



PHASE 2 ENVIRONMENTAL SITE AND GEOTECHNICAL INVESTIGATION





Corner of Horsley Drive and Cowpasture Road, Wetherill Park NSW

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Phase 2 Environmental Site and Geotechnical Investigation

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Table of Contents

List of Abbreviations	5
Executive Summary.....	6
1 Introduction	8
2 Site Condition and Surrounding Environment	10
3 Site History.....	13
4 Geology, Hydrogeology and Salinity	17
5 Conceptual Site Model	19
6 Sampling Analysis and Quality Plan.....	20
7 Evaluation of QA/QC.....	28
8 Results	30
9 Geotechnical Results	33
10 Site Characterisation.....	34
11 Conclusions	35
12 Limitations.....	36
13 References.....	37

Appendix A – Figures

Appendix B – Previous Report Extracts

Appendix C – Historical Aerial Photographs

Appendix D – Photographic Log

Appendix E – Results Tables

Appendix F – Auswide Geotechnical Report

Appendix G – Laboratory Certificates

Appendix H – WSP Soil Bore Records

List of Abbreviations

ANZECC	Australian and New Zealand Guidelines for Fresh and Marine Water Quality (2000)
ASS	Acid Sulfate Soil
bgl	Below ground level
BaP	Benzo a pyrene
BTEX	Benzene, toluene, ethyl benzene and xylene
COC	Chain of custody
COPC	Contaminants of potential concern
DO	Dissolved oxygen
DQI	Data quality indicators
DQO	Data quality objectives
DSI	Stage 2 Detailed Site Investigation as defined in NSW OEH (2011)
EC	Electrical conductivity
HIL	Health-based investigation levels for varying land uses as defined in Appendix II of NSW DEC (2006). Including HIL A (residential with access to gardens), HIL D (residential with minimal soil access), HIL E (parks, playing fields, open space) and HIL F (commercial / industrial)
LoP	Limit of protection as defined under ANZECC (2000)
M8	Eight heavy metals including arsenic, cadmium, chromium, copper, lead, mercury, nickel, zinc
NAPL	Non aqueous phase liquid
NSW EPA	Over the past few years the environmental regulatory body has undergone a number of name changes, including: Department of Environment and Conservation (DEC); Department of Environment and Climate Change (DECC); Department of Environment, Climate Change and Water (DECCW); and, Office of Environment and Heritage (OEH). For the purpose of currency, the organisation is referred to as NSW EPA in this report. EPA guidelines are referenced by the name of the organisation at the time of publication.
OCP	Organo chlorine pesticides
OPP	Organo phosphate pesticides
ORP	Oxygen reducing potential
PAH	Polycyclic aromatic hydrocarbons
PCB	Poly chlorinated biphenyls
pH	Unit of measurement for acidity and alkalinity
PID	Photo ionisation detector
PIL	Phytotoxicity-based investigation levels as defined in Appendix II of NSW DEC (2006)
PSI	Stage 1 Preliminary Site Investigation as defined in NSW OEH (2011)
PSH	Phase Separated Hydrocarbons
PVC	Poly vinyl chloride
QA/QC	Quality assurance / quality control
RAP	Remedial Action Plan as defined in NSW OEH (2011)
RPD	Relative percentage difference
SAP	Sampling and Analysis Plan
SAQP	Sampling Analysis and Quality Plan
SVOC	Semi volatile organic compounds
TCLP	Toxicity criteria leaching potential (laboratory extraction technique)
TPH	Total petroleum hydrocarbons (C10 to C36)
UCL	Upper confidence limit
USCS	Unified soil classification system
VOC	Volatile organic compounds
vTPH	Volatile total petroleum hydrocarbons (C6 to C9)
WSP	WSP Environmental Pty Limited trading as WSP Environment & Energy

Executive Summary

WSP Environment & Energy was engaged by Tim Colless, as project manager on behalf of the Western Sydney Parklands Trust (WSPT) to conduct a Stage 2 – Environmental Site and Geotechnical Investigation. The site is located on the corner of Horsley Drive and Cowpasture Road. It is understood that WSPT wishes to redevelop the site as an 'eco business park'.

The objectives of this report were to:

- Establish site history;
- Assess the site from a contamination point;
- Report findings of the geotechnical scope of works; and,
- Conclude whether or not the site is suitable for commercial land use.

The scope of works described in this report included the following:

- Review of background information;
- Advancement of boreholes across the site to a maximum depth of 12m bgl;
- Collection of soil samples for COPC and geotechnical assessment;
- Identification of potential contamination where applicable;
- Assessment of results against adopted site criteria; and,
- Preparation of the environmental component of the Report in general accordance with NSW OEH (2011) Contaminated Site: Guidelines for Consultants Reporting on Contaminated Land.

The majority of the site is open paddocks which have historically been used for agricultural purposes. Lot 10 DP 879209, located in the centre of the eastern boundary, was formerly a fuel depot. Between 2005 and 2009, one above ground storage tank, eleven USTs, fuel pumps and associated line work were removed. Contaminated soil excavated from the former tankpits and infrastructure locations was landfarmed in the south western corner of the Lot. In 2006, the landfarm was validated to NSW EPA (1994) guidelines.

Soil in the vicinity of the linework and tankpits 2 and 3 had concentrations of TPH (C₁₀-C₃₆) which exceeded the NSW EPA (1994) guidelines for Sensitive / Open Space landuse. Remaining sample locations met the guideline criteria.

The excavations were backfilled with validated excavated material and imported ENM.

Soil and groundwater investigations were conducted in 2009 and 2010. Works concluded the following:

- TPH soil impact was identified in the main shed area and in MW03 and MW06;
- Groundwater across Lot 10 DP 879209 was determined to flow in a south easterly direction. Groundwater was very saline and of low yield;
- Concentrations of heavy metals arsenic, nickel, cadmium, copper and zinc exceeded the ANZECC 2000 guidelines in the majority of wells. These concentrations were considered to be representative of background concentrations; and,
- PSH were identified at the southern boundary of Lot 10 DP 879209 and in the adjoining property (Lot 100 DP 879680).

Preliminary soil contamination assessment conducted across the site in 2011 did not detect any analytes above the NEPM HIL F and EPA 1999 Service Station Guidelines.

Based on the works described in this report, WSP makes the following conclusions regarding the site in relation to contamination:

- TPH impacted soil exists on Lot 10 DP 879209.
- Groundwater at the boundary of Lot 10 DP 879209 and Lot 100 DP 879680 is impacted with TPH. PSH were identified in two wells.
- Concentrations of heavy metals arsenic, nickel, cadmium, copper and zinc exceeded the ANZECC 2000 guidelines in the majority of wells. These concentrations were considered to be representative of background concentrations.
- All other results fall below the adopted site criteria.

Geotechnical issues need to be considered as the site is developed through cut and fill.

WSP will prepare a Remediation Action Plan for the site which will detail proposed methodologies for works required to make the areas impacted, suitable for unrestricted commercial land use.

1 Introduction

1.1 Background

WSP Environment & Energy was engaged by Tim Colless, as project manager on behalf of the Western Sydney Parklands Trust (WSPT) to conduct a Phase 2 – Environmental Site and Geotechnical Investigation to facilitate the State Significant Development (SSD) application for a 21 hectare parcel of land located within the Smithfield/Wetherill Park precinct of the Western Sydney Parklands, NSW (the site) (Figure 1, **Appendix A**).

The site is located on the corner of Horsley Drive and Cowpasture Road and is currently unoccupied with the exception of two residential properties defined as Lot 10, Development Plan (DP) 879209 and Lots 30A and 30B, DP 13961.

It is understood that WSPT wishes to redevelop the site as an 'eco business park' which involves subdividing the site into 12 lots which will receive access from a proposed road.

1.2 Information Provided to WSP

To assist in the preparation of this report, WSPT provided WSP with the following information:

- Stage Two Geotechnical Brief prepared by Costin Roe Consulting Pty Ltd (March 2012)
- The Western Sydney Parklands – Plan of Management 2020
- Director General's Environmental Assessment Requirements (March 2012)
- Architectural Concept Plan (HY-HW-PP-004 rev A, 20/12/2011)
- Preliminary Environmental Site Assessment prepared by Environmental Investigation Services (EIS) (December 2011)
- Preliminary Geotechnical Investigation prepared by Jeffrey and Katauskas (December 2011)

1.3 Objectives

The objectives of this report were to:

- Assess the site from a contamination point of view with regard to human health and environment;
- Report findings of the geotechnical scope of works; and,
- Conclude whether or not the site is suitable for commercial land use.

1.4 Scope of Works

The scope of works described in this report included the following:

- Review of background information;
- Clearance of selected locations by qualified service locator;
- Advancement of 192 boreholes across the site to a maximum depth of 1.5m;
- Advancement of 29 boreholes to a maximum depth of 5m below ground level (bgl);
- Collection of soil samples from near surface (0.1m), 0.5m and 1.5m bgl;
- Collection of Shrink/Swell, California Bearing Ratio (CBR) and Emerson Aggregate samples;
- Identification of potential contamination where applicable such as seepage, discolouration, staining, odours and anthropogenic waste;

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- Compositing of soil samples for laboratory analysis;
 - Analysis for contaminants of potential concern (COPC);
 - Assessment of results against adopted site criteria; and
 - Preparation of the environmental component of the Report in general accordance with NSW OEH (2011) Contaminated Site: Guidelines for Consultants Reporting on Contaminated Land.

2 Site Condition and Surrounding Environment

2.1 Site Identification

The location of the site is shown on Figure 1 in **Appendix A**, approximately 30km west of Sydney CBD. The site identification details are summarised in Table 1 below:

Table 1 Site Identification Details

Street Address:	Corner of Horsley Drive and Cowpasture Road, Wetherill Park NSW
Property Description:	Lots 24, 25, 28B, 30, 30A, 30B, 32, and 32A in DP 13961 Lot C in DP 103755 Lot 10 in DP 879209 Lot 100 in DP 879680 Lot 1 in DP 1036933 Lots 1, 2, 3, 4 and 5 in DP 1098128
Current Site Ownership	Western Sydney Parklands Trust
Geographical Coordinates (to approximate centre of site)	33°50'45.19" S 150°52'32.61" E
Property Size:	Total area of approximately 21 hectares of land
Local Government Area:	Fairfield City Council
Subdivision:	The property is planned to be subdivided into 12 lots
Zoning – Existing:	State Environmental Planning Policy (SEPP) Western Sydney Parklands 2009

2.2 Site Condition

The following site condition details were observed by Josie Milner and Josh Byrne (Environmental Engineers – WSP) during the site walkover survey and drilling works conducted from 11 to 17 April 2012. Site features are shown on Figure 2, **Appendix A**, and a photographic log is provided in **Appendix D**.

Table 2 Site Condition Details

Topography and Drainage	<p>The site has an elevation ranging between 60 to 80m AHD (referenced from Google Earth's elevation tool accessed on 04/04/12). The highest point coincides with the approximate centre of the site with surrounding land sloping down in all directions. Topographical features include:</p> <ul style="list-style-type: none"> ■ Approximately 100m length of the central portion of the eastern boundary comprising a cut slope approximately 3m in height (Jeffery & Katauskas, 2011) ■ Two dams located in north western portion of site; ■ Gully feature running from centre of western boundary through both dams to the north eastern corner of the site; ■ Undulating terrain densely vegetated with long grass, scrub and small to medium
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	<p>sized trees; and</p> <ul style="list-style-type: none"> ■ Surface water is expected to follow local topography and flow towards the boundaries of the site.
Quality of Surface Water	Surface water on the site could not be accessed during this investigation due to thick vegetation coverage.
Flood Potential	Saturated ground was encountered during the site inspection and appeared to extend along the natural gully feature running north-east through the northern portion of the site.
Boundary Conditions	The boundaries of the site were fenced. Two access gates were located along Horsley Drive with one access gate off Cowpasture Road.
Visible Signs of Contamination including presence of Drums, Wastes and Fill Materials	<p>Surface staining could not be identified due to thick vegetation growth.</p> <p>Areas of potential fill adjacent to existing dams in north west of site. Filled dam on north western boundary. Source of fill is unknown.</p> <p>Anthropogenic waste was observed on the surface of the site and included the following (refer to the photographic log in Appendix D for surface rubbish locations):</p> <ul style="list-style-type: none"> ■ Stockpile of surface rubbish (potentially scrap metal and rusted car bodies) directly south of dams. The stockpile was identified on aerial photographs and accessed on 16 May 2012 after clearing. Potential stockpile in south western corner of site (covered with vegetation). ■ Scrap metal, rusted car bodies, plastic, styrofoam, metal and plastic irrigation pipes on surface, glass, concrete and 200L drums (metal and plastic) was scattered across the site. A number of metal 200L drums were labelled Methyl Chloride and were empty at the time of investigations. ■ Three metal sheds containing car tyres and disused toilet/shower in south east portion of site.
Visible Signs of Plant Stress	No visible signs of plant stress were noted.
Odours	No odours were noted during the site inspection or field investigations with the exception of suspected septic tank overflow located on Lot 30A DP 13961.
Condition of Buildings & Roads	Two residential properties were present at the site. The buildings are single storey, brick and rendered dwellings with associated metal clad shed/garage structures adjacent. The residences appeared in good external condition with the sheds in poor condition.
Relevant Local Sensitive Environments	<p>Surrounding residential properties are located approximately 700m north of the site boundary and adjacent to Horsley Drive to the south.</p> <p>The Sydney Water Supply Canal is located approximately 35m west of the site boundary and flows in a northerly direction into Prospect Reservoir.</p> <p>The nearest environmental receptor for the southern portion of the site is an unnamed gully feature located approximately 0.4km to the south at the intersection of Cowpasture Road and The Horsley Drive. The channel flows in a north easterly direction through Wetherill Park and into Prospect Creek.</p>
Other Relevant Information	The NSW Natural Resource Atlas does not list any registered bores within 1km of the site (accessed 26/04/12).

2.3 Surrounding Land Use

Based on current aerial photographs and observations made during the site visit conducted by WSP on 11 April 2012, the surrounding land use can be summarised as follows:

Table 3 Surrounding Land Use

North	Transmission lines running east-west beyond which is vacant rural land
East	Cowpasture Road beyond which is an industrial/commercial precinct
South	Horsley Drive beyond which is one residential property with market gardens surrounded by vacant land
West	Paved bicycle path beyond which is Sydney Water Supply Canal followed by rural land.

3 Site History

3.1 Summary of Historical Information

To assist with the preparation of this report, WSP has been provided with or accessed copies of the following reports:

- ¹ Tank Removal Status Report prepared by RES (June 2006) – Pertains to Lot 10 DP 879209 only
- ² Landfarm Soil Testing prepared by WSP (December 2006) – Pertains to Lot 10 DP 879209 only
- ³ Tank Removal Works prepared by WSP (June 2009) – Pertains to Lot 10 DP 879209 only
- ⁴ Phase 2 Draft Environmental Site Assessment and Additional Investigation prepared by WSP (February 2010) – Pertains to Lot 10 DP 879209 only
- ⁵ Preliminary Environmental Site Assessment prepared by Environmental Investigation Services (EIS) (December 2011) – Pertains to the whole site area with the exception of Lot 10 DP 879209
- ⁶ Preliminary Geotechnical Investigation prepared by Jeffrey and Katauskas (December 2011) – Pertains to the whole site area

Results of enquiries conducted by WSP and a review of the above reports have been summarised and included in the following table. Relevant extracts from previous reports are included in **Appendix B**. Aerial photographs are provided in **Appendix C**.

Table 4 Summary of Historical Information

Past Zoning	No information is available of historical zoning.
Previous Land Uses	<ul style="list-style-type: none"> ■ Farming / agricultural uses since 1947 ■ Fuel Storage Depot at Lot 10 DP 879209
Summary of Council Records including Section 149 Certificates	<ul style="list-style-type: none"> ■ The site is not deemed to be: significantly contaminated; subject to a management order; subject of an approved voluntary management proposal; or subject to an on-going management order under the provisions of CLM Act 1997⁵ ■ Council is not aware that a Site Audit Statement (SAS) has been issued for the site⁵ ■ The site is not located within a Class 1 or 2 acid sulfate soil (ASS) risk area⁵
EPA Records	Lot 10 DP 879209 has been notified to the EPA as a contaminated site (formerly fuel storage depot) ¹
WorkCover Dangerous Goods Licenses including Inventory of Chemicals and Wastes and their Location	<p>Past reports did not provide WorkCover / Dangerous Goods information</p> <p>A WorkCover / Dangerous Goods search was not conducted as part of this investigation</p>
Summary of Aerial Photographs (on site) ² (Appendix C)	<ul style="list-style-type: none"> ■ In 1930, the site was undeveloped with grass coverage and scattered trees. The Sydney Water Supply Canal was visible along the western site boundary. ■ In 1943, agricultural activities had commenced. A dam is visible in the north west corner of the site. A number of rural residential properties are located along Horsley Drive. ■ In 1961, agricultural activities had intensified. Two additional dams had been constructed in the north west portion of the site. The number of residential properties along Horsley Drive had increased. Two residential properties existed along Cowpasture Road. ■ The site appeared in similar condition in the 1978 and 1986 aerial photographs.

	<ul style="list-style-type: none"> ■ In 1994, agricultural activity had ceased in the northern area of the site. ■ In 2005, agricultural activity had ceased across the entire site.
Summary of Aerial Photographs (adjacent sites) ² (Appendix C)	<ul style="list-style-type: none"> ■ In 1930, the surrounding area was undeveloped. Dense tree coverage is visible to the east of the site. ■ In 1943, agricultural activities have commenced with the exception of land to the east of the site which remains densely covered by vegetation. ■ In 1961 and 1978, agricultural activities continued to intensify with land to the east being partially cleared. ■ In 1986, agricultural activities have ceased to the east of the site. Commercial/industrial activities have commenced in this area. ■ Commercial/industrial activities to the east of the site continued to increase in 1994 and 2005.
Description of Manufacturing / Industrial Processes & Location	<p>Historical Title Deeds indicate that three properties were owned by proprietors whose trades have the potential to result in impacts to the soil and groundwater at the site. These include:</p> <ul style="list-style-type: none"> ■ Lot 3, DP 1098128: Garage proprietor, 1948 – 1951 ⁴ ■ Lot C DP 103755: Motor Mechanic, 1965 – 1979 ⁴ ■ Lot 10 DP 879209: Ampol/Caltex distribution depot, early 1970's - 2006 ⁵ <p>Agricultural activities also occurred across the majority of the site ⁴</p>
Product Spill and Loss History including discharges to Land, Air & Water	<p>Lot 10 DP 879209</p> <ul style="list-style-type: none"> ■ Hydrocarbon impacted material was identified and removed (to onsite landfarm) in the vicinity of former USTs. Remaining soil was validated to the NSW EPA (1994) and NEPM (1999) guidelines for open space landuse ¹. Some residual impacted soils remained at depth on site. ■ 300m³ landfarmed in the former tanker turning area was impacted by TPH. This area was regularly tilled and in 2006 the impact was validated with the soil considered suitable to remain onsite ² <p>WSP did not encounter any records of product spill or loss on the remainder of the site.</p>
Complaint History	None reported in the information provided.
Sewer & Service Plans	Unaware of current or historical presence of sewer or underground services on the site.
Local Site Knowledge	No information relating to previous site usage has been provided by the client.
Local Literature Review	Given the information reported above, a local literature review is unlikely to provide any additional information on the historical use of the site and potential for soil and groundwater impact not already identified to exist.
Permits, Licenses and Approvals	None reported as being required in the information provided.
Past Report Summary	<p>Tank Removal Status Report, RES (June 2006) ¹</p> <ul style="list-style-type: none"> - An above ground storage tank, eight USTs, fuel pumps and associated line work were removed from the site. Hydrocarbon impacted material was excavated from around the fuel tanks, pumps and fill points. - Soil surrounding the main tankpit and soil beneath the former above ground fuel tank was validated to the NEPM Open Space Landuse Criteria. - Soil from the wall and base of a diesel UST excavation pit exceeded the NEPM Open Space Landuse Criteria. <p>Landfarm Soil Testing, WSP (December 2006) ²</p> <ul style="list-style-type: none"> - A landfarm site was excavated from the former UST pits and associated line work at Lot 10 DP 879209. Approximately 300m³ of soil was regularly tilled over

a period of six months to allow for the degradation of organic compounds.

- Sampling at the conclusion of remediation of the soil concluded that material was suitable to remain onsite

Tank Removal Works, WSP (June 2009) ³

- Soil sampling was conducted to classify stockpiled material and validate multiple former UST pits and bowser locations on Lot 10 DP 879209. A suitability assessment was also conducted on the imported backfill material. The excavation pit, excavated stockpiled material and additional backfill material met the NEPM HIL-F Criteria.

Phase 2 ESA and Additional Investigation, WSP (February 2010) ⁴

- Soil and groundwater samples were obtained across Lot 10 DP 879209 to assess the properties suitability for proposed commercial/industrial landuse
- TPH impacted soils were identified in four locations
- Phase Separated Hydrocarbons (PSH) were identified in two wells. The PSH plume was estimated to extend along the south eastern boundary of this property, extending to an adjoining allotment (Lot 100 DP 879680)
- Concentrations of the heavy metals arsenic, nickel, cadmium, copper and zinc exceed the ANZECC 2000 guidelines for groundwater in a number of wells. These results were considered representative of background concentrations in western Sydney Wianamatta Shales
- The following was recommended:

Excavation of the shallow TPH impacted surface soil from within the storage shed formerly used as a drum loading area. The underlying soil would then need to be validated;

Excavation of soils around borehole MW03 where TPH exceeding site criteria was reported at 4.0m bgl. The excavation would also need to be validated;

Additional information gathered on groundwater conditions under the site; and

Undertaking a more detailed qualitative risk assessment in relation to groundwater contamination present under the site

Preliminary ESA, EIS (December 2011) ⁵

- Soil sampling was conducted at 12 locations across the site. Samples were analysed for heavy metals, petroleum hydrocarbons, BTEX, PAHs, pesticides and asbestos. All results were below the adopted HIL F and EPA 1994 Service Station guidelines.

Preliminary Geotechnical Investigation prepared by Jeffrey and Katauskas (December 2011)

- A preliminary geotechnical investigation was conducted across the site in conjunction with EIS. 12 soil bore locations were utilised for both investigations
- Soil bores were advanced to a maximum depth of 6m bgl. Groundwater was not encountered during drilling works
- The soil stratum was identified as silty clay topsoil to 0.5m bgl underlain by high plasticity residual silty clays. Weathered shale bedrock was identified in all locations with the exception of BH5 which was underlain by sandstone. The bedrock improved in quality with depth
- Comments were made regarding excavation conditions, site preparation, temporary and permanent batters and permanent retention, footings, and on-grade floor slabs, external pavements and drainage
- A detailed geotechnical investigation was recommended upon finalisation of the design details

3.2 Integrity Assessment

All sources of information referenced in Table 4 above were in general agreement. This degree of consistency suggests that the historical assessment described above has an appropriate level of accuracy necessary to achieve the objectives of this report.

4 Geology, Hydrogeology and Salinity

4.1 Summary of Geology and Hydrogeology Information

To assist with the preparation of this combined report, WSP has been provided with copies or accessed the following reports:

- ¹ Tank Removal Status Report prepared by RES (June 2006) – Pertains to Lot 10 DP 879209 only
- ² Landfarm Soil Testing prepared by WSP (December 2006) – Pertains to Lot 10 DP 879209 only
- ³ Tank Removal Works prepared by WSP (June 2009) – Pertains to Lot 10 DP 879209 only
- ⁴ Phase 2 Draft Environmental Site Assessment and Additional Investigation prepared by WSP (February 2010) – Pertains to Lot 10 DP 879209 only
- ⁵ Preliminary Environmental Site Assessment prepared by Environmental Investigation Services (EIS) (December 2011) – Pertains to the whole site area with the exception of Lot 10 DP 879209
- ⁶ Preliminary Geotechnical Investigation prepared by Jeffrey and Katauskas (December 2011) – Pertains to the whole site area

Relevant extracts of these documents (see **Appendix B**) together with results of enquiries conducted by WSP have been summarised and included in the following table.

Table 5 Summary of Ground and Groundwater Conditions

Soil Map Conditions	According to the 1:100,000 Penrith Soil Landscape Series Sheet 9030 (Third Edition), the site is situated in the Luddenham Erosional Landscape, which is characterised by undulating to rolling low hills on Wianamatta Group Shales often associated with Minchinbury Sandstone. The shallow (<100cm) soils consist of dark Podzolic Soils on crests, moderately deep (70-150cm) soil consists of red podzolic soils on upper slopes ⁴
Geology Map Conditions	The Penrith 1:100,000 Geological Series Sheet 9030 indicates that the site is underlain by Bringelly Shale of the Wianamatta Group. This geology typically consists of shale, carbonaceous claystone, claystone, laminate, fine-medium grained lithic sandstone, rare coal and tuff ⁵
Soil Classification Method	Unified soil classification system (USCS)
Acid Sulfate Soils	There are no published ASS Risk Maps covering the site. The adjacent Prospect/Parramatta River and Liverpool Maps indicate that there are no known occurrences of ASS in the surrounding area
Ground Conditions Summary from Borehole Records	Topsoil was recorded to depths of 0.3 - 0.5m ⁵ The soil stratum was identified as silty clay topsoil to 0.5m bgl underlain by high plasticity residual silty clays. Weathered shale bedrock was identified in all locations with the exception of BH5 which was underlain by sandstone. The bedrock improved in quality with depth ⁶
Location of Fill Materials	Dam in north western corner of site backfilled between 1994 and 2005 ⁵ Possible fill mound covered with thick grass in south west corner of site ⁶ Potential fill surrounding two existing dams in north west of site Fill material encountered on Lot 10 DP 879209. The fill generally extended to a depth of 0.1 – 2.0m with the exception of the western portion of the property where fill extended beyond 2.0m bgl ⁴
Summary of Monitoring Wells	Nine groundwater monitoring wells were installed in 2009 - 2010 by WSP and screened a range of depths from 1.5m to 20m bgl. These wells were generally located in the south

	eastern corner of Lot 10 DP 879209 ⁴
Depth to Groundwater	Groundwater was measured at between 6.27m and 17.52m bgl across the 9 wells on Lot 10 DP 879209 ⁴
Direction and Rate of Groundwater Flow	Ground water in the vicinity of the monitoring wells was determined to flow in a south-easterly direction ⁴ Shallow groundwater across the remainder of the site is expected to follow local topography and flow towards the site boundaries No rate of flow information was available. However a slug test conducted by WSP 2009 indicated very slow recharge.
Uses of Water Abstraction	No extraction wells were identified within 1km of the site Shallow groundwater (seepage water) is highly saline and slow to recharge and therefore unlikely to be utilised for future potable use ⁴
Background Water Quality	Seven wells were sampled from Lot 10 DP 879209 (two wells, MW02 and MW03 were dry at time of sampling) ⁴ <ul style="list-style-type: none"> ■ Groundwater was determined to be very saline ■ Concentrations of arsenic, cadmium, copper and zinc were above the ANZECC (2000) FW criteria and considered representative of background levels ■ A PSH plume was identified along the southern boundary of Lot 10 DP 879209 extending to the adjacent property Lot 100 DP879680 during 2010 investigations
Summary of Local Meteorology	Information not relevant to scope.

4.2 Salinity

According to the Department of Infrastructure, Planning and Natural Resources (DIPNR) Salinity Potential in Western Sydney Plan (2002), the site is located in an area designated as having moderate salinity potential. From information presented in the plan, soils in steeper areas with high local relief are at a lower risk of developing salinity (majority of the site). The only potential risk areas would be those adjoining drainage lines located towards the northern part of the study area. However, as extensive changes to the levels of the land are proposed, this is likely to result in changes to the salinity potential.

During the environmental investigations, no indicators such as scalding or indicator vegetation were observed across the site. It is noted that access to the gully feature in the northern portion of the site could not be achieved during the investigations.

4.3 Integrity Assessment

WSP's Phase 2 Draft ESA (2010) identifies the underlying site geology to be Ashfield Shale. Further review of the Penrith 1:100,000 Geological Series Sheet 9030 confirms that the site is underlain by Bringelly Shale, which is similar. With the exception of underlying site geology, sources of information referenced in Table 5 above were in general agreement. This degree of consistency suggests that the geological, hydrology and hydrogeological summary described above has an appropriate level of accuracy necessary to achieve the objectives of this report.

5 Conceptual Site Model

5.1 Potential Sources of Contamination

Based on the summary of historical information detailed in Section 3 above, the following potential sources of contamination have been identified:

Table 6 Potential Sources of Contamination

Source No.	Potential Sources of Contamination	Contaminants of Potential Concern
1	Agricultural activities – primarily market gardens	M8, Pesticides
2	Discarded 200L drums	VOCs (di-chloromethane)
3	Petroleum Depot	TPH, BTEX, PAHs, Metals

5.2 Potential Migration Pathways

The potential for contaminants to migrate off site is a combination of:

- The nature of the contaminants (i.e. solid / liquid and mobility characteristics)
- The extent of the contaminants (i.e. isolated or widespread)
- The location of the contaminants (i.e. on the site surface or at depth)
- The topography, geology, hydrology and hydrogeology at the site

Based on the information available to date, it is considered that the following potential off site migration pathways may exist for the potential sources of contamination detailed in Section 5.1 above:

- Given groundwater flow direction for Lot 10 DP 879209, the PSH plume has the potential to migrate beyond the eastern site boundary.

5.3 Potential Exposure Pathways

The exposure pathways considered to be potentially complete include the following:

- Inhalation, ingestion and / or dermal contact of contaminants in soils from Sources 1, 2 and 3 during site redevelopment
- Ingestion or dermal contact with impacted surface water resulting from leaching from Source 1
- Ingestion or dermal contact with impacted groundwater resulting from surface water infiltration and leaching from Sources 1 and 2
- Ingestion or dermal contact associated with PSH impacted groundwater

5.4 Potential Receptors

Potential receptors of COPC that may be present at the site could include the following:

- Site soils/Groundwater
- Surface waters

6 Sampling Analysis and Quality Plan

6.1 Data Quality Objectives

The DQO process is a systematic planning tool based on the scientific method for establishing criteria for data quality and for developing data collection designs. The DQO defines the experimental process required to test a hypothesis.

The DQO process has been developed to ensure that efforts relating to data collection are cost effective, by eliminating unnecessary, duplicative or overly precise data whilst at the same time, ensuring the data collected is of sufficient quality and quantity to support defensible decision making.

It is recognised that the most efficient way to accomplish these goals is to establish criteria for defensible decision making before data collection begins and develop a data collection design based on these criteria. By using the DQO process to plan the investigation effort, the relevant parties can improve the effectiveness, efficiency and defensibility of a decision in a resource and cost effective manner.

6.1.1 Guidance Documents

DQO have been developed to detail the type of data that is needed to meet the overall objectives of this project (refer to Section 1.3). The DQO have been developed in general accordance with procedures stated in the guidelines presented in Section 13 of this report.

6.1.2 Process for DQO Development

The DQO process consists of seven steps, which are designed to clarify the study objectives, define the appropriate type of data and specify tolerable levels of potential decision errors. The seven-step DQO process that is to be adopted for the works is as follows:

- Step 1 – Defining the Problem
- Step 2 – Identify the Decision
- Step 3 – Identify Inputs to the Decision
- Step 4 – Define the Study Boundaries
- Step 5 – Develop a Decision Rule
- Step 6 – Specify Limits on Decision Errors
- Step 7 – Optimise the Design for Obtaining the Data

6.1.3 Step 1 – Defining the Problem

6.1.3.1 Concise Description of the Problem

The potential sources of contamination (Section 5.1) required assessment to determine the actual presence of contamination and suitability of the site for the proposed commercial land use.

6.1.3.2 Planning Team Members and Decision Maker

The project was commissioned by Tim Colless of Hansen Yuncken on behalf of WSPT, who was the ultimate decision maker for this project. The WSP team included:

WSP Project Manager: Peter Moore
WSP Environmental Engineers: Josie Milner and Josh Byrne
Auswide Geotechnical Consultant: Damien Hart

6.1.3.3 Summary of Available Resources, Constraints and Relevant Deadlines

The project team above were assigned to conduct the investigations based on familiarity with WSPT requirements and relevant project experience. Auswide were commissioned by WSP to conduct the geotechnical aspects of the investigation.

The site inspection and fieldwork were conducted from 11 April to 16 May 2012.

A large portion of the site could not be initially accessed due to thick vegetation and extensive blackberry bush coverage. These areas were predominantly in the northern portion of the site. A number of locations were investigated in this area once the paddocks had been cleared of vegetation.

A natural gully feature runs north east from the centre of the western boundary to the north eastern corner of the site. Periods of heavy rain prior to site works rendered this area saturated and inaccessible.

A small portion of land along Horsley Drive was also initially inaccessible due to thick vegetation and fencing. Locations were investigated using hand tools on 16 May 2012.

6.1.4 Step 2 – Identify the Decision

6.1.4.1 Decision Statement Linking the Principal Study Question to Possible Actions that will Solve the Problem

Based on the decision making process for assessing urban redevelopment sites detailed in Appendix I of DEC (2006) and modified to relate to the specific redevelopment requirements for this report, the following decisions were required to be made:

- Do the soils at the site exceed the adopted HIL F or EPA 1999 Service Station guideline criteria?
- Are there any issues relating to the local background area soil and groundwater concentrations that exceed the adopted site criteria?
- Are there any aesthetic issues relating to the soils at the site?
- Is there evidence of, or the potential for, migration of contaminants from the site?
- Is any management or remediation required to render the site suitable for the current and / or future land use?

6.1.4.2 What is the Alternative Action

Do nothing – not acceptable, as the site is required to be characterised to answer the study questions above.

6.1.5 Step 3 – Identification of Inputs into the Decision

6.1.5.1 List of Informational Inputs Needed to Resolve the Decision Statement

WSP has been provided with or accessed previous investigations conducted between 2006 and 2011.

The data contained within the above reports was considered appropriate to advise on the potential contaminants of concern and ground conditions to be encountered as part of the proposed works.

6.1.5.2 Identification of the Media to be Assessed

The sole media to be sampled for COPC as part of these works was fill or natural soil horizons encountered in the upper 1.5m of the subsurface soil profile.

Geotechnical soil analysis and sampling was carried out to a maximum depth of 12m bgl.

Groundwater and surface water sampling was not to be undertaken until the results of the soil sampling were known. Previous investigations had already identified impacts to Lot 10 DP 879209 and Lot 100 DP 879680.

6.1.5.3 List of Environmental Variables or Characteristics that will be Measured

Based on historical uses and past reports, WSP has identified the primary contaminants of concern to be assessed during this investigation as heavy metals (M8), OCP and OPP. A maximum of three soil samples were collected per location at depths of 0.1m, 0.5m and 1.5m bgl. Where refusal was encountered at shallower depths, fewer samples were collected. Sample locations were chosen to target identified anthropogenic waste and maximise site coverage. To minimise costs, near-surface samples were composited for analysis in accordance with NSW Guidelines for Market Gardens. Depth samples were retained for delineation purposes. A VOC surface sample was also taken adjacent to a number of discarded 200L metal drums labelled methyl chloride.

6.1.5.4 Identification of Site Criteria for Each Medium of Concern

The site criteria to be adopted for this study was designed for commercial/industrial landuse and was sourced from:

- National Environment Protection Council (1999) National Environment Protection Measure – Assessment of Site Contamination Schedule B (1) Health Based Investigation Level (HIL) (F) for commercial / industrial land.
- NSW Office of Environment and Heritage – Guidelines for Assessing Former Orchards and Market Gardens (2005). These guidelines refer to the NEPM investigation level values.
- In the absence of National Environment Protection Council guidelines for TPH and BTEX, results were assessed against NSW EPA (1994) Contaminated Sites: Service Station Guidelines.

Table 7 Soil Criteria based on NSW DEC (2006) Guidelines for NSW Site Auditor Scheme

Contaminant	HIL F (mg/kg)
Metals	
Arsenic	500
Cadmium	100
Chromium (VI)	500
Copper	5,000
Lead	1,500
Mercury	75
Nickel	3,000
Zinc	35,000
OCP	
Aldrin + Dieldrin	50
DDT+DDD+DDE	1,000
Heptachlor	50

*Four primary soil samples were used per combined, therefore the above listed guidelines were quartered to maintain analytical integrity.

6.1.5.5 Identification of Analytical Methods that are Required for Chemicals of Potential Concern so that Assessment can be made Relative to the Site Criteria

The table below outlines the primary (Envirolab) and secondary (ALS) laboratory methods for determinants in soil. Both laboratories are NATA accredited.

Table 8 Analytical Reference Methods

Analyte	Envirolab Reference	ALS Reference
Mercury	Cold Vapour AAS (USEPA 7471A)	Cold Vapour / FIM (APHA 3112)
Metals	ICP-AES (USEPA 200.7)	ICP-AES (USEPA 200.2 mod)
OCP / OPP	GC/ECD (USEPA 8081)	GC/ECD/MS (USEPA 3510/8270)
VOC (dichloromethane)	P&T GC/MS (USEPA 8260)	P&T GC/MS (USEPA 5030/8620)

6.1.5.6 List of Informational Inputs Required to Resolve the Decision Statement

- Classification of soil strata, quality and depth
- Sample collection
- Laboratory analyses of soil quality
- Field logs
- Interpretation of soil characteristics

6.1.6 Step 4 – Defining the Study Boundaries

6.1.6.1 Detailed Description of the Spatial and Temporal Boundaries of the Problem

The study area boundary can be described as the 213,833m² area as shown in Figure 2, **Appendix A**. The vertical extent of the investigations will be limited to 1.5m below existing ground level for contamination investigations and 12m bgl for geotechnical works. For intrusive investigations, Lot 10 DP 879209 is assumed to have been previously assessed.

6.1.6.2 Any Practical Constraints that May Interfere with the Study

Practical constraints may include:

- Severe weather conditions
- Site access including dense vegetation, rugged terrain, gully feature and fences.

6.1.7 Step 5 – Developing Decision Rules

The decision rules adopted to answer the decisions outlined in Section 6.1.4.1 are summarised in the following table

Table 9 Summary of Decision Rules

No.	Decision to be Made	Decision Rule
1	Do the soils at the site exceed the adopted guidelines *Four primary soil samples were composited for analysis	For the soils to be considered suitable for commercial land use, the following criteria were adopted with respect to the decision making process: <ul style="list-style-type: none"> ■ If the composite soil results were less than ¼ of the adopted site criteria then the site was deemed suitable for use ■ If the composite soil results were greater than ¼ of the adopted guideline

No.	Decision to be Made	Decision Rule
	therefore results were assessed against ¼ of the adopted guideline value.	<p>then primary samples from those composites would be analysed and assessed against the full guideline criteria. If the primary soil results were less than the adopted site criteria then the site was deemed suitable for use</p> <ul style="list-style-type: none"> ■ If the primary soil results were greater than the adopted guideline and the statistical analysis demonstrates that the upper 95% confidence limit on the average concentration falls below the adopted site criteria; with no single analyte concentration exceeding 250% of the adopted site criteria; and, the standard deviation of the results being less than 50% of the site criteria then the site was deemed suitable for use ■ If the statistical analysis does not satisfy the requirements of the above point then further delineation assessment and/or remediation and/or management will be required to facilitate the proposed land use <p>Statistical analysis of results was only applied for contaminants that were consistent across a single stratum (i.e. not be applied to point sources of contamination).</p>
2	Are there any issues relating to the local background area soil concentrations that exceed the adopted site criteria?	If the 95% UCL of natural soils exceeded published background criteria then the decision was yes. Otherwise, the decision was no.
3	Are there any aesthetic issues relating to the soils at the site?	If the proposed land use is commercial/industrial then this does not apply. If there are any odours, discoloration or debris in shallow or surface soils then the decision was yes. Otherwise the decision was no.
4	Are there any impacts of chemical mixtures?	Were more than one group of chemicals present above the adopted guidelines and if so did their combined presence increase the risk of harm? If there were, then the decision was yes. Otherwise, the decision was no.
5	Is there evidence of, or the potential for, migration of contaminants from the site?	Were contaminants present at concentrations above the adopted guidelines AND were the same contaminants detected in leachate or groundwater analysis. If there were, then the decision was yes. Otherwise, the decision was no.
6	Is any management or remediation required to render the site suitable for the current and / or future land use?	If the answer to any of the above questions was yes then a site management / remediation strategy will be required. Otherwise, the site can be deemed as being suitable for use in its current state.

6.1.8 Step 6 – Specify Limits on Decision Errors

6.1.8.1 Decision-maker's Tolerable Decision Error Rates Based on a Consideration of the Consequences of Making an Incorrect Decision

NSW EPA (1995) states that *“Unless a site investigator can demonstrate otherwise, the EPA maintains that all statistical interpretation should be carried out at a confidence level of no lower than 95%”*. To ensure compliance with this guideline, an overall acceptable error rate of $\leq 5\%$ was adopted for this project.

The pre-determined data quality indicators (DQIs) established for the project are discussed below in relation to precision, accuracy, representativeness, comparability and completeness (PARCC parameters) as required by Step 6 of the DQO process.

Table 10 Data Quality Objectives and Indicators

Data Quality Objective	Frequency conducted	Data Quality Indicator ²
Precision		
Intra-laboratory field duplicates	1/20 samples	<5xLOR : <100% RPD ¹ 5-10xLOR : <75% RPD or >5xLOR: M8 <30% RPD >5xLOR: Other <50% RPD
Inter-laboratory field duplicates	1/20 samples	
Laboratory duplicates (Envirolab and ALS)	1/20 samples	<5xLOR : no limit ¹ 5-10xLOR : <70% RPD or >5xLOR: M8 <30% RPD >5xLOR: Other <50% RPD
Laboratory method blanks	1/20 samples	< LOR ¹
Accuracy		
Matrix spikes refer to lab report	1/20 samples	60 to 140%
Laboratory control samples	1/20 samples	70 to 130% (inorganic) As specified by lab (organic)
Representativeness		
Sampling handling storage and transport appropriate for media and analytes	-	Yes
Rinsate blanks	1 per day per equipment	<LOR
Laboratory blanks	1 per sampling event	<LOR
Trip Spike	1 per media	70 to 130% (inorganic) As specified by lab (organic)
Samples extracted and analysed within holding times.	-	Hold Times: 14 days - organics 6 months – inorganics
Comparability		
Standard operating procedures used for sample collection and handling (including decontamination)	All Samples	Yes
Standard analytical methods used for all analyses	All Samples	Yes
Consistent field conditions, sampling staff and laboratory analysis	All Samples	Yes
Limits of reporting appropriate and consistent	All Samples	Yes
Completeness		
Soil description and COCs completed and appropriate	All Samples	Yes
Appropriate documentation for testing	All Samples	Yes
Data set to be 95% complete after validation	All Samples	Yes

¹ - If the RPD between duplicates is greater than the pre-determined data quality indicator, a judgment will be made as to whether the excess is critical in relation to the validation of the data set or unacceptable sampling error is occurring in the field.

6.1.9 Step 7 – Optimise Design

6.1.9.1 The Optimum Manner in which to Collect the Data Required to meet the Objectives for the Assessment and which will meet the Project DQOs

With consideration to NSW EPA (1995); the review of existing environmental data; and, the evaluation of operational decision rules, a resource-effective SAP and sampling methodology is outlined in the following Section.

6.2 Sampling and Analysis Plan

The rationale for the selection of the SAP is presented below:

6.2.1 Sampling Pattern

A combination of judgemental (i.e. targeted to suspected sources of contamination identified in Section 5) and systematic (i.e. to provide good site coverage) sampling was adopted as it was considered to best meet the project objectives and satisfy the requirements of NSW EPA (1995).

6.2.2 Sampling Density and Estimated Size of Residual Hotspots Remaining

Based on Table A in NSW EPA (1995), a minimum of 234 sampling points were recommended for a site comprising 21 hectares in size. Previous studies have been conducted across the site with EIS investigating 12 locations in 2011 and WSP investigating 40 locations in 2010.

Bearing this in mind, an additional 157 environmental and 25 geotechnical investigation locations remain to satisfy EPA requirement. This sampling density, when performed over an even grid spacing, ensures that potential contamination hotspots of greater than 35.6m in diameter are detected with 95% confidence. It should be noted that due to a number of constraints including topography, vegetation coverage and saturated areas, the sampling points were not able to dispersed in a constant grid pattern across the site. However, additional sampling locations were investigated to ensure that adequate site cover was achieved where possible. Sampling was also targeted towards potential areas of concern including surface rubbish and former buildings located on the site. A total of 222 borehole locations were drilled by WSP. Together with the previous investigations, this exceeds the minimum requirements in Table A.

6.2.3 Sampling Depths

WSP obtained samples from the following depths during the intrusive environmental investigation works:

- Near-surface (0.1m bgl);
- 0.5m bgl; and
- 1.5m bgl.

6.3 Sampling Methodology

6.3.1 General

A description of the sampling methods adopted for the investigation is presented below. Borehole and installation details are presented on the logs in **Appendix H**:

- Soil contamination samples were collected between 11 April and 16 May 2012 using a bobcat mounted solid flight auger or hand tools (surface samples only)

-
- Geotechnical samples were collected between 16 and 26 April 2012 using a truck mounted solid flight auger
 - Disposable nitrile gloves were replaced between samples to minimise cross contamination. Loose soil/debris was removed from the auger or hand tools between sampling locations
 - Ground conditions were described using the USCS and details of any discolouration, staining, odours or other indicators of contamination noted
 - Soil samples were placed in laboratory supplied sample containers
 - All sample containers were labelled with the sample number, name of person sampling, project number and date obtained. This information was recorded on the COC form
 - One soil sample was collected for targeted VOC analysis. This sample was immediately placed in a separate esky and kept below approximately 4 °C for transport to the laboratory
 - Near-surface samples were composited for analysis using prescribed techniques. Four primary samples were combined per composite. Depth samples were retained for delineation purposes
 - Composite samples were transported to primary and secondary laboratories in Sydney within adequate time to allow technical holding times for analysis to be achieved
 - COC forms and custody seals were attached to the Esky for delivery to the laboratory
 - Sample receipts were checked against COC carbon copies and filed

6.3.2 Field Screening

Visual and olfactory indicators were recorded during investigations and used to aid in scheduling samples for chemical analysis.

6.3.3 Field QA/QC Sampling

The methodology for obtaining QA/QC samples was conducted as follows:

6.3.3.1 Duplicate and Triplicate Samples

In accordance with AS4482.1 (2005) Guide to the Investigation and Sampling of Sites with Potentially Contaminated Soil, at least 1 in every 20 samples (5%) was duplicated and submitted for analysis. Due to compositing requirements, material from the four primary samples was conglomerated and then split to form both the composite and duplicate samples. Duplicate and Triplicate samples were used to determine intra-laboratory and inter-laboratory precision respectively.

6.3.3.2 Trip Spike and Trip Black

Laboratory prepared trip spikes and trip blanks are used to determine potential volatile degradation and cross contamination during handling and transport. Only one sample was collected for targeted VOC analysis during the investigation. This sample was collected; packed and transported individually therefore there was no potential for cross-contamination. The sample was immediately placed in an ice-filled esky and was received by the laboratory within 6 hours of sampling. Potential for loss of volatiles was therefore considered minimal.

6.3.3.3 Rinsate Blanks

Potential cross-contamination from the auger and hand tools was minimised by removing loose soil/debris between locations. Samples were also taken from soil which was not in contact with the equipment. New disposable nitrile gloves were replaced before the collection of each sample. Given the minimal risk of cross-contamination from sampling equipment, rinsate blanks were not considered necessary for this investigation.

7 Evaluation of QA/QC

7.1 Soil Results

The QA/QC results for soil are summarised in Table 14 below. Soil RPD results are provided in **Appendix E**. **Appendix G** provides laboratory reports with QAQC result details.

Table 11 Soil QA/QC Results Summary

Data Quality Objective	Sampling Frequency	Frequency Achieved?	DQI	95% DQI Met ?
<u>Precision</u>				
Intra-laboratory field duplicates	3/57 samples	Yes	<5xLOR : <100% RPD 5-10xLOR : <75% RPD or >5xLOR: M8 <30% RPD >5xLOR: Other <50% RPD	No See Table 2. Appendix E
Inter-laboratory field duplicates	3/57 samples	Yes		A number of results exceeded the RPD criteria. This is assumed to be due to sample heterogeneity. Given that all results are below the adopted site criteria, this is not expected to affect the outcome of this report.
Laboratory duplicates (Envirolab and ALS)	1/20 samples	Yes	<5xLOR : no limit 5-10xLOR : <70% RPD or >5xLOR: M8 <30% RPD >5xLOR: Other <50% RPD	Yes
Laboratory method blanks	1/20 samples	Yes	< LOR ¹	Yes
<u>Accuracy</u>				
Matrix spikes	1/20 samples	Yes	60 to 140%	Yes
Laboratory control samples	1/20 samples	Yes	70 to 130% (inorganic) As specified by lab (organic)	Yes
<u>Representativeness</u>				
Sampling handling storage and transport appropriate for media and analytes	Yes	Yes	Yes	Yes
Rinsate blanks	-	-	<LOR	-
Laboratory blanks	-	-	<LOR	-
Trip Spike	-	-	70 to 130% (inorganic) As specified by lab (organic)	-
Samples extracted and analysed within holding times.	Yes		Hold Times: 14 days - organics 6 months – inorganics	Yes

Data Quality Objective	Sampling Frequency	Frequency Achieved?	DQI	95% DQI Met ?
<u>Comparability</u>				
Standard operating procedures used for sample collection and handling (including decontamination)	Yes		Yes	Yes
Standard analytical methods used for all analyses	Yes		Yes	Yes
Consistent field conditions, sampling staff and laboratory analysis	Yes		Yes	Yes
Limits of reporting appropriate and consistent	Yes		Yes	Yes
<u>Completeness</u>				
Soil description and COCs completed and appropriate	Yes		Yes	Yes
Appropriate documentation for testing	Yes		Yes	Yes
Data set to be 95% complete after validation	Yes		Yes	Yes

8 Results

8.1 Previous Results

8.1.1 Lot 10 DP879209

Between November 2005 and February 2006, one above ground storage tank, eight USTs, fuel pumps and associated line work were removed from Lot 10, DP879209. Extract 1, **Appendix B** shows the former tank locations.

Contaminated soil excavated from the former tankpits and infrastructure locations was landfarmed in the south western corner of Lot 10, DP879209 (See Extract 2, **Appendix B**). Soil results from the landfarm indicated that TPH(C₁₀-C₃₆) exceeded the site criteria on 9 May 2006.

The remaining soil surrounding the AST and main tankpit, was validated by RES to the NSW EPA (1994) and NEPM (1999) guidelines for open space landuse.

Soil in the vicinity of the linework and tankpits 2 and 3 had concentrations of TPH(C₁₀-C₃₆) which exceeded the NSW EPA(1994) guidelines for Sensitive / Open Space landuse at depth and was left in situ.

Soil in the landfarm was regularly tilled over a period of approximately six months to allow for the degradation of organic compounds. In December 2006, it was concluded that TPH soil results from the landfarm area were below the NSW EPA (1994) guidelines and hence the soil was suitable to remain onsite.

In 2009, three more USTs along with associated linework and dispensers were removed from Lot 10 DP879209. The excavation, stockpiled excavated material and additional ENM were validated as being suitable for commercial/industrial landuse. The excavation was backfilled with the excavated material and the additional ENM (Extract 3, **Appendix B**).

An intrusive environmental site investigation was conducted in 2009 and 2010. The works involved both soil and groundwater assessment. Works concluded the following:

- Shallow TPH soil impact was identified in the main shed area (BH23 and BH24). TPH impacted soils were also identified in MW03 and MW06 to depths of 4.0m bgl. These impacts were not delineated however approximate impact areas are shown in Extract 4, **Appendix B**.
- Groundwater across the site was determined to flow in a south easterly direction and was measured between 6.27 and 17.52m bgl. Groundwater was very saline and of low yield.
- Concentrations of heavy metals arsenic, nickel, cadmium, copper and zinc exceeded the ANSECC 2000 guidelines in the majority of wells. These concentrations were considered to be representative of background concentrations.
- PSH was identified at the southern boundary of the site and in the adjoining property Lot 100 DP 879680 (MW01 and MW07). The extent of the PSH plume was estimated in Extract 5, **Appendix B** however was not delineated.

8.1.2 The Site (excluding Lot 10 DP 879209)

A preliminary site assessment was undertaken across the entire site (with the exception of Lot 10 DP 879209) in 2011. Soil sampling was conducted at twelve locations with no analytes detected above the NEPM HIL F and EPA (1994) Service Station guidelines.

A Preliminary Geotechnical Investigation was undertaken utilising the EIS soil bores. Soil bores were advanced to a maximum depth of 6m bgl. Groundwater was not encountered during drilling works. The soil stratum was identified as silty clay topsoil to 0.5m bgl underlain by high plasticity residual silty clays. Weathered shale bedrock was identified in all locations with the exception of BH5 which was underlain by sandstone. The bedrock improved in quality with depth.

Comments were made regarding excavation conditions, site preparation, temporary and permanent batters, permanent retention, footings, on-grade floor slabs, external pavements and drainage. A detailed geotechnical investigation was recommended upon finalisation of design details for the site.

8.2 Field Observations

The site perimeter was fenced on all sides with two access gates along Horsley Drive and one access gate on Cowpasture Road. A paved bicycle path bordered the western boundary beyond which was another fence and the Sydney Water Supply Canal.

Topographic site features indicated that the highest point coincided roughly with the centre of the site with surrounding land sloping down in all directions. Two dams were located in north western portion of site however were inaccessible due to thick vegetation coverage (blackberry bushes) and saturated ground. A gully feature appeared to run from centre of western boundary through both dams to the north eastern corner of the site.

The remaining site area consisted of undulating terrain covered with thick grasses with patches of dense vegetation (primarily blackberry bushes and aniseed weed). The site did not appear to have been slashed during the preceding months with the exception of the two remaining residences. No distressed vegetation was identified.

Two residential properties were present on the site. Details of each property are as follows:

- Lot 10 DP 879209 fronts Cowpasture Road and is located in the centre of the eastern boundary. The property consisted of an asphalt/gravel driveway, single story brick residence with attached car port, two sheds (approximately 150m² and 25m²) and shipping container used for equipment storage. The residence appeared in good external condition with the sheds and shipping container in poor condition. The rear of the property was open paddock with an oval dirt track. The paddock was covered with thick grasses and weeds.
- Lot 30B DP 13961 fronts Horsley Drive and is located in the centre of the southern boundary. The property had an asphalt/gravel driveway, single storey brick residence and one shed to rear of the lot (approximately 100m²). The residence appeared in good external condition. A septic overflow was noted in adjacent lot to the west.

Anthropogenic rubbish was observed on the surface of the site and included scrap metal, rusted car bodies, plastic, styrofoam, metal and plastic irrigation pipes on surface, glass, concrete and 200L drums (metal and plastic). A number of metal 200L drums were labelled Methyl Chloride and were empty at the time of investigations. Three metal sheds containing car tyres and abandoned toilet/shower were located in the south east portion of site.

A total of 221 locations were investigated as shown in Figures 3a and 3b, **Appendix A**. These figures also indicate the locations of previous investigations across the site. Locations were chosen to achieve adequate site coverage where possible, target former building locations and to target potential surface contamination.

Surface staining could not be identified due to thick vegetation coverage. No odours or staining were noted in any of the soil bores. Minor charcoal inclusions were identified in three locations (BH17, BH24 and BH132) at depths of 0.3 – 0.6m bgl. The charcoal was localised and appeared to originate from fire pits or bonfire remnants.

Borehole investigations identified the following soil strata:

- Dark brown, silty clay topsoil generally to 0.4m bgl. At the time of sampling, topsoil was generally moist, and soft with root inclusions.
- Topsoil was underlain by silty clay which varied in colour from mottled orange, red and grey to light brown.
- Weathered shale, was encountered on slopes and higher formations at minimum depths of 0.6m bgl. The weathered shale was generally dry and light brown to orange.

8.3 Soil Analytical Results

Laboratory results for soil samples obtained by WSP are presented in Table 1, **Appendix E**.

Analysis for COPC indicate that concentrations of metals, OCP, OPP and methyl chloride fall below the adopted HIL F site criteria detailed in Section 6.

9 Geotechnical Results

Geotechnical Investigations conducted by Damien Hart from HartGeo on behalf of Auswide Geotechnical.

This site is typical of a large area of the South-Western suburbs of Sydney, much of which has been converted to residential communities with associated commercial and recreational infrastructure. The geotechnical report is a snapshot of the delineated area, and this like other similar sized areas (anywhere), from a Geotechnical point of view has dominating issues, which need to be addressed as the project moves forward.

The issues on this site are different from a lot of other projects as the proposal includes a significant site cut and deep filling which at present consists of a maximum cut of 12 metres and a fill depth of almost 12 metres.

The major issues on this site are;

- Protecting the existing infrastructure on the northern and western boundaries in both the short term and long term;
- The excavation of the rock, where the site cut exceeds 6 metres in depth; and
- Quantifying the long term performance of the deep fill proposed.

Comments and recommendations were made regarding excavation, earthworks and compaction, erosion and soil management, footing types, filled ground, temporary batters, retaining structures, road construction, removal of existing structures and further geotechnical investigations. The full Geotechnical Report is included in **Appendix F**.

10 Site Characterisation

10.1 Assessment of Soil Concentrations

- **Do the soils at the site exceed the adopted HIL F or EPA 1999 Service Station guideline criteria?**

No - for this investigation

Yes - for TPH at Lot 1 DP 879209 and Lot 100 DP 879680 in previous investigations

10.2 Assessment of Background Soil and Groundwater Concentrations

- **Are there any issues relating to the local background area soil and groundwater concentrations that exceed the adopted site criteria?**

No

10.3 Assessment of Aesthetic Issues

- **Are there any aesthetic issues relating to the soils at the site?**

Surface rubbish

Septic overflow

10.4 Assessment of Contaminant Migration

- **Is there evidence of, or the potential for, migration of contaminants from the site?**

Potential for PSH plume to migrate south east from Lot 1 DP 879209 and adjoining allotment (Lot 100 DP 879680)

10.5 Requirement for Site Management / Remediation Strategy

- **Is any management or remediation required to render the site suitable for the current and / or future land use?**

Yes – removal of surface rubbish

Yes – TPH delineation of plume present on Lot 1 DP879209 and Lot 100 DP 879680 and possible remediation of groundwater

Yes – TPH remediation in shallow soils on Lot 1 DP 879209

11 Conclusions

Based on the works described in this report, WSP makes the following conclusions regarding the site in relation to soil and groundwater contamination:

- TPH impacted soil exists on Lot 10 DP 879209;
- Groundwater at the boundary of Lot 10 DP 879209 and Lot 100 DP 879680 is impacted with TPH. PSH was identified in two wells;
- Concentrations of heavy metals arsenic, nickel, cadmium, copper and zinc exceeded the ANZECC 2000 guidelines in the majority of wells. These concentrations were considered to be representative of background concentrations; and,
- All other results fall below the adopted site criteria.

Details of geotechnical investigations can be found in the full report found in **Appendix F**.

WSP has prepared a Remediation Action Plan for the site which will detail proposed methodologies for works required to make the areas impacted suitable for unrestricted commercial/industrial land use. The RAP will outline the remediation strategy, methodology and proposed validation works recommended for the site.

12 Limitations

The findings of this report are based on the scope of work outlined in Section 1.4. WSP performed the services in a manner consistent with the normal level of care and expertise exercised by members of the environmental assessment profession. No warranties, express or implied, are made.

Subject to the scope of work, WSP's assessment was limited strictly to identifying typical environmental conditions associated with the subject property area and does not include evaluation of any other issues. This report does not comment on any regulatory obligations based on the findings. This report relates only to the objectives stated and does not relate to any other work undertaken for the Client. It is a report based on the conditions and concentrations observed in soil, water and air at the time of the sample collection. These conditions may change with time and space.

The absence of any identified hazardous or toxic materials on the subject property should not be interpreted as a guarantee that such materials do not exist on the site.

All conclusions regarding the property area are the professional opinions of the WSP personnel involved with the project, subject to the qualifications made above. While normal assessments of data reliability have been made, WSP assumes no responsibility or liability for errors in any data obtained from regulatory agencies, statements from sources outside of WSP, or developments resulting from situations outside the scope of this project.

WSP is not engaged in environmental assessment and reporting for the purpose of advertising sales promoting, or endorsement of any Client interests, including raising investment capital, recommending investment decisions, or other publicity purposes.

The Client acknowledges that this report is for their exclusive use. Other parties may only gain reliance on this report following receipt of written approval from WSP.

13 References

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Appendix A – Figures

- Figure 1 Site Location
- Figure 2 Site Features
- Figure 3a Investigation Locations – Northern Portion
- Figure 3b Investigation Locations – Southern Portion

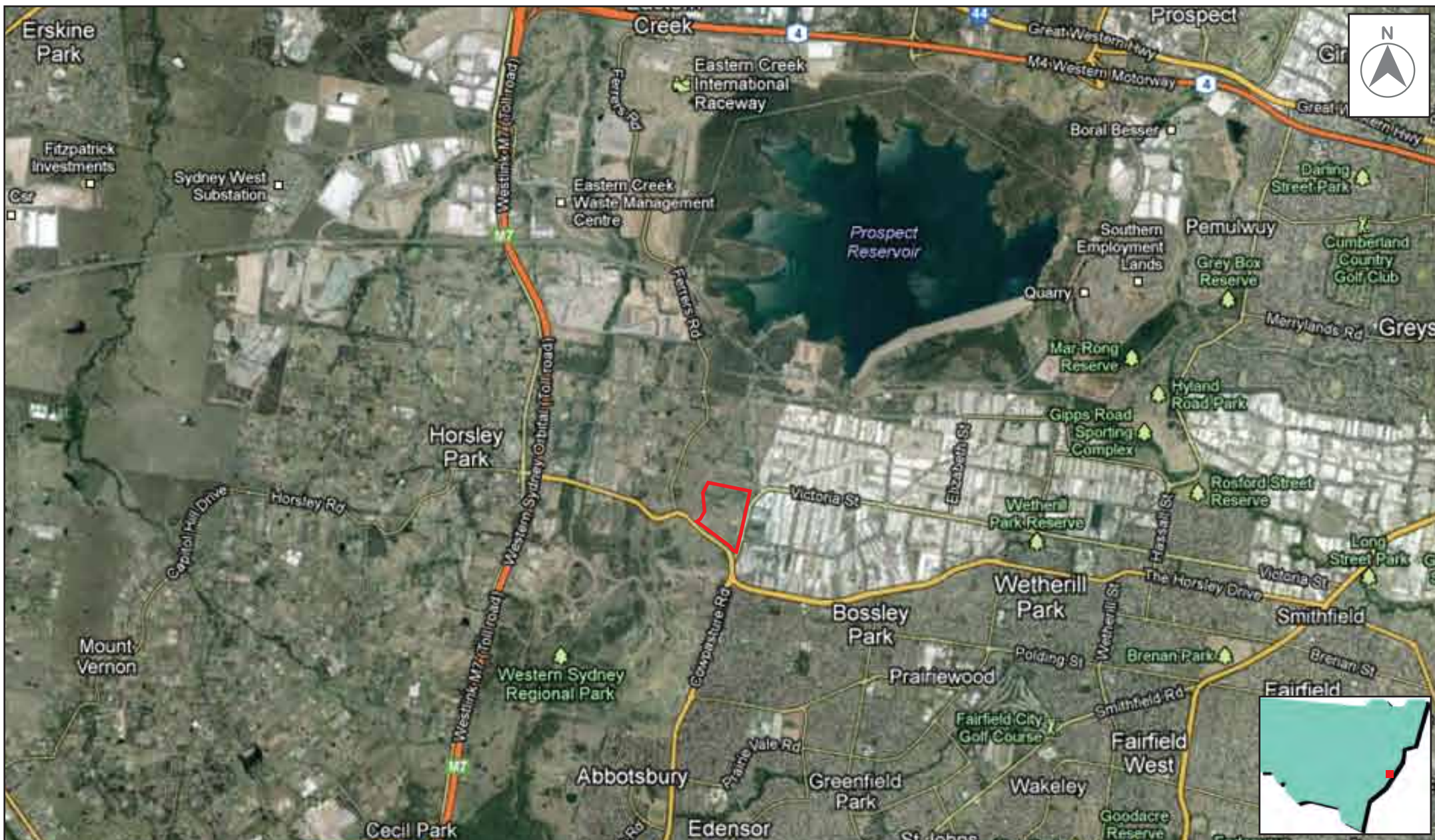
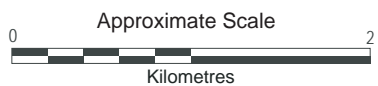


Image Courtesy of Google Maps (2012)

 Site Boundary



Site Location

Phase 2 Investigation, Cnr Horsley Drive and Cowpasture Road, Wetherill Park NSW

00030337

FIGURE 1



Image Courtesy of NearMap (Aerial Photograph 5 February 2012)

- Site Boundary
- Inaccessible During Initial Investigations
- Former Building Location
- Abandoned Shed

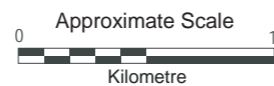
Site Features
 Phase 2 Investigation, Cnr Horsley Drive and Cowpasture Road, Wetherill Park NSW
 00030337
 FIGURE 2





Image Courtesy of Google Earth (2012)

- Site Boundary
- BH01 WSP 2012 Soil Bore Location
- GBH01 Geotechnical 2012 Soil Bore Location
- BH1 EIS 2011 Soil Bore Location
- BH1 WSP 2010 Soil Bore Location



Site Layout - Northern Portion

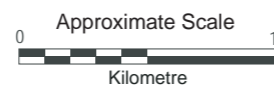
Phase 2 Investigation, Cnr Horsley Drive and Cowpasture Road, Wetherill Park NSW
00030337
FIGURE 3a





Image Courtesy of Google Earth (2012)

- Site Boundary
- BH01 WSP 2012 Soil Bore Location
- GBH01 Geotechnical 2012 Soil Bore Location
- BH1 EIS 2011 Soil Bore Location
- BH1 WSP 2010 Soil Bore Location
- MW01 WSP 2010 Groundwater Well Location



Site Layout - Southern Portion

Phase 2 Investigation, Cnr Horsley Drive and Cowpasture Road, Wetherill Park NSW
 00030337
 FIGURE 3b







Appendix B – Previous Report Extracts

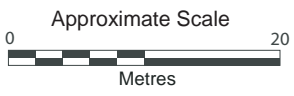
- Extract 1 Former Tank Locations – Tank Removal Works (2009)
- Extract 2 RES Investigation Areas – Tank Removal Status Report (2006)
- Extract 3 2009 Tank Pull Validation Locations – Tank Removal Works (2009)
- Extract 4 Identified Soil Impact Areas – Phase 2 Draft ESA & Additional Investigation (2010)
- Extract 5 PSH Plume Location – Phase 2 Draft ESA & Additional Investigation (2010)



Photo Courtesy of Nearmap (2010)

KEY

-  Site Boundary
-  Underground Storage Tank
-  Above Ground Storage Tank
- *AMMENDMENT**
-  Additional Underground Storage Tank

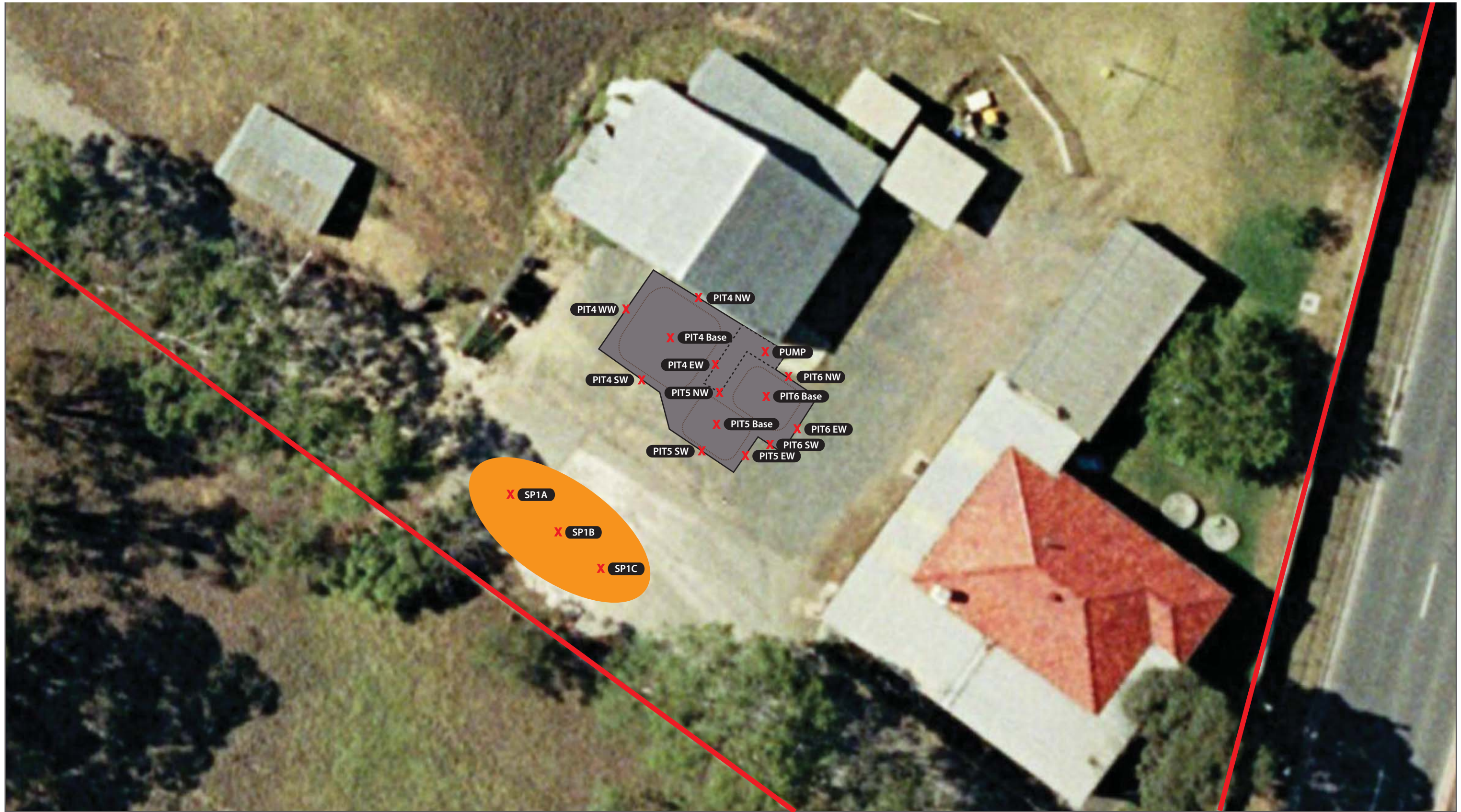


Former Tank Locations
Menolotto, Cowpasture Road, Horsley Park, NSW
FIGURE 1





Landfarming Area
Tank Removal, 27 Cowpasture Road, Horsley Park
FIGURE 3



- KEY**
- Tank Pit
 - Stockpile
 - Site Boundary
 - X PIT5 EW Sample Location

10m



Tank Pit Validation Sample Locations




1-09-039 - Tank Pull - 27 Cowpasture Road, Horsley Park, NSW



FIGURE 2





KEY

-  Site Boundary
-  MW04 Monitoring Well Location
-  BH29 New Borehole Location (Nov 09)

-  Assumed Shallow Contamination
-  Assumed Deep Contamination

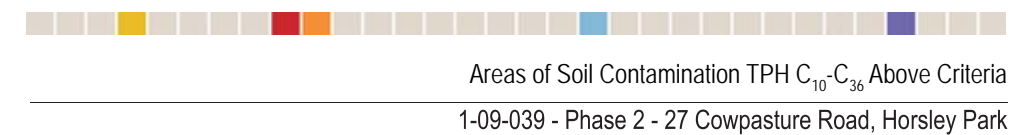
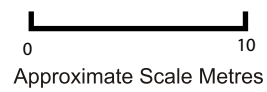







FIGURE 1

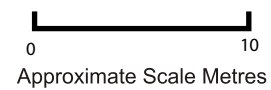




KEY

-  Site Boundary
-  MW04 Monitoring Well Location
-  BH29 New Borehole Location (Nov 09)

-  Estimated Extent of PSH Plume
-  Areas of Uncertainty



Estimated Extent of PSH Plume

1-09-039 - Phase 2 - 27 Cowpasture Road, Horsley Park

FIGURE 5



Appendix C – Historical Aerial Photographs



Approximate Site Boundary

Aerial Photograph - 1930

Phase 2 Investigation, Cnr Horsley Drive and Cowpasture Road, Wetherill Park NSW
00030337



Approximate Site Boundary

Aerial Photograph - 1947

Phase 2 Investigation, Cnr Horsley Drive and Cowpasture Road, Wetherill Park NSW
00030337



Approximate Site Boundary

Aerial Photograph - 1961

Phase 2 Investigation, Cnr Horsley Drive and Cowpasture Road, Wetherill Park NSW
00030337



Approximate Site Boundary

Aerial Photograph - 1978

Phase 2 Investigation, Cnr Horsley Drive and Cowpasture Road, Wetherill Park NSW
00030337



Approximate Site Boundary

Aerial Photograph - 1986

Phase 2 Investigation, Cnr Horsley Drive and Cowpasture Road, Wetherill Park NSW
00030337



Approximate Site Boundary

Aerial Photograph - 2008

Phase 2 Investigation, Cnr Horsley Drive and Cowpasture Road, Wetherill Park NSW
00030337