. Seasonal groundwater level changes of 1 - 2 m can occur in a shallow regolith aquifer or a deeper shale aquifer due to natural influences.

A search of the NSW Office of Water groundwater bore database indicated that there were 23 registered bores located within a distance of approximately 2 km from the Site. The bores were located to the south west, north and east of the Site, at a final depth of between 2.8 m and 156.5 m.

Work summaries from each bore search indicated that the authorised and intended purposes of the groundwater bores are for monitoring, waste disposal, and testing (see Work Summaries - Appendix B).

4. Site History Summary

A site history investigation was undertaken by DP to identify potential areas of environmental concern and contaminants of concern which may arise from previous land uses, the presence of demolished or partly demolished buildings, soil stockpiles, land filling, waste disposal and other potentially contaminating activities. The site history investigation is described in Sections 4.1 - 4.3.

4.1 Historical Aerial Photograph Review

Historical aerial photographs are presented in Drawings 3 – 8, Appendix A. A summary of the aerial photograph review is given below.

1956: The Site appeared to be used for cultivation practises with a north south aligned access track running through the centre of the Site. The surrounding areas to the east and south appeared to be vacant with some sporadic trees. Cultivation associated with the current site use extended to the north and west of the Site boundary.

1961: The Site appeared to have remained relatively unchanged since the 1956 aerial photograph. Significant industrial development is evident immediately west of the Site with what appears to have been the construction of a large industrial warehouse. The remainder of the surrounding area appears relatively unchanged since the 1956 aerial photograph.

1970: The Site appears vacant and is grass covered with no evidence of the type of cultivation that was identified in the 1956 aerial photograph. Two large industrial warehouses are identified immediately west of the current site boundary whilst an excavated surface is evident to the north and east of the Site. The area to the immediate south is grass covered, beyond which is what appears to be an asphalt carpark.

1986: The Site has undergone significant development since the 1970 aerial photograph with what appears to be the development of three structures in the southwest corner of the Site. The balance of the Site has been cleared of vegetation with the development of what appears to be a gravel carpark. Further development of the two industrial warehouses located directly west of the Site is evident. The east of the Site has undergone significant change with what appears to be the development of three structures. The south of the Site remains relatively unchanged since the 1970 aerial photograph.

1994: The Site has undergone further development since the 1986 aerial photograph with the construction of what appears to be an asphalt carpark in the northern and central portion of the Site. The remainder of the balance of the Site appears relatively unchanged. Significant development is evident directly east of the Site with the construction of a large structure and what appears to be an associated asphalt carpark. The remainder of the surrounding areas appear relatively unchanged.

2005: The Site has undergone further development of the asphalt carpark since the 1994 aerial photograph. The remainder of the Site appears relatively unchanged. A storage yard with what appears to be shipping containers, cars and associated structures is evident immediately north of the Site. The remainder of the surrounding areas appear relatively unchanged.

4.2 Search of EPA Register

A search of the NSW EPA website on 22 May 2017 indicated that:

- The following site within a 2 km radius of the Site is listed on NSW contaminated sites notified to the EPA:
  - A former waste oil recycling and reprocessing facility at 27 Powers Road, Seven Hills (approximately 1 km south east of the Site) – listed as Site Audit Statements - 'Issued'. A Site Audit Statement was issued on 19 November 2015 for the remediation of petroleum hydrocarbons and volatile halogenated impacted groundwater at this location. Given the anticipated groundwater flow direction at this location and that 27 Powers Road is located down gradient of the Site, DP does not consider potential contamination issues associated with the former waste oil recycling and reprocessing facility are likely to impact the Site;
- The following notices or orders made under the Contaminated Land Management (CLM) Act 1997 have been issued for properties located less than 2 km of the Site;
  - Transport Infrastructure Development Corporation classified as 'Other Industry' located at 1 Powers Road (approximately 700 m south west of the Site) - listed as 'Regulation under CLM Act not required'. Given the approximate distance of the industry to the Site and the anticipated groundwater flow at this location (south towards Blacktown Creek), DP does not consider potential contamination issues associated with the industry are likely to impact the Site;
  - Caltex Service Station located at 105 Station Road (approximately 300 m south of the Site) - listed as 'Under Assessment'. Given the approximate distance of the industry to the Site and the anticipated groundwater flow at this location (south towards Blacktown Creek), DP does not consider potential contamination issues associated with the Service Station are likely to impact the Site;
  - 7-Eleven (former Mobil) Service Station located at 151 Prospect Highway (approximately 400 m north west of the Site) - listed as 'Under Assessment'. Given the approximate distance of the industry to the Site and the anticipated groundwater flow at this location (south west towards Blacktown Creek), DP does not consider potential contamination issues associated with the Service Station are likely to impact the Site;
  - Former BP Service Station located at 154 - 156 Prospect Highway (approximately 400 m north west of the Site) - listed as 'Under Assessment'. Given the approximate distance of the industry to the Site and the anticipated groundwater flow at this location (south west towards Blacktown Creek), DP does not consider potential contamination issues associated with the Service Station are likely to impact the Site;
  - Australian Waste Oil Refineries classified as 'Other Industry' located at 27 Powers Road (approximately 700 m south east of the Site) - listed as 'Contamination currently regulated under CLM Act'. Given the approximate distance of the industry to the Site and the anticipated groundwater flow at this location (west towards Toongabbie Creek), DP does not consider potential contamination issues associated with the industry are likely to impact the Site;

- Australia Post located at 3 Powers Road (approximately 500 m south west of the Site) - listed as 'Regulation under CLM Act not required'. Given the approximate distance of the industry to the Site and the anticipated groundwater flow at this location (south towards Blacktown Creek), DP does not consider potential contamination issues associated with the industry are likely to impact the Site; and
- Caltex Service Station located at 38 Abbott Road (approximately 1 km north east of the Site) – listed as 'Regulation under CLM Act not required'. Given the approximate distance of the industry to the Site and the anticipated groundwater flow at this location (south towards Toongabbie Creek), DP does not consider potential contamination issues associated with the industry are likely to impact the Site.

- 18 licences under Schedule 1 of the Protection of the Environment Operations (POEO) Act, 1997 have been issued for six properties located within a 500 m radius of the Site (refer Appendix B - POEO Licenses).

4.3 SafeWork Search

The results for a WorkCover search for licences to store hazardous chemicals at the Site were received on 6 April 2017. A copy of the WorkCover search documents is provided in Appendix B.

The hazardous chemical that has been stored on the Site is hypochlorite solution. It is understood that the hypochlorite solution is used to facilitate the treatment of the liquid waste and is stored within the depot (See Photograph 5, Appendix C).

5. Site Walkover

The Site walkover was undertaken by DP on 16 December 2017. The Site features are shown on Drawing 2, Appendix A and photographs taken during the site walkover are presented in Photographic Plates 1 – 3, Appendix C.

During the site walkover the following observations were noted:

- An active liquid waste treatment facility was observed in western portion of the Site with associated concrete and site sheds (refer Photograph 1);
- A bunded concrete slab of approximately 10 m by 3 m was observed adjacent to the liquid waste facility in the western portion of the Site and was the pump out location where liquid waste was deposited to the treatment facility (refer Photograph 1);
- Recyclable white goods in the form of approximately ten refrigerators were observed in the north west portion of the Site (refer Photograph 2). The refrigerators appeared to have been constructed after 1987 and were in good condition;
- Two small grass-covered areas were observed in the western and south west portion of the Site (refer Photograph 3); and
- The majority of the remainder of the Site consisted of an asphalt wearing course (refer Photograph 4).

A license provided by Blacktown City Council confirmed that liquid waste was stored on the Site, treated with chlorine and then disposed of to the sewer (see Consent to Discharge Industrial Trade Wastewater - Appendix B).

Apart from the localised waste treatment facility and the asphalt carpark, there were generally no other obvious indications of potential contamination observed (i.e. staining, odours, distressed vegetation).

6. Preliminary 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 (linkages). A preliminary CSM provides a framework to identify potential contamination sources 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).

6.1 Potential Sources

Based on the review of site history information and the site walkover, the identified potential sources, description of sources and contaminants of potential concern (COPC) at the Site have been summarised in Table 1 (following page).

Table 1: Potential Contamination Sources and COPC

Potential Source	Description of Potential Source	Contaminants of Potential Concern
Import of Fill (S1)	Two small grass-covered areas containing fill of unknown origin. It is possible that the fill was imported.	Metals, TRH, BTEX, PAH, OCP, OPP, PCB, phenols, and asbestos
Liquid Waste (S2)	A liquid waste facility is present at the Site. It is possible that any leaks from the liquid waste treatment facility may lead to contaminants entering the soil and groundwater.	Metals, TRH/BTEX, PAH, OCP, OPP, PCB, Oil and Grease, VOCs

Notes: *Metals - comprising arsenic (As), cadmium (Cd), chromium (Cr), copper (Cu), lead (Pb), mercury (Hg), nickel (Ni) and zinc (Zn);*
TRH - Total recoverable hydrocarbons;
BTEX - Benzene, toluene, ethylbenzene and xylene;
PAH - Polycyclic aromatic hydrocarbons;
OCP and OPP - Organochlorine and organophosphorous pesticides;
PCB - Polychlorinated biphenyls;
VOCs – Volatile organic compounds

6.2 Potential Receptors

The following potential human receptors (R) have been identified for the Site:

- R1 – Construction and maintenance workers (during Site redevelopment);
- R2 – Future site users following development of the Site; and
- R3 – Land users in adjacent areas (industrial and commercial).

The following potential ecological receptors (R) have been identified for the Site:

- R4 – Local groundwater and receiving water bodies;
- R5 – Surface water bodies (creeks); and
- R6 – Local ecology. DP notes that potential ecological receptors are usually associated with the upper 2 m (root zone and habitation zone for many species) of the soil profile.

6.3 Potential Pathways

Potential pathways for contamination include the following:

- P1 – Ingestion and dermal contact;
- P2 – Inhalation of fibres and/or dust and/or vapours;
- P3 – Leaching of contaminants and vertical migration into groundwater;
- P4 – Surface water run-off;
- P5 – Lateral migration of groundwater providing base flow to watercourses; and
- P6 – Direct contact with ecological receptors.

6.4 Summary of Potential Complete Pathways

A 'source - pathway - receptor' approach has been used to assess the potential risks of harm being caused to human or ecological receptors from contamination sources on or in the vicinity of the Site, via exposure pathways. The possible pathways between the above sources (S1 and S2) and receptors (R1 to R6) are provided in Table 2 (following page). Assessment of the preliminary CSM was used to determine data gaps and the requirement for sampling and analysis to assess the suitability of the Site for the proposed residential use.

Table 2: Preliminary Conceptual Site Model

Source	Exposure Pathway	Receptor	Requirement for Additional Data and / or Management
S1: Import of Fill S2: Liquid Waste	P1 – Ingestion and dermal contact. P2 – Inhalation of fibres and/or dust and/or vapours.	R1 - Construction and maintenance workers. R2 - Future site users following development of the Site.	An intrusive investigation is required to quantify and assess possible contamination including chemical testing of soil (and groundwater if deemed necessary).
	P2 – Inhalation of fibres and/or dust and/or vapours.	R3 - - Land users in adjacent areas.	
	P3 – Leaching of contaminants and vertical migration into groundwater.	R4 - Local groundwater and receiving water bodies.	
	P4 – Surface water run-off. P5 – Lateral migration of groundwater providing baseflow to watercourses.	R5 – Surface water bodies.	
	P6 – Direct contact of contaminated ground with ecological receptors.	R6 – Local ecology.	

7. Sampling Analysis Plan

7.1 Sampling Rationale

Field investigations were undertaken on 19 January and 9 February 2017 by a DP Environmental Scientist. A total of seven boreholes were drilled and soil samples collected from each bore. Three groundwater wells were installed as part of this DSI and groundwater samples were collected there from each location to investigate the potential impact of any on site or off-site contaminant sources including the presence of the liquid waste treatment facility as a potential on-site source of groundwater contamination. Borehole locations were generally based on a systematic grid pattern; however some judgemental sampling was undertaken which targeted observed filling material and the wearing course of the asphalt pavement.

Borehole and groundwater well locations are shown on Drawing 2, Appendix A. The rationale for the selected sampling locations and analytes tested are provided in Table 3 (following page). Soil samples analysed targeted both the fill and natural materials encountered.

For a 0.2 ha site the EPA Sample Design Guidelines requires a minimum of seven sampling points.

Table 3: Summary of Sampling and Analysis Rationale

Location	Sample Depth	BH depth (m bgl)	Depth of filling (m bgl)	Analytes	Location Target	Sample Target
BH1	0.4 – 0.5	3.1	0.4	HM, TRH, BTEX, PAH, Phenols, OCP, OPP, PCB	Carpark	Natural Clay
BH2	0.01 – 0.2	1.5	0.4	HM, TRH, BTEX, PAH, Phenols, OCP, OPP, PCB, ASB*	Carpark	Filling
BH3	0 – 0.1	7.5	1.1	HM, TRH, BTEX, PAH, Phenols, OCP, OPP, PCB, ASB*	Grass Covered Filling	Filling
BH4	0.4 – 0.5	2.5	1.8	HM, TRH, BTEX, PAH, Phenols, OCP, OPP, PCB	Carpark	Filling
BH5	0.4 – 0.5	3.0	1.1	HM, TRH, BTEX, PAH, Phenols, OCP, OPP, PCB	Carpark	Filling
BH6	0.0 – 0.05	7.5	2.1	HM, TRH, BTEX, PAH, Phenols, OCP, OPP, PCB, ASB*	Grass Covered Filling	Filling
BH7	0.4 – 0.5	7.5	1.3	HM, TRH, BTEX, PAH, Phenols, OCP, OPP, PCB	Carpark	Filling
MW1	3.5 – 5.0	7.5	1.1	HM, TRH, BTEX, PAH, OCP, OPP, PCB, Oil and Grease, VOCs	General Site Coverage – Upgradient to groundwater flow direction	Groundwater
MW2	4.5 – 5.5	7.5	2.1	HM, TRH, BTEX, PAH, OCP, OPP, PCB, Oil and Grease, VOCs	General Site Coverage	Groundwater

Location	Sample Depth	BH depth (m bgl)	Depth of filling (m bgl)	Analytes	Location Target	Sample Target
MW3	6 – 6.5	7.5	1.3	HM, TRH, BTEX, PAH, OCP, OPP, PCB, Oil and Grease, VOCs	General Site Coverage – Downgradient to groundwater flow direction	Groundwater

Notes: *HM - metals;*
TRH - Total recoverable hydrocarbons;
BTEX - Benzene, toluene, ethylbenzene and xylene;
PAH - Polycyclic aromatic hydrocarbons;
OCP and OPP - Organochlorine and organophosphorous pesticides;
PCB - Polychlorinated biphenyls;
ASB – selected samples tested for Asbestos (500ml) and sieved (10 L sieve samples)*
VOCs – Volatile organic compounds

8. Sampling Procedure

8.1 Soil Sampling Procedure

Sampling data was recorded to comply with routine Chain-of-Custody requirements and DP's standard operating procedures. The general sampling, handling, transport and tracking procedures are detailed below:

- Sample locations were pre- determined using GIS prior to field work and were located in the field using a handheld GPS;
- Representative soil samples were collected from 0.0 - 0.2 m, 0.2 - 0.5 m and, where filling is encountered, from regular depth intervals based on field observations. Selected samples were analysed to characterise the different fill layers across the site;
- Disposable nitrile gloves were used to collect all samples. Gloves were replaced prior to the collection of each sample in order to prevent cross-contamination;
- A Geoprobe 7822DT Drill Rig fitted with a 125 mm auger was used to excavate all boreholes. Samples were collected from the auger and placed into new laboratory prepared glass jars, with minimal headspace, and sealed with a Teflon lined lid. In addition, 500 ml bag samples were collected for asbestos testing;
- Sample containers were labelled with individual and unique identification including project number, sample ID, depth and date of sampling;
- Logs were completed for all boreholes and included, where relevant, sample identification, coordinates, date of collection, a description of the substrate conditions encountered, visual or olfactory evidence of contamination, the depth of samples collected, QA/QC samples collected, the sampler and equipment used; and
- For the asbestos sieving of selected samples, 10 L samples (representative samples from each stratum or per 1 m depth for thick units) were sieved using a 7 mm sieve on site. The oversize material was placed on plastic sheeting next to the test pit for detailed inspection/raking for ACM.

8.2 Groundwater Sampling Procedure

Subsequent to installation, the wells were developed by continuous pumping until dry or until the water was free of sediment/mud as determined by the environmental scientist on site. The purpose of well development was to remove as far as practicable sediment introduced to the well via drilling and to facilitate the connection of the well to the local groundwater regime.

All re-used equipment was decontaminated between samples using a 3% solute of Decon 90 followed by rinsing with deionised water. Groundwater samples were collected using a low-flow pump with adjustable flow rate, and disposable polyethylene tubing.

Sample handling and transport to Envirolab for analysis was conducted as described for soil sampling.

8.3 Quality Assurance and Quality Control

Laboratory analysis of primary and intra-laboratory samples was conducted by Envirolab Services Pty Ltd (Envirolab). Envirolab is accredited by the National Association of Testing Authorities (NATA) and is required to conduct in-house QA/QC procedures. These are normally incorporated into every analytical run and include assessment of reagent blanks, spike recovery, surrogate recovery and laboratory duplicates.

The analytical methods used are summarised in the laboratory certificate of analysis, included in Appendix G.

9. Site Assessment Criteria

The Site Assessment Criteria (SAC) applied in this DSI have been informed by the current zoned land use (i.e. industrial) and the CSM – which identified human and ecological receptors to potential contamination on the Site (refer to Section 6). Analytical results were assessed (as a Tier 1 assessment) against the investigation and screening levels as per Schedule B1, National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended 2013 (NEPC, 2013).

As the Site is proposed to be divested and the current zoning is for industrial land use, the investigation and screening levels adopted are consistent with a generic industrial land use scenario. The derivation of the SAC is included in Appendix E and the adopted SAC are listed in the analytical results table (Table D1 in Appendix D).

10. Results

10.1 Field Work Observations

The borehole logs are included in Appendix F, together with notes defining classification methods and descriptive terms.

Relatively uniform conditions were encountered across most of the Site, with filling observed at all borehole locations. The general strata across the Site is summarised as follows:

- FILLING – sandy silty clay, clayey silt, silty clay and sandy gravel filling was observed within all boreholes to maximum depths of between 0.4 m and 2.1 m bgl. BH3 comprised anthropogenic materials including suspected ACM and scrap metal. Asphalt (associated with a carpark wearing course) was observed at the surface of BH1, BH2, BH4, BH5 and BH7;
- SILTY CLAY – silty clay was encountered within all boreholes to maximum depths of between 1.5 m to 6.5 m bgl or to test pit termination; and
- BEDROCK – extremely low to low strength siltstone or shale was encountered from depths of between 5.3 m and 6.5 m bgl in BH3, BH6 and BH7.

No free groundwater was observed in any of the boreholes during drilling or for the short time that they were left open and four bores were immediately backfilled following excavation which precluded longer term assessment of any groundwater levels that might be present. However, BH3, BH6 and BH7 were converted to monitoring wells (MW1 - MW3) to facilitate groundwater monitoring and sampling. Groundwater rest levels were recorded as described in Section 10.2 (Table 2) and ranged from 30.359 m (AHD) to 34.317 m (AHD).

One suspected fragment of ACM (F1) was observed and collected from the surface of BH3. As BH3 / 0 - 0.1 recorded concentrations of asbestos fines during analysis, F1 was not sent to the laboratory for confirmatory analysis of the presence/absence of asbestos under AS4964:2004.

Asbestos sieving was undertaken on three selected samples collected from BH3 / 0 - 0.1, BH5 / 0 - 1 and BH6 / 0 - 1. The results for the soil sieving conducted during the assessment are summarised in Table D2 in Appendix D, together with the adopted SAC. Two fragments of suspected ACM were identified within the bulk sample BH3 / 0 - 0.1. No fragments of ACM were observed within the bulk soil sample sieved from BH5 / 0 - 1 and BH6 / 0 - 1.

10.2 Groundwater Levels and Field Parameters

Groundwater wells installed by DP were surveyed using a dGPS. Groundwater levels were gauged on 31 January 2017 using an electronic oil/water interface meter prior to developing the wells. The measured standing water levels (SWL) are shown in Table 2 (following page).

Table 2: Summary of Groundwater Level Measurements 31 January 2017

Well ID	Top of Casing (m AHD)	SWL (m bgl)	SWL (m AHD)
MW1	36.277	1.96	34.317
MW2	35.676	3.16	32.516
MW3	35.789	5.43	30.359

Notes to table: AHD – Australian Height Datum
SWL – standing water level
bgl – below ground level

Based on the groundwater level measurements at the Site, groundwater was generally flowing to the south east.

Field parameters were measured whilst sampling. The field parameters are summarised in Table 3.

Table 3: Summary of Field Parameters

Well / Sample ID	Temp. (°C)	DO (mg/L)	EC (mS/cm)	pH	Redox (mV)
MW1	23.1	0.64	20.64	5.58	183
MW2	28.4	2.84	10.67	5.60	262
MW3	23.1	1.57	21.81	5.80	211

Groundwater temperatures ranged between 23.1°C and 28.4°C. Dissolved oxygen ranged from 0.64 mg/L to 2.84 mg/L in the wells. The electrical conductivity ranged between 10.67 ms/cm and 21.81 ms/cm reflecting values typical of brackish to saline water. The pH of the groundwater was slightly acidic ranging between 5.58 and 5.80 pH units. Redox potential (Eh) ranged between 183 and 262 mV.

No light non-aqueous phase liquid (LNAPL) was observed whilst sampling.

10.3 Analytical Results

10.3.1 Soil Results

The analytical results for the soil samples collected during this DSI are summarised in Table D3 in Appendix D, together with the adopted SAC. The laboratory certificate of analysis for this DSI is provided in Appendix G.

A summary of the results is provided below:

- Concentrations of heavy metals were below the SAC for all samples submitted for analysis with the exception of the following:
    - Copper: the reported concentration of copper in sample BH3 /0 - 0.1 was above the adopted ESL (100 mg/kg) but was below the adopted HIL (240,000 mg/kg);

  - Nickel: the reported concentrations of nickel in samples BH1 / 0.4 - 0.5 (27 mg/kg), BH2 / 0.01 - 0.2 (86 mg/kg), BH3 / 0 - 0.1 (49 mg/kg) and BH6 (49 mg/kg) were above the adopted EIL (25 mg/kg) but were below the adopted HSL D (6,000 mg/kg);
  - Zinc: the reported concentrations of zinc in samples BH3 / 0 - 0.1 (280 mg/kg) and BH6 / 0.0 - 0.05 (290 mg/kg) were above the adopted EIL (220 mg/kg) but below the adopted HIL D (400,000 mg/kg);
- Concentrations of phenols, BTEX, OCP, OPP and PCB were reported below their respective laboratory limits of reporting in all samples submitted for analysis;
- Concentrations of TRH and PAH were below their respective SAC for all samples submitted for analysis. The following reported values above the laboratory limit of reporting;
  - PAH: the reported concentrations of benzo(a)pyrene in sample BH3 / 0 - 0.1 (0.1 mg/kg) and BH6 / 0.0 - 0.05 (0.08 mg/kg) was above the laboratory limit of reporting (<0.05 mg/kg) but was below the adopted ESL (0.7 mg/kg). The reported concentrations of total PAH in sample BH3 / 0 - 0.1 (0.93 mg/kg) and BH6 / 0.0 - 0.05 (1 mg/kg) was above the laboratory limit of reporting but below the adopted HIL D (4,000 mg/kg);
  - TRH: the reported concentrations of the >C16 - C34 fraction in sample BH4 / 0.4 - 0.5 (260 mg/kg) was above the laboratory limit of reporting (<100 mg/kg) but was below the adopted ESL (2,500 mg/kg) and Management Limit (3,500 mg/kg). The reported concentration of >C34 - C40 in sample BH4 / 0.4 - 0.5 (150 mg/kg) was above the laboratory limit of reporting (<100 mg/kg) but was below the adopted ESL (6,600 mg/kg) and Management Limit (10,000 mg/kg);

Asbestos was not detected at the limit of reporting in the soil samples submitted for analysis with the exception of BH3 / 0 - 0.1. Sample BH3 / 0 - 0.1 exceeded the adopted SAC for FA and AF (0.001% w/w) with a concentration of 0.0013% w/w.

As reported concentrations of metals were above the adopted screening EIL's, for BH1 / 0.4 - 0.5, BH2 / 0.01 - 0.2, BH3 / 0 - 0.1 and BH6 / 0.0 - 0.05, specific EIL's were determined for each of the material types and from similar depth encountered during the investigation. Based on the CEC and pH adopted for BH1 / 0.4 - 0.5 (pH of 7.7 and CEC of 12), BH2 / 0.01 - 0.2 (pH of 9.4 and CEC of 4.0), BH3 / 0 - 0.1 (pH of 8.4 and CEC of 20) and BH6 / 0 - 0.05 (pH of 7.0 and CEC of 16) the following specific EILs were derived:

- BH1 / 0.4 - 0.5: the specific EIL for nickel was determined to be 330 mg/kg;
- BH2 / 0.01 - 0.2: the specific EIL for nickel was determined to be 40 mg/kg;
- BH3 / 0 - 0.1: the specific EIL for copper, nickel and zinc was determined to be 320 mg/kg, 460 mg/kg and 1200 mg/kg respectively; and
- BH6 / 0 - 0.05: the specific EIL for nickel and zinc was determined to be 400 mg/kg and 980 mg/kg respectively.

All previous exceedances of the screening EIL's were below the specific EIL's with the exception of BH2 / 0.01 - 0.2 where a nickel concentration of 86 mg/kg was recorded above the specific EIL (40 mg/kg). It is noted that BH2 / 0.01 - 0.2 is located within the road base material identified across the Site. It is also noted that EILs may not be applicable during future studies if the Site is likely to remain paved or is built over.

10.3.2 Groundwater Results

The analytical results for the groundwater samples collected during this DSI are summarised in Table D2 in Appendix D, together with the adopted SAC. The laboratory certificate of analysis for this DSI is provided in Appendix G.

A summary of the results is provided below:

- Concentrations of heavy metals were below the SAC for samples submitted for analysis with the exception of the following:
    - Cadmium: the reported concentration of cadmium in all samples was above the adopted GIL (0.2 µg/L). The reported concentration of cadmium in MW3/090217 (3.3 µg/L) was above the adopted NWQMS guidelines (2 µg/L);
    - Chromium: the reported concentration of chromium in MW1/090217 was above the adopted GIL (1 µg/L) but was below the adopted NWQMS guidelines (50 µg/L);
    - Copper: the reported concentration of copper in all samples was above the adopted GIL (1.4 µg/L) but below the HIL and NQMS guidelines (240000 µg/L and 2000 µg/L respectively);
    - Mercury: the reported concentration of mercury in MW2/090217 was above the adopted GIL (0.06 µg/L) but was below the adopted NWQMS guidelines (1 µg/L);
    - Nickel: the reported concentration of nickel in all samples were above the adopted GIL (11 µg/L) and NWQMS guidelines (20 µg/L); and
    - Zinc: the reported concentration of zinc in all samples were above the adopted GIL (8 µg/L) but were below the adopted NWQMS guidelines (3000 µg/L).

10.4 Quality Assurance and Quality Control

A review of the adopted QA / QC procedures and results (Appendix H) indicates that the DQIs have generally been met. On this basis, the sampling and laboratory methods used during the investigation were found to meet the DQOs for this project (Appendix E).

11. Discussion

The Site history review indicates that the property has been located in an industrial/commercial area and has been used as a liquid waste treatment facility since at least 1986.

Seven boreholes and three wells were constructed for this DSI. A total of seven soil samples from seven boreholes and three groundwater samples from three wells were analysed from the seven locations.

Reported concentrations of contaminants of concern in the selected soil samples collected from borehole locations were within the adopted SAC with the exception of BH2 / 0.01 - 0.2 that recorded nickel concentrations (86 mg/kg) above the specific EIL (40 mg/kg). It is noted that BH2 / 0.01 - 0.2 is located within the road base material identified across the Site. DP does not consider further investigation of this EIL exceedance is required as the result was from the roadbase material which was immediately below the asphalt pavement (hardstand area) and DP considers that this material is not a suitable medium for plant growth.

Reported concentrations of contaminants of concern in all selected groundwater samples collected from groundwater monitoring wells were within the adopted SAC with the exception of heavy metals. As the Site is located within an urban catchment, it is therefore considered that the heavy metal concentrations may be typical of the regional groundwater quality impacted by diffuse sources of contamination (e.g. from service leakage) rather than direct impacts from the liquid waste treatment facility or related operations.

Asbestos fines were detected below the reporting limit in all soil samples with the exception of BH3 / 0 - 0.1 which recorded concentrations of asbestos fines above the site assessment criteria. In addition three 10 L bulk samples (BH3 / 0 - 0.1, BH5 / 0 - 1 and BH6 / 0 - 1) were collected from boreholes excavated within the Site. Two suspected ACM fragments were observed in one of the three bulk samples (BH3 / 0 - 0.1) of filling. Soil sieving results indicated that BH3 / 0 - 0.1 was above the adopted SAC.

As asbestos fines were identified in BH3 / 0 - 0.1, the observed fragments of suspected asbestos were not sent to the laboratory for confirmatory analysis of the presence/absence of asbestos but were assumed to contain asbestos.

Based on the results of this investigation, it is considered that further investigation and/or remediation of the asbestos impacted topsoil fill surrounding BH3 (refer Drawing 9, Appendix A) is required.

12. Conclusions and Recommendations

The aim of the investigation was to assess the potential for site contamination resulting from past or present uses and / or features, and to provide information on the contamination status of the Site and its suitability for continued industrial / commercial land use.

Based on the findings of this DSI, it is considered likely that the site can be made suitable for the continued commercial/industrial use following further investigation and/or remediation of the asbestos impacted filling surrounding BH3 (refer Drawing 9, Appendix A).

It is considered that the heavy metal concentrations in the groundwater at the Site are likely to represent diffuse industrial background levels and therefore do not require further testing. It is recommended that future users of the Site do not construct water bores as the groundwater is not of potable quality.

A Remediation Action Plan or Work Method Statement will need to be prepared to facilitate the remediation and validation process. A detailed asbestos investigation can be undertaken prior to preparation of the Remediation Action Plan to limit the amount of filling that will require remediation.

13. Limitations

Douglas Partners Pty Ltd (DP) has prepared this DSI report for this project at Park Road, Seven Hills in accordance with DP's proposalMAC160350 dated October 2016 and acceptance received on 11 November 2016. The work was carried out under DP's Conditions of Engagement. This report is provided for the exclusive use of Blacktown City Council for this project only and for the purposes as described in the report. It should not be used by or relied upon for other projects or purposes on the same or other site or by a third party. Any party so relying upon this report beyond its exclusive use and purpose as stated above, and without the express written consent of DP, does so entirely at its own risk and without recourse to DP for any loss or damage. In preparing this report DP has necessarily relied upon information provided by the client and/or their agents.

The results provided in the report are indicative of the sub-surface conditions on the site only at the specific sampling and/or testing locations, and then only to the depths investigated and at the time the work was carried out. Sub-surface conditions can change abruptly due to variable geological processes and also as a result of human influences. Such changes may occur after DP's field testing has been completed.

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

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

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

Asbestos has been detected by observation and by laboratory analysis, in filling materials at the test locations sampled and analysed.

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

Douglas Partners Pty Ltd