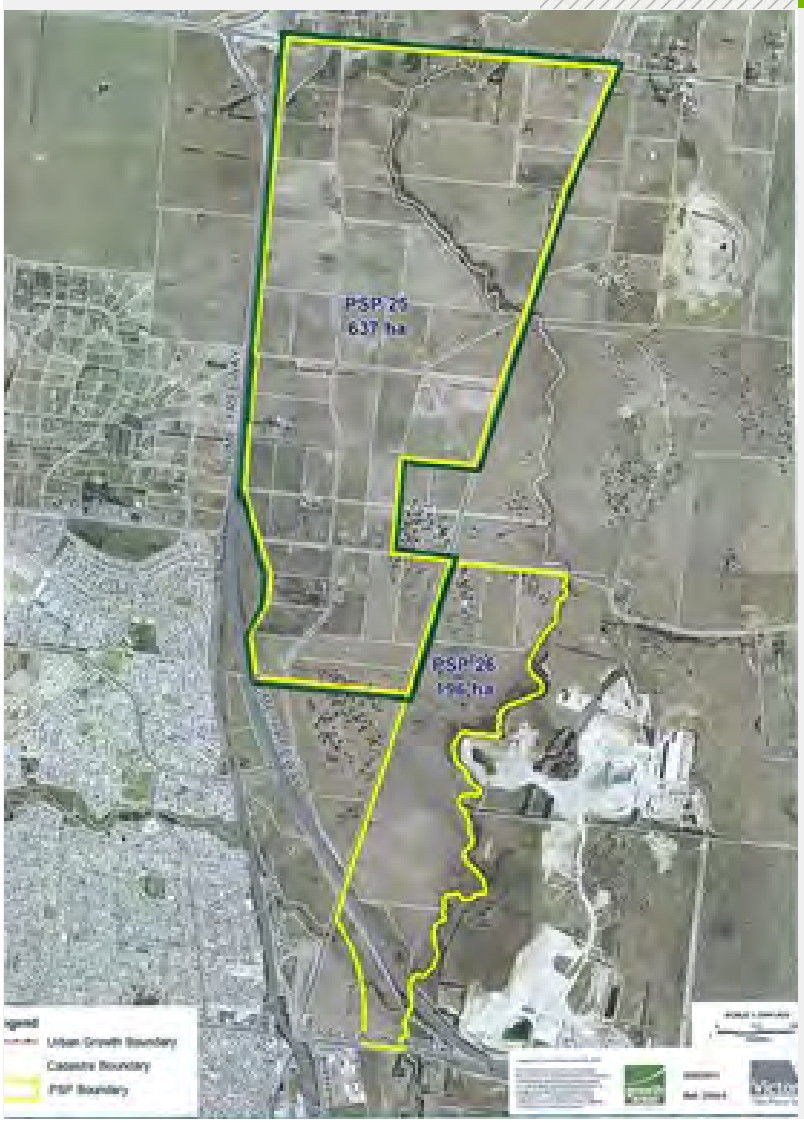

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Precinct Structure Plan Area 25 Growth Areas Authority

Desktop Environmental, Hydrological and Geotechnical Study

Reference: 230243-001

Prepared for: Growth Areas Authority

Revision: 2

13 September 2012

growth areas AUTHORITY

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Document Control Record

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Document control						aurecon
Report Title		Desktop Environmental, Hydrological and Geotechnical Study				
Document ID		20120912 PSP25 Desktop 230243.docx	**Project Number**		230243-001-01	
File Path		N:\Temp\Greg.BECK\Documents\Projects\230243 GAA PSP 25 and 26\PSP25\20120912 PSP25 Desktop 230243.docx				
Client		Growth Areas Authority	**Client Contact**			
Rev	**Date**	**Revision Details/Status**	**Prepared by**	**Author**	**Verifier**	**Approver**
0	20 July 2012	Draft to client for review	MC	MC	RK	JM
1	24 July 2012	Revised Draft to client for review	JM	JM		JM
2	14 September 2012	Revised final issued to client	MC	MC		JM
Current Revision		**Revision 2**				

Approval			
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Appendices

Glossary of terms

AEC	Area of Environmental Concern
ANZECC	Australian and New Zealand Environment and Conservation Council
bgl	Below Ground Level
BTEX	Benzene, Toluene, Ethylbenzene, and Xylenes
DSE	Department of Sustainability and Environment
EPA	Environment Protection Authority
GAA	Growth Areas Authority
GIS	Geographic Information System
Ha	hectares
IWRG	Industrial Waste Resource Guidelines
km	kilometres
MSL	Mean Sea Level
NEPM	National Environment Protection Measure
NHMRC	National Health and Medical Research Council
PAH	Polycyclic Aromatic Hydrocarbons
PSP	Precinct Structure Plan
SEPP	State Environmental Planning Policy
TPH	Total Petroleum Hydrocarbons
UFZ	Urban Floodway Zone

Executive summary

Background

The Growth Areas Authority (GAA) is preparing a Precinct Structure Plan (PSP) for Area 25, comprised of approximately 637 hectares (ha) of land on 54 separate properties located east of the Hume Freeway near Craigieburn, Kalkallo and Donnybrook, in the Hume City and City of Whittlesea local government areas, Victoria, Australia. Limited information regarding future land uses within PSP Area 25 was provided by GAA for the purposes of this assessment. This assessment will inform the design of the urban structure of PSP 25 in terms of suitability of nominated land uses. Historical research, document review and site assessment activities were conducted during the weeks of 29 June and 20 July 2012.

Scope of work

The scope of works called for:

- A desktop review to determine previous land uses and implications for environmental contamination, hydrology and geology.
- A desktop review of soil, geological and hydrogeological conditions on the site.
- Review of Wetlands databases and sites of National Environmental Significance.
- Performance of a site inspection limited to publicly accessible areas of the site.

Site contamination

In general, the following past or present site activities, with the potential to cause soil or groundwater contamination, were identified in proximity to the PSP 25 Area:

- An apparent out of production market garden on parcel 502095 (810 Summerhill Road).
- Farm equipment and abandoned automobiles stored on a number of site properties (eg 780 Donnybrook Road, 295 Brookville Drive and 220 Brookville Drive).
- Large scale intensive farming operations where fertilisers, pesticides, and herbicides may have been used (eg 30 Amaroo Road, 185 and 295 Brookville Drive).
- Small scale intensive farming operations where fertilisers, pesticides, and herbicides may have been used (eg 800 Donnybrook Road, 245 and 275 Brookville Drive, 770, 790, 835 and 840 Summerhill Road).
- Areas where abandoned vehicles, farm equipment, debris or dumping of unspecified materials have occurred (eg 720 Donnybrook Road, 30 Amaroo Road, 220 and 295 Brookville Drive, 920/920A Hume Highway and 60 Kinloch Court).
- Structures that may contain asbestos and have lead based paint and septic systems.
- A large truck stop service station, constructed between 2006 and 2010, is located on the southwest corner of the interchange of Hume Freeway and Donnybrook Road.
- Potential transport of contamination from off-site sources hydraulically upgradient of the Area onto the site via Merri Creek or Kalkallo Creek.

Recommendations for assessment of individual site properties based on use and potential for contamination are summarized in the report. Recommendations are made in accordance with the Victoria DSE *Potentially Contaminated Land, General Practice Note, 2005* (DSE, 2005). Where land has been identified as potentially contaminated, a further investigation is necessary as part of the next stage of the planning process such as planning permit application or planning scheme amendment on a property by property basis (DSE, 2005).

Of the fifty-four (54) site properties, further assessment is recommended for twenty-two (22) properties, with recommendations for environmental audits on four additional properties. In general, recommendations for assessment were made based on sensitive land use, such as large-scale intensive agriculture. The presence of significant (more than 0.5 ha) small-scale agriculture, abandoned vehicles, farm equipment or unidentified debris was considered secondary indicators of the need for assessment in the case of sensitive land use. Environmental audits were recommended for the former market garden at 810 Summerhill Road and properties used for large-scale intensive agriculture at 30 Amaroo Road, 185 Brookville Drive and 295 Brookville Drive, each of which was considered at high potential for contamination based on past and present land use. Due to the limited nature of the site inspection, additional site properties may be recommended for assessment in the future based on receipt of additional information not available at the time of this assessment.

Intrusive sampling and analysis should be undertaken in accordance with *National Environment Protection (Assessment of Site Contamination) Measure* (1999 NEPM) and draft 2011 NEPM, Australian Standard (2005) *Guide to the investigation and sampling of sites with potentially contaminated soil Part 1: Non-volatile and semi-volatile compounds* (AS 4482.1-2005), Australian Standard (1999) *Guide to the sampling and investigation of potentially contaminated soil Part 2: Volatile substances* (AS 4482.2-1999) and Victoria Environment Protection Authority*, Industrial Waste Resource Guidelines* (IWRG) Soil Sampling, 2009. The results of the sampling and analysis would be compared with guideline values for protection of human health and the environment as well as waste disposal criteria (as applicable).

In addition, hazardous materials surveys should be carried out for structures identified for demolition or relocation. The surveys should address asbestos, lead-based paint, polychlorinated biphenyls in electrical fixtures, and hazardous materials storage. Should asbestos containing material be encountered during future investigations or construction, the testing, inspection and removal of asbestos materials are required by law to be undertaken by a suitably qualified and licensed asbestos specialist/removalist.

Geotechnical

Limited geotechnical data are available for the site. The geology of PSP Area 25 is predominantly Pleistocene and Miocene basalts with minor scoria and ash belonging to the Newer Volcanic Group, overlain by Holocene quaternary alluvial deposits of gravel, sand and silt concentrated along existing creek courses. The site is predominantly overlain by sodosol-type soils which are found to vary in texture and depth though generally comprises clay and sand loam. Sodosols have a high clay content and high sodium which sometimes leads to dispersion and instability. Localised fill or natural reworked material deposits are likely to be present on site, especially around areas of recent development, however further investigation will be required to identify and delineate these occurrences.

In general, PSP Area 25 is gently undulating and soil cover is expected to be relatively thin. As such the risk of geotechnical hazards are considered low to moderate though a thorough understanding of the geological model will be required prior to development. The key geotechnical constraints that may affect the development of PSP Area 25 are:

- Differential settlement of overlying residual clay in localised areas of extremely weathered basalt. Alluvial clay and silt deposits and localised un-engineered fill material may result in settlement of proposed road formations and structures. The alluvial sediments tend to be concentrated along existing creek courses, such as Merri Creek and Kalkallo Creek on PSP Area 25.
- Shallow soil failure (soil creep, slumping, collapse) in areas of increased gradient. Although PSP Area 25 is of a relatively gentle gradient, steeper slopes are noted in close proximity to surface water bodies such as Merri Creek. Weathered alluvial or residual material can be susceptible to shallow soil failure (soil creep, slumping and collapse) in areas of increased gradient.
- The presence of voids in scoria could result in the loss of stability or localised collapse hazard.
- Low bearing capacity within soft clay material or unconsolidated alluvial material can result in a loss of stability or potential collapse of structures during the construction phase of the development. The presence of soft material encountered at depth may result in a bearing capacity or settlement hazard for any proposed foundations.
- Clay likely to be derived from basalt rock is likely to be subject to considerable shrinkage or swelling in response to change in moisture content. Highly expansive clay can cause unexpected ground movements that are able to damage to building foundations, structures and road infrastructure. The published soils map indicates that the Area is predominantly overlain by sodosol-type soils which are found to vary in texture and depth though generally comprise clay and sand loam. Sodosols have a high clay content and high sodium which sometimes leads to dispersion and instability.
- Ephemeral creeks, primarily draining into Merri Creek, could serve as drainage channels during flood events, resulting in erosion of soft sediment and bedrock. Similar conditions could develop within the main channels of Merri Creek and Kalkallo Creek on PSP Area 25.
- The presence of zones of deeper residual soils or swamp conditions may affect footing design and performance.

It is recommended that further geotechnical assessment be undertaken across the site to aid the detailed design process for future construction in the PSP area on a project by project basis (ie road works and services on a PSP level or at the property development level for residences etc.). The purpose of the geotechnical assessment will be to undertake intrusive investigation to obtain information for the purposes of:

- Determining a better understanding of the sub-surface geological profile and hydrogeological conditions to develop an accurate geological model.
- Develop baseline geotechnical parameters to aid design, settlement and slope stability modelling (where required).
- Determine depth to rock head and degree of weathering within the upper layers of the bedrock.
- Determine the nature of factures and jointing within the underlying volcanic material.
- Determine the presence of voids within the underlying basalt material.

Hydrology and wetlands

Two semi-ephemeral creeks, Merri Creek and Kalkallo Creek. are located on the northern half of the site. An unnamed semi-ephemeral creek is located in the northwest corner of the property and drains into Kalkallo Creek. Occasional small ponds are located along each of these creeks. The site is within the 396 square kilometres (km^2) Merri Creek catchment, a major tributary of the Yarra River Basin. The creeks are fed from catchments in the north, flowing to the south where the Merri Creek eventually joins the Yarra River. No water level data for Merri Creek was available from Melbourne Water.

There is an Urban Floodway Zone (UFZ) at a minimum of 100 m either side of Merri Creek and Kalkallo Creek. This area has been identified as having a greater risk of flooding. A permit is required to carry out works in this area and must be consistent with the local Floodplain Development Plan.

No groundwater level information was available for the boreholes located on the site. The closest borehole to the site for which groundwater level data was available was borehole B68888, located approximately 665 m south of site southern boundary, at 95-135 Amaroo Road. This borehole showed a groundwater depth on 1 April 2009 of 15.71 m below ground level (bgl). Aerial photographs show exposed groundwater in numerous irrigation ponds on the Area. Although depth to groundwater is difficult to assess in the aerial photographs, this is believed to be indicative of a depth to groundwater of less than 5 m on the site. This ground water is not believed to represent a perched water table.

Groundwater beneath the site is present in two main aquifers, the upper Newer Volcanics aquifer, a fractured rock basalt aquifer, and a deeper regional aquifer within the Silurian aged formation. The *Victorian Water Resources Data Warehouse* and *GeoVic* GIS tools identified 30 registered boreholes within 1 km of the site. Borehole usage was primarily domestic and agricultural water supply with a small number of extractive industries boreholes.

No nationally important wetlands, wetland sites of National Environmental Significance or sites of state significance were identified within the PSP area.

The following recommendations are made regarding hydrology and wetlands:

- UFZs should remain free of any significant development as they are at risk of flooding.
- Flood modelling should be undertaken to determine hydrologic effects that any new developments will have on the existing creek system, in particular existing culvert and bridge flow capacities.
- Waterways, including Merri Creek and Kalkallo Creek and associated low-lying areas will require feature surveys to provide detail of drainage patterns and inform planning for urban drainage systems.
- Drainage paths will need to be either maintained or diverted to ensure all areas are well drained during and after any development.

1. Introduction and objectives

1.1 Background

The Growth Areas Authority (GAA) is preparing a Precinct Structure Plan (PSP) for Area 25, comprised of approximately 637 hectares (ha) of land on 54 separate properties located east of the Hume Freeway near Craigieburn, Kalkallo and Donnybrook, in the Hume City and City of Whittlesea local government areas, Victoria, Australia. This assessment will inform the design of the urban structure of PSP 25 in terms of suitability of nominated land uses. Historical research, document review and site assessment activities were conducted during the weeks of 29 June and 20 July 2012.

1.2 Objectives

The overall objective of this desktop environmental, hydrological and geotechnical study is to identify the potential for ground contamination within the study area and the nature of likely contaminants to be encountered during detailed design and construction.

The key objectives of this assessment were to conduct a desktop study and site inspection to:

- Confirm suitability of properties for sensitive uses and provide advice regarding what level of further assessment would be required to determine suitability of properties for sensitive uses in accordance with the Potentially Contaminated Land General Practice Note 2005 (eg. Environmental Audit, Site Assessment).
- Identify data gaps and outline future testing requirements and the need for more detailed investigations (if required).
- Provide a plan of the study area clearly showing which properties were included in the desktop study and which properties have low, medium and high risk of contamination.
- Prepare a report of findings that will be used to inform the design of precinct structure plans for the study area (in terms of suitability of land uses nominated for each location/area) and to identify key issues that should be addressed during the detailed design phase and construction.

1.3 Scope of work

1.3.1 Desktop review

A desktop review was conducted to evaluate current and previous land uses and to assess the implications for environmental contamination, hydrology and geology. The desktop review included:

- Assessment of historical aerial photography for the precinct and surrounding areas.
- Consultation with relevant agencies as required, including:
    - EPA for review of records including the 'Priority Sites Registry' (EPA Victoria, 2012a) and the list of issued '*Certificates and Statements of Environmental Audit*' (EPA Victoria 2012b).
    - Department of Sustainability and Environment, Port Phillip & Westernport Catchment Management Authority, Southern Rural water, City West Water and Melbourne Water for hydrographs, groundwater and drainage information and other relevant data.
- Soil, geology and hydrogeology conditions desktop review, including survey, mapping and other base data as available from relevant authority and agency data sets and maps. This is aimed at identifying potential shortcomings in data coverage.
- Review and summary of any previous reports or studies regarding environmental, geological or groundwater conditions, in or within the vicinity of the study area.

- Compilation of known groundwater borehole/well locations and testing results.
- Groundwater well databases.
- Review of Wetlands databases and sites of National Environmental Significance.
- Review of Australian Heritage Databases.
- Obtainment and analysis of current titles for all properties in the study area.
- Historical title search of any properties where further historical land use information is needed to establish potential for contamination.
- Review of Victoria Department of Primary Industries online GIS system, GeoVic.

1.3.2 Site inspection

Aurecon performed a site inspection of the study area, evaluating properties from existing roadways and publicly accessible areas. At the Client's request, no on-site inspection of properties within PSP Area 25 was performed. The site inspection was conducted once the desktop review had been completed and was used to focus on-site observations.

1.3.3 Reporting

Based on the findings of this desktop assessment, Aurecon prepared this report including the following:

- Summary of findings and recommendations of the desktop review and site inspection for each discipline area (environmental, hydrology and geotechnical assessment).
- Issues summary and resultant recommendations for management and/or remediation in terms of environmental contamination, geology/geotechnical and hydrology/groundwater.
- Outline of any future testing requirements and the need for more detailed investigations if recommended.
- Evaluation (to the extent practicable within limitations) of the suitability of properties for sensitive uses and what level of further assessment would be required to determine suitability of properties for sensitive uses in accordance with the *Potentially Contaminated Land General Practice Note 2005* (eg Environmental Audit, Site Assessment).
- A plan of the study area clearly showing which properties were included in the desktop study and which properties have low, medium and high potential for contamination.
- Clear and concise drawings/maps, to illustrate existing conditions and support report as required.

It should be noted that this report is a limited desktop assessment of the site and no sampling was performed for this assessment.

1.4 Legislative requirements and relevant assessment guidelines

The scope of work for this desktop environmental, hydrological and geotechnical assessment of the site has been performed in general accordance with requirements outlined in the following documents:

- Victoria Environmental Protection Act 1970
- State Environment Protection Policy (SEPP), *Groundwaters of Victoria*, December 1997, No. S160.
- SEPP, *Prevention and Management of Contaminated Land*, June 2002, No. S95.
- SEPP, *Waters of Victoria*, October 2004, No. S210.
- EPA Victoria 2009a. *Industrial Waste Resource Guidelines - Sampling and Analysis of Waters, Wastewaters, Soils and Wastes, June 2009, IWRG701.*

- EPA Victoria 2009b, *Industrial Waste Resource Guidelines - Soil Sampling, June 2009, IWRG702.*
- *Australian and New Zealand Guideline for the Assessment and Management of Contaminated Sites,* published by Australian and New Zealand Environment and Conservation Council (ANZECC) and the National Health and Medical Research Council (NHMRC), January 1992.
- *Guide to the investigation and sampling of sites with potentially contaminated soil, Part 1: Non-volatile and semi-volatile compounds*, AS 4482.1-2005, Standards Australia.
- *Guide to the sampling and investigation of potentially contaminated soil, Part 2: Volatile substances*, AS 4482.2-1999, Standards Australia.
- National Environment Protection (Assessment of Site Contamination) Measure, 1999.
- National Environment Protection (Assessment of Site Contamination) Measure, draft 2011.
- Environmental Protection Authority, *A Guide to the Sampling and Analysis of Waters, Wastewaters, Soils and Wastes*, March 2000, Publication 441.
- Native Vegetation Management Framework 2002.
- Wildlife Act 1975.

1.5 Limitations

Aurecon Australia Pty Ltd (ABN 54 005 139 873) has prepared this report (the "Report") for the exclusive use of GAA (the "Client"), regulatory authorities, auditors and others approved by the Client for the purpose of desktop environmental, hydrological, and geotechnical study for PSP Area 25.

The Report must be read in light of:

- The limited readership and purposes for which it was intended.
- Its reliance upon information provided to Aurecon by the Client and others which has not been verified by Aurecon and over which Aurecon has no control.
- The limitations and assumptions referred to throughout the Report.
- The cost and other constraints imposed on the Report (such as limited site access).
- Other relevant issues which are not within the scope of the Report.

Subject to the limitations referred to above, Aurecon has exercised all due care in the preparation of the Report and believes that the information, conclusions, interpretations and recommendations of the Report are both reasonable and reliable.

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This disclaimer must accompany every copy of the Report, which is an integral document and must be read in its entirety.

2. Site identification

2.1 Location and description

The site is comprised of 54 separate properties totalling approximately 637 ha in area and designated as PSP Area 25 in the Craigieburn, Kalkallo and Donnybrook, in the Hume City and City of Whittlesea local government areas, Victoria, Australia. Site properties are summarized in Table 1.

Table 1 Site property details

No.	Appendix B Page No.	Address	Legal description	Title (Volume/Folio)	Area (ha)
23341	1	780 Donnybrook Road CRAIGIEBURN VIC 3064	Lot 1 LP 119619	9271/196	8.2
23358	10	800 Donnybrook Road CRAIGIEBURN VIC 3064	Lot 2 LP 119619	9538/269	8.2
23366	17	804 Donnybrook Road CRAIGIEBURN VIC 3064	Lot 1 TP 423925	8806/645	0.4
26997	25	45 English Street DONNYBROOK VIC 3064	Lot 3 LP 119619	9227/855	8.1
27003	30	65 English Street DONNYBROOK VIC 3064	Lot 4 LP 119619	9214/672	8.4
27011	35	90 English Street DONNYBROOK VIC 3064	CP 174104	10016/031	33.3
	40	80 English Street DONNYBROOK VIC 3064	Lot 1 TP 844886	10822/940	
27037	44	80 English Street DONNYBROOK VIC 3064	Lot 1 TP 844886	10822/950	30.9
66548	48	25 Norman Road DONNYBROOK VIC 3064	CP 172167 RESERVE	9944/068	16.1
397661	52	750 Donnybrook Road CRAIGIEBURN VIC 3064	Lot 1 TP 125838	9017/631	26.1
411710	57	810 Donnybrook Road CRAIGIEBURN VIC 3064	CP 159200	9737/864	0.3
501719	64	25 Amaroo Road CRAIGIEBURN 3064	Lot 4 LP 205880	9769/309	12.9
501720	68	65 Amaroo Road CRAIGIEBURN 3064	Lot 7 LP 205880	9769/312	12.1
501721	73	85 Amaroo Road CRAIGIEBURN 3064	Lot 8 LP 205880	9769/313	11.9
501722	80	30 Amaroo Road CRAIGIEBURN 3064	Lot 2 PS 518232	9769/307	8.0
501723	87	50 Amaroo Road CRAIGIEBURN 3064	Lot 3 PS 518232	9769/306	7.6
501724	96	105 Brookville Drive CRAIGIEBURN VIC 3064	Lot 1 PS 518231	9769/550	12.7

Table 1 Site property details					
No.	Appendix B Page No.	Address	Legal description	Title (Volume/Folio)	Area (ha)
501725	105	165 Brookville Drive CRAIGIEBURN VIC 3064	Lot 10 LP 205835	9769/551	12.1
501726	112	185 Brookville Drive CRAIGIEBURN VIC 3064	Lot 6 LP 205834	9818/414	20.9
501727	120	225 Brookville Drive CRAIGIEBURN VIC 3064	Lot 5 LP 205834	9818/413	9.0
501728	128	245 Brookville Drive CRAIGIEBURN VIC 3064	Lot 24 PS 616391	9818/409	8.7
501729	137	275 Brookville Drive CRAIGIEBURN VIC 3064	Lot 23 PS 616391	9818/408	8.4
501730	144	295 Brookville Drive CRAIGIEBURN VIC 3064	Lot 22 PS 616391	9818/407	7.8
501731	150	180 Brookville Drive CRAIGIEBURN VIC 3064	Lot 7 LP 205834	9818/415	20.9
501732	160	220 Brookville Drive CRAIGIEBURN VIC 3064	Lot 8 LP 205834	9818/416	20.6
501733	170	230 Brookville Drive CRAIGIEBURN VIC 3064	Lot 9 LP 205833	9818/417	8.9
501734	177	270 Brookville Drive CRAIGIEBURN VIC 3064	Lot 10 LP 205833	9818/410	9.0
	184		Lot RD1 LP 205833	9818/412	
501735	186	290 Brookville Drive CRAIGIEBURN VIC 3064	Lot 11 LP 205833	9818/411	9.1
501779	192	315 Brookville Drive CRAIGIEBURN VIC 3064	Lot 21 PS 616391	10111/889	3.7
501781	197	310 Brookville Drive CRAIGIEBURN VIC 3064	Lot 20 PS 616397	9693/576	9.6
501782	212	670 Donnybrook Road CRAIGIEBURN VIC 3064	Lot 1 TP 324690 RES1 PS 616393 MUNICIPAL RESERVE RES2 LP 133012	8553/206, 11179/674, 11046/035	15.7
501783	236	700 Donnybrook Road CRAIGIEBURN VIC 3064	Lot 1 LP 71220	10877/977	2.9
501784	239	714 Donnybrook Road CRAIGIEBURN VIC 3064	Lot 1 LP 70557	8611/630	0.5
501785	273	720 Donnybrook Road CRAIGIEBURN VIC 3064	Lot 1 TP 411428	8143/793	0.8
501955	283	920A Hume Highway CRAIGIEBURN 3064	Lot 2 PS 518231	9828/775	17.1
501956	283	920 Hume Highway CRAIGIEBURN 3064	Lot 2 PS 518231	9828/775	17.1
501904	291	980 Hume Highway CRAIGIEBURN 3064	Lot 1 TP 830130	9706/679	9.6

Table 1 Site property details					
No.	Appendix B Page No.	Address	Legal description	Title (Volume/Folio)	Area (ha)
501953	303	70 Amaroo Road CRAIGIEBURN 3064	Lot 4 PS 518232	9769/314	6.5
501984	310	10 Kinloch Court CRAIGIEBURN 3064	Lot 11 LP 205835	9769/552	13.2
501985	316	20 Kinloch Court CRAIGIEBURN 3064	Lot 12 LP 205835	9769/553	12.3
501986	323	30 Kinloch Court CRAIGIEBURN 3064	Lot 13 LP 205835	9769/554	12.3
501987	329	40 Kinloch Court CRAIGIEBURN 3064	Lot 14 LP 205835	9769/555	12.3
501988	336	50 Kinloch Court CRAIGIEBURN 3064	Lot 15 LP 205835	9769/556	14.3
501989	343	60 Kinloch Court CRAIGIEBURN 3064	Lot 16 LP 205835	10191/894, 9769/557	13.5
501990	371	70 Kinloch Court CRAIGIEBURN 3064	Lot 17 LP 205835	9769/558	12.8
501991	379	80 Kinloch Court CRAIGIEBURN 3064	Lot 18 LP 205835	9769/559	14.3
502087	387	745 Summerhill Road CRAIGIEBURN 3064	Lot 6 LP 205880	9769/311	12.1
502088	391	755 Summerhill Road CRAIGIEBURN 3064	Lot 5 LP 205880	9769/310	12.0
502089	394	835 Summerhill Road CRAIGIEBURN 3064	Lot 1 PS 518232	6769/308	8.9
502093	399	770 Summerhill Road CRAIGIEBURN 3064	Lot 3 LP 143296	9546/805	12.3
502094	406	790 Summerhill Road CRAIGIEBURN 3064	Lot 4 LP 143296	9546/806	12.4
502095	412	810 Summerhill Road CRAIGIEBURN 3064	Lot 5 LP 143296	9546/807	12.3
502096	419	840 Summerhill Road CRAIGIEBURN 3064	Lot 6 LP 143296	9546/808	12.4
502097	428	860 Summerhill Road CRAIGIEBURN 3064	Lot 3 PS 518231T	9546/809	9.1
671180	440	620 Donnybrook Road CRAIGIEBURN VIC 3064	RES1 PS 616391 ROADS CORPORATION RESERVE	11144/826	9.2
	445		Lot RD1 LP 205880	9769/315	
	447		Lot RD1 LP 205835	9769/560	
	447		Lot RD2 LP 205835	9769/560	
	449		Lot RD1 LP 143296	9546/811	

2.2 Site features

The properties that comprise the site are generally rural residential properties with small-scale agriculture, agricultural properties with relatively intensive cultivation or undeveloped property. An electricity transmission line crosses the site from east to west, approximately 1.5 km south of the northern Area boundary. The site is bounded to the south by undeveloped land; to the west by the Hume Freeway, to the north by Donnybrook Road, and to the east by the North Eastern Railway line and agricultural land. Site location and features are presented on Figure 1 in Appendix A.

2.3 Surrounding land use

The surrounding area is characterized by generally rolling plains used primarily for residential properties and non-intensive agricultural purposes such as livestock grazing and livestock feed production. The land uses directly adjacent to the site are as follows:

- West – Hume Freeway, across which lies dry non-intensive agricultural land with farm residences, rural residential properties and a truck stop service station.
- North – Donnybrook Road, across which lies non-intensive agricultural land, rural residential properties and a railway station.
- East – Dry non-intensive agricultural land and the North Eastern Railway line, across which lies agricultural land with farm residences.
- South – Undeveloped land.

2.4 Proposed land use

This desktop study is part of the pre-planning process for PSP Area 25, with land uses to be decided in the future. For purposes of the risk assessment, Aurecon has considered all potential land use categories listed in the Land State Environmental Planning Policy (SEPP) and Groundwater SEPP.

2.5 Topography

The topography of the site slopes gently toward the southeast across the site from approximately 226 m above mean sea level (MSL) in the northwest corner to approximately 208 m above MSL in the southeast corner. The majority of the site comprises undulating hills and ridges on volcanic plain with stony rises. The stream valleys of Merri Creek and Kalkallo Creek comprise the main elements of relief and terrain variation, with river valley cliffs and bluffs, and provide exposure of underlying geology.

2.6 Geology

The Melbourne sheet (SJ 55-5 Edition 2) in the 1:250,000 Geological Map Series 1997 (Vandenberg, 1997) indicates that the geology of PSP Area 25 is predominantly Pleistocene Quaternary to Miocene Neogene basalts of the Newer Volcanic Group with minor scoria and ash (tholeiitic to alkaline). The map indicates that the geology on the site also includes Holocene Quaternary fluvial alluvium, gravel, sand and silt confined to existing rivers and streams. The southwestern portion of PSP Area 25 is underlain by Pridoli to Ludlow Silurian age marine sedimentary deposits of the Dargile Formation, consisting of marine siltstone and thin-bedded sandstone. An area geology map is presented on Figure 2 in Appendix A.

2.7 Soil characteristics

The Digital Atlas of Australian Soils (NRIC 1991), based on *Atlas of Australian Soils, Sheets 1 to 10* (Northcote *et al.* 1960-68) identifies the soils beneath PSP Area 25 to be Sodosols [SO] classification.

Sodosols are a soil order of the Australian Soil Classification (Isbell, 2002) with an abrupt or clear change in texture at the B2 horizon. The B2 horizon in sodosols is sodic and not strongly acidic. These soils are often brightly coloured and have a pH of 5.5 (water) or greater in the upper B2 horizon.

2.8 Acid sulphate soils

The Digital Atlas of Australian Soils (NRIC 1991), based on *Atlas of Australian Soils, Sheets 1 to 10* (Northcote *et al.* 1960-68), indicates that PSP Area 25 has an extremely low probability of being at risk from Acid Sulphate Soils.

2.9 Historical mining activity

A review of the Victoria Dept. Primary Industries online geographic information system (GIS), *GeoVic* (DPI, 2012) indicates that PSP Area 25 has not been subjected to historical mining activity.

2.10 Inferred geological conditions

The published geological setting and existing information describes Holocene quaternary alluvial deposits overlying Pleistocene and Miocene basalts with minor scoria and ash belonging to the Newer Volcanic Group. The alluvial sediments tend to be concentrated along existing creek courses.

The reported geological profile recorded by the existing borehole database confirms the published geological setting. Reported lithologies, from bore logs available in the Victorian Water Resources Data Warehouse, identify a layer of surficial fill or topsoil approximately 0.30 m to 0.50 m thick, overlying a layer of residual clay with a basalt bedrock surface generally ranging in depth between 0.50 m and 3.0 m. The residual clay and extremely weathered rock (soil like) typically contain basalt cobbles and boulders. The transition between the soil/clay and rock is typically sharp.

The south-western part of the site, as delineated in the geological plan (see Figure xx) is underlain by the Dargile Formation which comprises Silurian-age deep-water derived alternating beds of sedimentary mudstone and fine-grained sandstone. The Dargile Formation is typically folded into synclines or anticlines that dip at a gradient of between 45°and 70°. They are noted to be intruded locally by granite with accompanying tabular dykes.

Basaltic lava is typically interbedded with minor scoria, lapilli and tuff deposits. Basaltic lava flows are typically very hard with polygonal vertical fractures near the upper and lower horizons. Vesicles are usually present in the upper surface. Fossil soil horizons can also develop on the surface of flows during a non-eruptive period, which have been buried by subsequent flows; Residual basaltic clay is typically of high plasticity and has reactive properties.

Scoria deposits comprise typically angular to sub-angular, poorly sorted, gravel to boulder size basalt fragments that can form either welded rootless lava flows, or indistinct unwelded blocky deposits. Scoria and ash deposits typically weather to soft to very soft sand, silt and clay of medium to high plasticity. Tuff deposits typically comprised thin graded beds of unconsolidated basaltic sand and silt sized particles.

Holocene alluvial deposits typically comprise undifferentiated interbedded poorly compacted gravel, sand and silt deposits. Cohesive material is typically very soft to firm, while granular material is typically very loose to loose, poorly consolidated angular to rounded basalt and sandstone derived from externally sourced bedrock.

Colluvial deposits have also been documented along Merri Creek which comprise poorly to well sorted silt, sand and gravel.

The published soils map indicates the site is predominantly overlain by sodosol-type soils which are found to vary in texture and depth though generally comprise clay and sand loam. Sodosols have a high clay content and high sodium which sometimes leads to dispersion and instability.

Localised fill or natural reworked material deposits are likely to be present on site, especially around areas of recent development, however further investigation will be required to identify and delineate these occurrences. In addition to the general subsurface profile, a review of aerial photography indicates some dry river or stream channels that may indicate the presence of localised pockets of soft, unconsolidated alluvial sediments that are not shown as being present on the geological map.

Previous experience has shown that the basalt rock is generally permeable. The ground water table fluctuates seasonally due to rainfall and generally flows south towards Port Phillip Bay. A perched water table may be present within the soil layer at the interface between the residual clay/extremely weathered basalt and highly weathered basalt interface.

2.11 Identified landforms and geomorphological features

The following landforms have been identified within the study area:

- Gently undulating hills and ridges
- Undulating volcanic plain with stony rises
- River valley cliffs and bluffs
- Valley side slopes
- Stream terraces, both bedrock and alluvial
- Modern floodplain and stream channels

These land forms may have been significantly altered through anthropological land use and development in the previous 200 years, typically for flood protection though it is noted that regrading of slopes and replacement of natural soil may have occurred on site. A number of quarries are also noted in close proximity to the development area.

2.12 Identified geotechnical hazards

The identified geotechnical hazards considered to be appropriate for the site are summarised in Table 2.

Table 2 Summary of key geotechnical constraints

Constraints	Discussion
Settlement of proposed road formations and structures	Quaternary alluvial clay and silt deposits are typically poorly consolidated and un-lithified so may settle if unsupported or overloaded. The presence of localised un-engineered fill material may also result in a differential settlement hazard. Dependent on the state of weathering, localised areas of extremely weathered basalt may result in differential settlement of overlying residual clay.
Voids	Where scoria is identified beneath the site, the presence of voids cannot be ruled out. The presence of unidentified voids within the scoria may present a hazard to shallow footings. The presence of voids could result in the loss of stability or localised collapse hazard.
Slope stability	Although the PSP area is of a relatively gentle gradient, steeper slopes are noted in close proximity to surface water bodies. Weathered alluvial or residual material can be susceptible to shallow soil failure (soil creep, slumping and collapse) in areas of increased gradient.

Table 2 Summary of key geotechnical constraints	
Constraints	Discussion
Bearing capacity	Low bearing capacity within soft clay material or unconsolidated alluvial material can result in a loss of stability or potential collapse of structures during the construction phase of the development. The presence of soft material encountered at depth may result in a bearing capacity or settlement hazard for any proposed foundations. Although basalt bedrock is relatively competent the bearing capacity may be significantly reduced if it is vesicular or has been subject to significant weathering processes.
Shrink-swelling	Clay derived from basalt rock is likely to be moderately to highly reactive, and subject to considerable shrinkage or swelling in response to change in moisture content. Highly expansive clay can cause unexpected ground movements that are able to damage to building foundations, structures and road infrastructure, especially in the vicinity of semi-mature and mature trees.
Erosion	A number of ephemeral creeks are located across the site (generally oriented north to south). It is possible that, during flood events, these creeks could serve as drainage channels for storm water, resulting in the erosion of soft sediment and bedrock. Brown sodosols, which are prevalent in this region of Victoria, are noted to be susceptible to gully and tunnel erosion
Irregular residual profile	Zones of deeper residual soils or in some places swamp conditions may exist where the topography impeded complete drainage out of depressions in the surface of the lava flow. These irregularities might affect footing design and performance.

In general, PSP Area 25 is flat or gently undulating and soil cover is expected to be relatively thin. As such the risk of geotechnical hazards are considered low to moderate though a thorough understanding of the geological model will be required prior to development.

2.13 Hydrology and hydrogeology

2.13.1 General site assessment

Information regarding hydrology of the site and surrounding area is based solely on a desktop study. No chemical or groundwater elevation evaluation of groundwater was performed for this assessment.

Merri Creek runs from Donnybrook Road on the north boundary of the site, between parcels 501785 and 397661, to the eastern boundary of the site where it crosses under the North Eastern Railway line between parcels 66548 and 501986. Kalkallo Creek enters the northwest corner of the site and continues east until joining with Merri Creek on parcel 501782. Based on the concentration of vegetation along the creeks, Merri Creek and Kalkallo Creek are believed to be semi-ephemeral with a few areas of ponding, particularly near culverts at road crossings, and groundwater generally near the surface. An unnamed semi-ephemeral creek is located on property numbers 501730 and 501779, east of Hume Freeway, in the northwest corner of the property, and drains into Kalkallo Creek.

2.13.2 Surface water assessment

The site is within the 396 square kilometres (km^2) Merri Creek catchment, a major tributary of the Yarra River Basin. The creeks are fed from catchments in the north, flowing to the south where the Merri Creek eventually joins the Yarra River. No water level data for Merri Creek were available from Melbourne Water.

There is an Urban Floodway Zone (UFZ) at a maximum of 100 m either side of Merri Creek and Kalkallo Creek. This area has been identified as having a greater risk of flooding. A permit is required to carry out works in this area and must be consistent with the local Floodplain Development Plan.

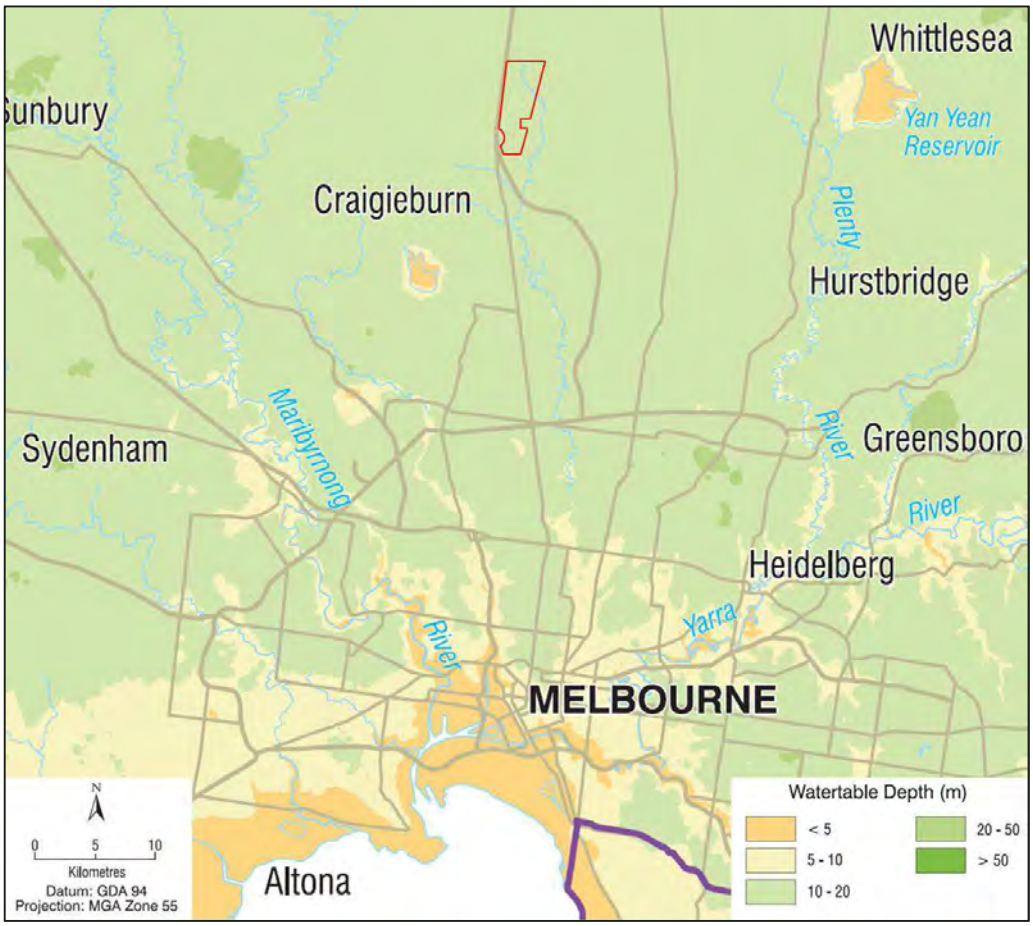
Drainage paths have been determined for the area from the contour plan. The drainage paths are areas of likely surface water flows during rainfall events and appropriate drainage infrastructure will be required to manage these flows if developing in these areas. Drainage paths are depicted on Figure 2 presented in Appendix A.

2.13.3 Groundwater assessment

The *Victorian Water Resources Data Warehouse* (DSE, 2012b) and *GeoVic* (DPI, 2012) GIS tools identified 30 registered boreholes within 1 km of the site. No groundwater level information was available for the boreholes located on the site. The closest borehole to the site for which groundwater level data was available was borehole B68888, located approximately 665 m south of site southern boundary, at 95-135 Amaroo Road. This borehole shows a groundwater depth on 1 April 2009 of 15.71 m below ground level (bgl).

Groundwater beneath the site is present in two main aquifers, the upper Newer Volcanics aquifer, a fractured rock basalt aquifer, and a deeper regional aquifer within the Silurian aged formation. Exposed groundwater is visible in numerous irrigation ponds on the Area. This is indicative of a depth to groundwater of less than 5 m on the site. A general snapshot of groundwater depths in the area is shown in the figure below.

Water table depths (Department of Sustainability and Environment, 2012a)



2.13.4 Groundwater resources and usage

Borehole usage was primarily domestic and agricultural water supply with a small number of extractive industries boreholes. The registered boreholes are summarized in Table 3. This suggests that groundwater is shallow enough for extraction but deep enough to pose no significant risk to construction.

Table 3 Registered groundwater bores in vicinity of the site

Bore ID	Position in relation to site	Depth (m)	Purpose
310871	Northwest corner (23341)	42.37	Groundwater
68867	Northern margin	13.72	General Geological
68829	Northern margin (23341)	24.5	Groundwater
68852	Northern margin (501781)	22	Groundwater
68860	Northwest corner (501781)	29	Groundwater
68796	Northwest corner (23358)	19.81	Groundwater
68831	Northwest corner (23358)	30.5	Groundwater
68827	Northern portion (26997)	18.2	-
68830	Northwest portion (174104)	61	Groundwater
68826	Northwest portion (27003)	18.5	Groundwater
68846	Northern central (27037)	15.24	Groundwater
68875	Northern central (27037)	26	Groundwater
68886	Southwest portion (502094)	41	Groundwater
68821	Southwest portion (501719)	59.5	Groundwater
68797	Southwest corner	48.8	Groundwater
S61198/1	Northern margin	-	-
68915	Northern margin (501782)	26	Groundwater
68903	Northern margin (501782)	47	Groundwater
68912	Northern margin (501782)	23	Groundwater
68908	Northwest corner (501781)	124	Groundwater
68910	Northwest portion (501984)	38	Groundwater
68914	Northeast portion (27011)	80	Groundwater
68944	Western portion (501988)	83.8	Groundwater
68873	Central portion (501991)	16.7	Groundwater
68919	Southwest portion (502095)	50	Groundwater
68902	Southwest portion (502096)	111	Groundwater
68922	Southern portion (502094)	50	Groundwater
68920	Southwest portion (501724)	47	Groundwater

2.14 Review of Wetlands databases and sites of National Environmental Significance

2.14.1 General

Searches of the Directory of Important Wetlands in Australia and the DSE Biodiversity Interactive Map for Victoria (DSEWPC, 2010) were conducted, in order to determine whether there were any sites of National Environmental Significance within PSP Area 25.

2.14.2 Directory of Important Wetlands in Australia

The Directory describes wetlands that have qualified as nationally important and includes a breakdown of nationally important wetlands by State and Territory. Wetland classification and mapping was undertaken across Victoria from 1980 onwards culminating in a Statewide wetland inventory and publication of a report assessing Victoria's wetlands in 1992 and completion of a geospatial wetlands layer in 1994. The inventory lists approximately 13,000 naturally occurring wetlands (over one hectare in size). Wetlands are identified within each of Victoria's bioregions. The South East Coastal Plain is the relevant bioregion for PSP Area 25.

No nationally important wetlands are listed for the PSP 25 Area.

2.14.3 DSE Biodiversity Interactive Map

The DSE Biodiversity Interactive Map provides information on the biodiversity of Victoria and displays flora and fauna data. The search was conducted for the following map layers:

- Ramsar Sites
- Important Wetlands
- 1788 Wetland Categories
- 1994 Wetland Categories

No wetland sites of national environmental significance or sites of state significance were identified within PSP Area 25.

3. Records review

3.1 Search of public records

3.1.1 Certificates of title

Land ownership records were reviewed to obtain evidence of previous land uses on the various parcels of land as the occupation of land owners is often included. While an occupation does not necessarily denote land use for a property, it can give a good indication of potential land use.

Current certificates of title for all site properties were requested from the Department of Sustainability and Environment (DSE). Crown allotment land for which titles could not be obtained is listed in Table 4.

Table 4 Crown allotment land

Street Address	Legal Description	Location
Donnybrook Road CRAIGIEBURN 3064	CA 2003 Kalkallo Parish	The Merri Creek channel

Site title information for significant parcels is listed in Table 5. Copies of current certificates of title are presented in Appendix B.

Table 5 Significant site title information

Volume/ Folio	Property	Legal Description	Date	Registered Proprietor	Area (ha)
9769/ 307	30 Amaroo Road (501722)	Lot 2 PS 518232	17/09/87	Fabio Luele (Intensive agriculture)	8.0
9818/414	185 Brookville Drive (501726)	Lot 6 LP 205824	09/05/01	Nadim Soueid (Market garden)	20.9
9546/807	810 Summerhill Road (502095)	Lot 5 LP 143296	01/03/84	M.A.V.M. Nominees Pty Ltd (Market garden)	12.3
9706/679	980 Hume Highway (501904)	Lot 1 on TP 830130	02/07/07	Zaysung Pty Ltd (Gasoline Service Stations company)	9.6
9769/309	25 Amaroo Road (501719)	Lot 4 LP 205880	14/07/89	Borsato Constructions Pty Ltd	12.9
10016/031	90 English St (27011)	CP174104S	08/05/91	Lavender Rain Pty Ltd (Cattle and sheep breeders and sellers)	33.3

3.1.2 Environmental Protection Authority

A search of Victoria EPA records, including the Priority Sites Register (EPA Victoria, 2012a) and the list of issued Certificates and Statements of Environmental Audit (EPA Victoria, 2012b), was performed to identify subject site or vicinity properties that have been listed as having been issued a cleanup notice or pollution abatement notice (relative to land and/or groundwater) or undergone a statutory environmental audit. No locations were identified on PSP Area 25 or within 2 km of the site.

3.1.3 Local government records

The Hume City Council and City of Whittlesea council do not maintain contaminated site registers and requests for specific properties of interest based on review of historic aerial photographs or observations made during the site visit provided no information regarding potential on site or vicinity property contamination.

3.1.4 Other government records

WorkSafe Victoria was contacted on 10 July 2012 regarding Dangerous Goods Licenses for site properties and responded that a Letter of Authorisation would be required from each property owner before a record search for that property could be conducted. Dangerous Goods Licenses permit storage and handling of dangerous goods, including flammable and combustible liquids, as defined in the 2000 Victoria *Code of Practice for the Storage and Handling of Dangerous Goods*. Letters of Authorisation from the site property owners have not been, and are not anticipated to be, provided for this desktop study and the lack of data regarding Dangerous Goods Licenses is considered to be a data gap.

3.1.5 Aerial photographs

Aerial photographs dating back to 1963 were either provided by United Photo and Graphics in Blackburn, Victoria or viewed on Google Earth™ and reviewed to obtain information on the historic use and development of the site. No aerial photographic coverage was available for the northern third of the Area until 1979. A listing of the aerial photographs reviewed is presented in **Error! Reference source not found.**. Table 7 summarizes notable observations from each photograph. Copies of the historical aerial photographs from 1963 to 1998 are presented in Appendix D of this report.

Table 6 Aerial photographs reviewed

Date	Identification	Scale	Source
1963	M13 360	1:9600	United Photo and Graphics
1968	M25N 656	1:9600	
1979	782216 7822	1:25000	
1989	7822NL4 2004	1:15000	
1998	UPG	1:16,000	
2006	Unknown	Unknown	©2010 Google Earth Image ©2012 DigitalGlobe Image ©2012 Sinclair Knight Mertz & Fugro ©2012 Whereis® Sensis Pty Ltd
2010	Unknown	Unknown	

Table 7 Aerial photograph review summary	
Aerial Photograph	**Comments**
1963	No photographic coverage was available for the portion of the Area north of present day Kinloch Court. Hay field cultivation is evident on the northern half of parcel 502088 (755 Summerhill Road) and on a small portion of parcel 502087 (745 Summerhill Road). A residence and several large farm sheds (several corresponding to present day) are evident on parcel 501955 and 501956 (920 and 920A Hume Highway). A barn corresponding to present day is evident on parcel 501719 (25 Amaroo Road) and a house, barn and various outbuildings (with the house corresponding to present day) are evident on parcel 501722 (30 Amaroo Road). Non-intensive agriculture evident on parcels 501724, 501955 and 501956. The remainder of the visible Area is undeveloped. **Off site**: Hume Highway is evident to the west, across which is largely undeveloped land. The North Eastern Railroad tracks form the eastern border of the Area.
1968	No photographic coverage was available for the portion of the Area north of parcel 501732 (220 Brookville Drive). A large barn and shed are evident on the western margin of parcel 502097 (860 Summerhill Road). A farmhouse, several large barns, three round water tanks and 12 livestock pens with small sheds are evident on parcels 501955 and 501956 (920 and 920A Hume Highway). The farmhouse, water tanks and several outbuildings correspond to present day. Non-intensive agriculture is evident over most of the remainder of the Area.
1979	A cricket ground and associated buildings corresponding to present day is evident on the eastern half of parcel 501783 (700 Donnybrook Road). A residence, several farm buildings and tanks/silos corresponding to present day are evident on parcel 27003 (65 English Street). Residential buildings are evident on parcel 501722 (30 Amaroo Road). A barn structure and water tank/silo corresponding to present day is evident on parcel 501719 (25 Amaroo Road). Residential and farm buildings corresponding to present day are evident on parcel 23366 (804 Donnybrook Road) and farm buildings corresponding to present day is evident on parcel 411710 (810 Donnybrook Road). Non-intensive agriculture evident on parcels 502093 to 502096, 501988, and 501989. Additional farm structures and 15 additional livestock pens with small sheds are evident on parcels 501955 and 501956 (920 and 920A Hume Highway). Fence line or roads are evident on parcels 66548 (25 Norman Road) and 27011 (90 English Street).A barn corresponding to present day and many hay bales are evident on the northwest corner of parcel 27011. Oblong dirt racetracks corresponding to present day are evident on parcels 27037 (80 English Street) and 397661 (750 Donnybrook Road). Numerous farm structures corresponding to present day and a residence are evident on the northern half of parcel 397661. Residences and farm structures roughly corresponding to present day are evident on parcels 501783, 501785 and 501782 (720, 714 and 670 Donnybrook Road, respectively). A line of power pylons are evident crossing the Area from east to west on the northern margins of parcels 501904, 501725 and 501984 to 501986. **Off site**: Some non-intensive agriculture and a large quarry are evident east of the railroad tracks northeast of the Area.

Table 7 Aerial photograph review summary	
Aerial Photograph	**Comments**
1989	Additional farm buildings, tanks/silos and paddocks with small structures corresponding to present day are evident on parcel 27003 (65 English Street). One residence and a large farm building corresponding to present day are evident on parcel 501722 (30 Amaroo Road). Amaroo Road is evident as a pave road oriented north to south on the lower third of the Area. Kinloch Court is evident as a paved road branching east from Amaroo Road. Brookville Drive is evident as a paved road running from Kinloch Court to Donnybrook Road. Residential and/or farm buildings corresponding to present day are evident on the northeast corner of parcel 27011 (90 English Street), parcel 27003 (65 English Street), parcel 26997 (45 English Street), parcel 23341 (780 Donnybrook Road), parcel 501781 (310 Brookville Drive), parcel 501982 (670 Donnybrook Road), and parcel 501729 (275 Brookville Drive). Additional farm buildings are evident on parcels 501955 and 501956 (920 and 920A Hume Highway). A grove is evident on parcel 502096 (840 Summerhill Road) and a small structure is evident on parcel 671180 (620 Donnybrook Road). Non-intensive agriculture evident on many of the Area parcels. **Off site**: A petrol station and market are evident on the southwest corner of the intersection of Hume Freeway and Donnybrook Road. Some scattered residential development evident north of Donnybrook Road.
1998	Additional residences and farm buildings corresponding to present day are evident on the northeast corner of parcel 27011 (90 English Street). An additional cricket ground corresponding to present day is evident on the western half of parcel 501783 (700 Donnybrook Road). Additional farm buildings corresponding to present day are evident on parcel 23366 (804 Donnybrook Road) and parcel 411710 (810 Donnybrook Road). Farm buildings corresponding to present day are evident on parcel 501730 (295 Brookville Drive) and parcel 501733 (230 Brookville Drive). Miscellaneous small farm structures corresponding to present day are evident on parcel 501734 (270 Brookville Drive). A roughly rectangular dirt racetrack and small structure are evident on parcel 66548 (25 Norman Road). Several farm structures corresponding to present day are evident on the eastern sides of parcel 501726 (185 Brookville Drive) and parcel 501728 (245 Brookville Drive), parcel 501732 (220 Brookville Drive), parcel 501986 (30 Kinloch Court) and on the northern margins of parcels 501988 to 501991 (50, 60, 70 and 80 Kinloch Court, respectively). A residence corresponding to present day is evident on parcel 501719 (25 Amaroo Road). Additional market garden development is evident on parcel 502095 (810 Summerhill Road). Groves are evident on parcel 502093 (770 Summerhill Road), parcel 502094 (790 Summerhill Road), parcel 502089 (835 Summerhill Road) and parcel 501722 (30 Amaroo Road).
2006	Groves are evident on parcel 23358 (800 Donnybrook Road) and parcel 501729 (275 Brookville Drive). A grove, a residence and multiple abandoned vehicles corresponding to present day are evident on parcel 501730 (295 Brookville Drive). A residence corresponding to present day is evident on parcel 501728 (245 Brookville Drive). A grove is evident on parcel 501729 (275 Brookville Drive). Groves are evident on parcel 501726 (185 Brookville Drive). A residence corresponding to present day is evident on parcel 501724 (105 Brookville Drive). A small non-residential structure is evident on parcel 501735 (290 Brookville Drive).

Table 7 Aerial photograph review summary	
Aerial Photograph	**Comments**
2006	A residence corresponding to present day is evident on the southeast quadrant of parcel 502095 (810 Summerhill Drive). Groves are evident on parcel 501723 (50 Amaroo Road) and a small structure corresponding to present day is evident on parcel 501953 (70 Amaroo Road). Several residential structures are evident on parcel 501720 (65 Amaroo Road). Several structures are evident on parcel 501984 (10 Kinloch Court). A small structure corresponding to a present day well pump house is evident on parcel 502087 (745 Summerhill Road). Debris and abandoned vehicles evident on parcel 501732 (220 Brookville Drive). **Off site**: Hume Freeway is evident along the western boundary of the Area. Significant residential development is evident to the southwest of the Area, across Hume Freeway. The quarry evident northeast of the Area has expanded operations.
2010	Small-scale non-intensive agriculture is evident on parcel 23366 (804 Donnybrook Road) and parcel 411710 (810 Donnybrook Road). The former structure on parcel 671180 has been demolished and replaced with a traffic circle and on-ramp to Hume Freeway. Groves are evident on parcel 501728 (245 Brookville Drive). Additional structures and debris are visible on parcel 501984 (10 Kinloch Court). The livestock pens with small sheds and some farm structures formerly on parcels 501955 and 501956 (920 and 920A Hume Highway) are no longer evident. Unidentified debris and soil piles are evident on parcel 501721 (85 Amaroo Road). A residence and tank or silo is evident on the southeast corner of parcel 501725 (165 Brookville Drive). The market garden on parcel 502095 (810 Summerhill Road) no longer appears active. The structures formerly on parcel 501720 (65 Amaroo Road) are no longer visible but scattered debris is evident. **Off site**: The intersection of Hume Freeway and Donnybrook Road has been expanded into a major interchange. The petrol station and market formerly located on the southwest corner of Hume Freeway and Donnybrook Road has been relocated approximately 100 m to the southwest and expanded into a major truck stop.

3.1.6 Australian heritage databases

A search of Australian heritage databases was performed to located sites of historic significance on the site. The following heritage databases were searched:

- Hume and Whittlesea Planning Schemes – Heritage Overlay (sites of National, State, regional and local significance)
- Victoria Heritage Register/Database (Heritage Victoria, 2012)
- Australian Heritage Database
- Protected Matters Search Tool (Department of Sustainability, Environment, Water, Population and Communities)
    - Includes; Protected areas, Commonwealth Heritage Places, World Heritage Properties, National Heritage Places

Although no heritage sites were identified on PSP Area 25, five specific heritage sites were identified immediately adjacent to PSP Area 25 and are summarized in Table 8.

Table 8 Heritage site summary			
Name	**Location**	**Map Reference**	**Description**
Railway Bridge	Over Merri Creek, Craigieburn. Located immediately beyond the eastern boundary of PSP Area 25, immediately east of the northeast corner of property no. 501987.	HO230	
Victoria Bridge	Donnybrook Road (over Kalkallo Creek), Kalkallo. Immediately north of northeast corner of 671180.	HO1	External paint controls apply.
Nelsons Farmhouse	Donnybrook Road (north side), Kalkallo.	HO244	External paint controls apply. Prohibited uses may be permitted.
Amaroo Road 1	95-135 Amaroo Road, Craigieburn. Approximately 200 m south of property number 501721.	Heritage Inventory No. D7822-0844	The site comprises of a large clearance cairn composed of collected basalt fieldstones. The cairn is elliptical in shape and approximately 0.5 m high by 20 m x 10 m. The cairn is partially overgrown.
Occupation Stock Crossing Site	650 Summerhill Road and 50 Kinloch Court, Craigieburn, Hume City. Located immediately beyond the eastern boundary of PSP Area 25, approximately 125 m northeast of the south corner of property number 501988.	Heritage Inventory No. H7822-0731	A pair of rectangular platforms constructed of basalt blocks, designed to enable stock to cross the railway tracks. The central portion has been removed for track upgrades.

Locations of heritage sites are presented on Figure 3 in Appendix A and copies of documents relevant to the heritage search are presented in Appendix C. No evidence was found that historic land use on heritage sites located on PSP Area 25 represents a significant environmental concern to the Area or would have any adverse impact, other than potential preservation requirements, on the potential for development of PSP Area 25.

3.1.7 Previous reports and documents

No previous reports of investigations or environmental audits conducted on the site or within 2 km of the site were available in searched databases or provided by the client.

3.2 Summary of historic contamination potential

The historical data search including the aerial photograph review provided limited information regarding potential historical source areas on the site. Specific land use patterns including market gardens or large-scale intensive agriculture on parcel 501722 (30 Amaroo Road), parcel 501726 (185 Brookville Drive), parcel 501730 (295 Brookville Drive) and parcel 502095 (810 Summerhill Road); a collection of abandoned automobiles on parcel 501730 (295 Brookville Drive), small scale intensive agriculture, such as family-owned olive groves on a number of parcels, aboveground storage tanks, structures with possible septic systems, debris and dumping provide the potential for on-site sources of contamination. In addition, the lack of availability of aerial photographs dated prior to 1963 limited our ability to evaluate the historic uses of the site prior to 1963.

The potential for off-site sources of contamination migrating to the site via surface and sub-surface pathways such as watercourses and groundwater exists. The nature, extent and mobility of any potential contamination depend on the type of activities that have historically been undertaken in the context of the local geological and hydrogeological environments.

4. Site inspection

4.1 General

A site walkover was performed by Jacqueline McLeod on 9 July 2012. No access to site properties was granted for this desktop study and the site inspection was therefore limited to what was visible from adjacent roadside areas. Aerial photographs and other sources were used to identify specific sites where land use may need investigation. Select site photographs are presented in Appendix E.

4.2 Significant issues

Significant issues noted during the site visit are summarized below:

- An apparent out of production market garden on parcel 502095 (810 Summerhill Road).
- Farm equipment and abandoned automobiles stored on a number of site properties (eg 780 Donnybrook Road, 220 and 295 Brookville Drive).
- Large scale intensive farming operations where fertilisers, pesticides, and herbicides may have been used (eg 30 Amaroo Road, 185 and 295 Brookville Drive).
- Small scale intensive farming operations where fertilisers, pesticides, and herbicides may have been used (eg 800 Donnybrook Road, 245 and 275 Brookville Drive, 770, 790, 835 and 840 Summerhill Road).
- Areas where abandoned vehicles, farm equipment, debris or dumping of unspecified materials have occurred (eg 720 Donnybrook Road, 30 Amaroo Road, 220 and 295 Brookville Drive, 920/920A Hume Highway and 60 Kinloch Court).
- Structures that may contain asbestos and have lead based paint and septic systems.
- Waterways, including Merri Creek and Kalkallo Creek subject to flooding are present on the site.

4.3 Areas of environmental concern

Based on review of available historical sources and the site visit, a number of Areas of Environmental Concern (AECs) were identified as being present on PSP Area 25. The AECs are summarised in **Error! Reference source not found.**.

Table 9 Summary of site AECs

Areas of Environmental Concern	Potentially contaminating activity
Large-scale agriculture (market gardens, intensive agriculture)	Historical aerial photographs indicate the presence of market gardens and relatively large scale intensive agricultural activities, including medium-sized (greater than 0.5 ha) olive or fruit groves. Contaminants of concern are heavy metals, pesticides, herbicides and fertilisers.
Structures (with possible asbestos, lead based paint and septic tanks)	Historical aerial photographs indicate that existing residential and farm structures were present on some Area parcels in 1963. Contaminants of concern are lead, asbestos, pesticides, herbicides and faecal coliforms.

Table 9 Summary of site AECs	
Areas of Environmental Concern	**Potentially contaminating activity**
Abandoned vehicles, equipment and debris	Historical aerial photographs indicate the presence of abandoned vehicles and farm and other equipment on a number of site parcels. Contaminants of concern are heavy metals, petroleum hydrocarbons, VOCs and asbestos.
Fuel and solvent usage and storage	Fuel storage and vehicle and equipment maintenance activities may have been associated with commercial, residential and agricultural activities on the site. Contaminants of concern are heavy metals, petroleum hydrocarbons and volatile organic compounds (VOCs).
Small-scale agriculture	Historical aerial photographs indicate the presence of agricultural activities, including residential produce production and maintenance of small (less than 0.5 ha) olive or fruit groves. Contaminants of concern are heavy metals, pesticides, herbicides and fertilisers.
Animal husbandry	Small unidentified farm structures present on Area parcels may have been used to raise pigs, goats or chickens. Contaminants of concern are nutrients, hormones and antibiotics.
Off-site sources	A large truck stop service station, constructed between 2006 and 2010, is located on the southwest corner of the interchange of Hume Freeway and Donnybrook Road. Non-intensive agricultural land is located adjacent to the Area to the west, north and east. There is a potential for transport of contamination from off-site sources located hydraulically upgradient of the Area on to the site via Merri Creek or Kalkallo Creek. Contaminants of concern are heavy metals, petroleum hydrocarbons, pesticides, herbicides, fertilisers and VOCs.

5. Environmental risk

5.1 General

A contaminant is a substance that has the potential to cause harm to environmental receptors. The simple environmental risk assessment is based on a source of contamination – pathway – receptor methodology.

Source:	Sources can include particular ground conditions, for example redundant footings in the ground, which have the potential to impact on redevelopment proposals.
Pathway:	The route by which the source is brought into contact with the receptor. This can include the transport of contamination via water (surface and groundwater), wind borne dust, vapours, excavation and deposition.
Receptor:	Human beings, other living organisms, physical systems and built structures that could be affected by the source. A receptor will only be affected if a pathway from the source to the receptor is present. Groundwater and surface water systems can be considered as receptors in their own right as their quality is regulated by statutory bodies, as well as being pathways for contaminant migration to other receptors.

The source-pathway-receptor relationship allows an assessment of potential environmental risk to be determined, based on the nature of the source, the degree of exposure of a receptor to a source and the sensitivity of the receptor. On this basis an assessment is made of the environmental liabilities associated with the risk. These can be expressed for example, in terms of additional costs associated with site redevelopment or remedial measures, the potential for costs, fines or penalties imposed for breaches of environmental legislation or third party claims, and loss of land value.

The identified potential environmental liabilities have been evaluated with respect to the potential impacts on:

- surface water bodies
- groundwater
- sensitive sites and ecosystems
- construction and maintenance workforce
- current and future site users
- current and future adjacent site users

5.2 Site characterisation - conceptual site model

5.2.1 General

Central to the requirements for the assessment of risk is the development of a conceptual site model based on the available information.

5.2.2 Contaminants of concern

Sources of potential contamination were identified on the site and the following contaminants may potentially be present:

- Petroleum hydrocarbons, such as total petroleum hydrocarbons (TPH); benzene, toluene, ethylbenzene and xylenes (BTEX), phenols and polycyclic aromatic hydrocarbons (PAH).
- Heavy metals.

- Organochlorine and organophosphate pesticides (OCP/OPP).
- Volatile organic compounds (VOC).
- Asbestos.
- Hormones and antibiotics.
- Nutrients (Nitrogen, Phosphorus and Potassium)

5.2.3 Exposure pathways

The potential pathways for contaminant exposure to both people and the environment are interwoven and include:

- Site drainage and underground service pits, vaults and conduits
- Release through the air (particularly if disturbed during demolition and excavation)
- Groundwater
- Direct contact with soil (which can lead to dermal absorption)
- Soil vapour inhalation
- Nearby watercourses

The potential exists for the migration of contaminants onto the site from contamination sources via groundwater and/or drainage. Airborne release and soil vapour can result from demolition and excavation activities, and dermal absorption can occur via direct contact with contaminated material.

Contaminated soil can reach off site locations during transportation or movement of stockpiles.

The dispersal and migration of chemical contaminants resulting from inputs associated with the contaminants of concern will generally be controlled by sub surface conditions (e.g. soil type and moisture content) along with physical and chemical properties of individual contaminants and weather.

Other factors that may impact the movement and migration of contaminants on the site include:

- Erosion of disturbed and cleared areas that contribute to sediment transport and deposition
- Stripping of topsoil material
- On-site movement of light vehicles and machinery that will contribute to shallow soils being disturbed
- The presence of naturally occurring erodible soils
- The presence of drainage culverts forming preferential migration pathways downgradient of identified Areas of Environmental Concern (AECs)
- Rainfall conditions

5.2.4 Potential receptors

Potential receptors and pathways from identified sources are summarized in Table 10.

Table 10 Potential receptors and pathways

Receptor	Pathway
Current site users	Dermal contact, ingestion and inhalation
Adjacent site users	Dermal contact, ingestion and inhalation
Future site users (including site workers during development)	Dermal contact, ingestion and inhalation
Groundwater	Leaching from soil, transport in perched groundwater
Surface water	Transport in perched groundwater, surface run-off

Table 10 Potential receptors and pathways	
Receptor	**Pathway**
Ecosystems	Uptake through soil, direct contact
Buried services	Chemical attack, vapour migration

5.2.5 Environmental considerations

The desktop review and site inspection identified several environmental factors to be considered in designing the Conceptual Site Model. These factors are summarized in Table 11.

Table 11 Environmental considerations	
Receptor	**Pathway**
Surface water	Surface water and run off from rain and dust settlement activities may mobilise contaminants (dissolved and particulate) and therefore may contribute to migration of contamination.
Groundwater	Exposed groundwater is visible in numerous irrigation ponds across the Area. This is indicative of a general depth to groundwater of less than 5 m on the site and an increasing depth to groundwater toward the south.
On-site sources of contamination	There are a number of parcels historically used for market gardens or intensive agriculture as well as small-scale intensive agriculture and areas of debris or abandoned automobiles on the site that may have led to contamination, predominantly in the form of pesticides and heavy metals. It is possible that asbestos containing material may be present on site.

5.3 Qualitative risk assessment

A qualitative risk assessment was conducted considering the sources of potential contamination identified above, and the series of potential receptors identified, together with linking pathways. This assessment also takes account of specific chemicals of concern or groups of similar chemicals of concern. It is implicit that, where a source has been identified during the desktop study, it has been included within the list. The derivation of the risk classes is presented in Table 12.

Table 12 Derivation of risk classes				
Classification	**Human health**	**Ground/surface water**	**Ecological**	**Built environment**
Severe	Irreversible damage to human health	Substantial pollution of sensitive water resources	Significant change to the number of one or more species or ecosystems	Irreparable damage to buildings, structures or the environment
Moderate	Non-permanent health effects to humans	Substantial pollution of non-sensitive water resources or small scale pollution of sensitive water resources	Change to population densities of non-sensitive species.	Damage to sensitive buildings, structures or the environment
Mild	Slight short term health effects to humans	Slight pollution to non-sensitive water resources	Some change to population densities but with no negative effects on the function of the ecosystem.	Easily repairable effects of damage to buildings or structures

Table 12 Derivation of risk classes				
Classification	**Human health**	**Ground/surface water**	**Ecological**	**Built environment**
Negligible	No measurable health effects to humans	Insubstantial pollution to non-sensitive water resources	No significant changes to population densities in the environment or in any ecosystem.	Very slight non-structural damage or cosmetic harm to buildings or structures.

The 'Classification' column is an overall assessment of the actual risk, which considers the likely effect on a given receptor, taking account of both of the previous rankings (ie consequence and likelihood). The risk classifications are defined in Table 13.

Table 13 Risk classifications	
Classification	**Descriptions**
Very High	There is a high probability that severe harm to a designated receptor could arise from an identified source without appropriate remedial action.
High	A designated receptor is likely to experience significant harm from an identified source without remedial action.
Moderate	It is possible that harm could arise to a specific receptor, but it is unlikely that such harm would be significant.
Low	It is possible that harm could arise to a designated receptor from an identified source though this is likely to be mild or unlikely.
Negligible	The presence of the identified source does not give rise to the potential to cause significant harm

An overall risk matrix is presented in Table 14. In the column entitled 'Likelihood', an assessment is made of the probability of the selected source and receptor being linked by the identified pathway. This assessment is ranked based on site-specific conditions as follows:

- Very unlikely 0 to 5%
- Unlikely 5 to 45%
- Possible 45 to 55%
- Likely 55 to 95%
- Almost Certain 95 to 100% (ie impact noted during the investigation)

In cases of physical features, such as foundations and underground services, harm is defined as impact which would result in non-serviceability of the identified receptor or extra over build costs associated with redevelopment. On this basis, overall risk is assigned using the following overall risk matrix:

Table 14 Overall risk matrix					
Potential Consequence	**Likelihood**				
	Very Unlikely	**Unlikely**	**Possible**	**Likely**	**Almost Certain**
Severe	Low	Low	Moderate	High	Very High
Moderate	Negligible	Low	Moderate	Moderate	High
Mild	Negligible	Low	Low	Moderate	Moderate
Negligible	Negligible	Negligible	Negligible	Low	Low

In Table 15, a two stage assessment has been carried out based on the identified sources, pathways and receptors. Initially, the column designated as 'Potential Consequence of Contaminant - Receptor Linkage', gives an indication of the sensitivity of a given receptor to a particular source or contaminant of concern under consideration. It is a worst case classification and is based on full exposure via the particular linkage being examined.

5.4 Risk assessment summary

The qualitative risk assessment identified a high risk to construction workers during demolition and excavations from the historical or current bulk storage and use of hydrocarbons, potentially asbestos containing structures and equipment, uncontrolled filling and electrical transformers. Assessed risk to other critical receptors for these and other activities is considered to range from negligible to moderate and is not believed to represent a significant environmental concern to the site. Contamination potential for individual site properties, in accordance with the Victoria DSE *Potentially Contaminated Land, General Practice Note, 2005* (DSE, 2005) are summarized in Table 16 and indicated on Figure 4 presented in Appendix A.

Table 15 Qualitative risk assessment, PSP Area 25								
Source Activity	**Contaminant**	**Critical Receptor**	**Pathway**	**Potential Effects**	**Potential Consequence of Contaminant-Receptor Linkage**	**Likelihood of Source-Receptor Linkage**	**Risk Classification**	**Comments**
Large-scale agriculture (market gardens, intensive agriculture)	Heavy metals, pesticides, herbicides, fertilisers	Human (Current Site Users)	Dermal Contact, Ingestion, Inhalation	Toxic, Carcinogenic, Hazardous to Human Health	Severe	Possible	**Moderate**	
Large-scale agriculture (market gardens, intensive agriculture)	Heavy metals, pesticides, herbicides, fertilisers	Human (Future Site Users including construction workers)	Dermal Contact, Ingestion, Inhalation	Toxic, Carcinogenic, Hazardous to Human Health	Severe	Likely	**High**	Risk of exposure for construction workers
Large-scale agriculture (market gardens, intensive agriculture)	Heavy metals, pesticides, herbicides, fertilisers	Human (Adjacent Site Users)	Dermal Contact, Ingestion, Inhalation	Toxic, Carcinogenic, Hazardous to Human Health	Severe	Unlikely	**Low**	
Large-scale agriculture (market gardens, intensive agriculture)	Heavy metals, pesticides, herbicides, fertilisers	Groundwater	Permeation through Soil Profile	Groundwater Contamination	Severe	Possible	**Moderate**	
Large-scale agriculture (market gardens, intensive agriculture)	Heavy metals, pesticides, herbicides, fertilisers	Surface water	Perched Groundwater Flow, Surface run-off	Surface Water Contamination	Severe	Possible	**Moderate**	

Table 15 Qualitative risk assessment, PSP Area 25								
Source Activity	**Contaminant**	**Critical Receptor**	**Pathway**	**Potential Effects**	**Potential Consequence of Contaminant-Receptor Linkage**	**Likelihood of Source-Receptor Linkage**	**Risk Classification**	**Comments**
Large-scale agriculture (market gardens, intensive agriculture)	Heavy metals, pesticides, herbicides, fertilisers	Flora and Fauna	Leaching and uptake	Toxic, phytotoxic	Severe	Possible	**Moderate**	
Large-scale agriculture (market gardens, intensive agriculture)	Heavy metals, pesticides, herbicides, fertilisers	Services/ Infrastructure	Permeation through Soil Profile	Physical and chemical damage to structures	Mild	Very Unlikely	**Negligible**	
Structures (with possible asbestos, lead based paint and septic tanks)	Lead, asbestos, hazardous materials, pesticides, herbicides, faecal coliforms	Human (Current Site Users)	Dermal Contact, Ingestion, Inhalation	Toxic, Carcinogenic, Hazardous to Human Health	Severe	Possible	**Moderate**	
Structures (with possible asbestos, lead based paint and septic tanks)	Lead, asbestos, hazardous materials, pesticides, herbicides, faecal coliforms	Human (Future Site Users including construction workers)	Dermal Contact, Ingestion, Inhalation	Toxic, Carcinogenic, Hazardous to Human Health	Severe	Possible	**Moderate**	
Structures (with possible asbestos, lead based paint and septic tanks)	Lead, asbestos, hazardous materials, pesticides, herbicides, faecal coliforms	Human (Adjacent Site Users)	Dermal Contact, Ingestion, Inhalation	Toxic, Carcinogenic, Hazardous to Human Health	Severe	Unlikely	**Low**	

Table 15 Qualitative risk assessment, PSP Area 25								
Source Activity	**Contaminant**	**Critical Receptor**	**Pathway**	**Potential Effects**	**Potential Consequence of Contaminant-Receptor Linkage**	**Likelihood of Source-Receptor Linkage**	**Risk Classification**	**Comments**
Structures (with possible asbestos, lead based paint and septic tanks)	Lead, asbestos, hazardous materials, pesticides, herbicides, faecal coliforms	Groundwater	Permeation through Soil Profile	Groundwater Contamination	Severe	Possible	**Moderate**	
Structures (with possible asbestos, lead based paint and septic tanks)	Lead, asbestos, hazardous materials, pesticides, herbicides, faecal coliforms	Surface water	Perched Groundwater Flow, Surface run-off	Surface Water Contamination	Severe	Unlikely	**Low**	
Structures (with possible asbestos, lead based paint and septic tanks)	Lead, asbestos, hazardous materials, pesticides, herbicides, faecal coliforms	Flora and Fauna	Leaching and uptake	Toxic, phytotoxic	Moderate	Unlikely	**Low**	
Structures (with possible asbestos, lead based paint and septic tanks)	Lead, asbestos, hazardous materials, pesticides, herbicides, faecal coliforms	Services/ Infrastructure	Permeation through Soil Profile	Physical and chemical damage to structures	Mild	Very Unlikely	**Negligible**	
Abandoned vehicles, equipment and debris	Heavy metals, petroleum hydrocarbons, solvents, asbestos	Human (Current Site Users)	Dermal Contact, Ingestion, Inhalation	Toxic, Carcinogenic, Hazardous to Human Health	Severe	Possible	**Moderate**	

Table 15 Qualitative risk assessment, PSP Area 25								
Source Activity	**Contaminant**	**Critical Receptor**	**Pathway**	**Potential Effects**	**Potential Consequence of Contaminant-Receptor Linkage**	**Likelihood of Source-Receptor Linkage**	**Risk Classification**	**Comments**
Abandoned vehicles, equipment and debris	Heavy metals, petroleum hydrocarbons, VOCs, asbestos	Human (Future Site Users including construction workers)	Dermal Contact, Ingestion, Inhalation	Toxic, Carcinogenic, Hazardous to Human Health	Severe	Likely	**High**	Risk of exposure to construction workers
Abandoned vehicles, equipment and debris	Heavy metals, petroleum hydrocarbons, VOCs, asbestos	Human (Adjacent Site Users)	Dermal Contact, Ingestion, Inhalation	Toxic, Carcinogenic, Hazardous to Human Health	Severe	Unlikely	**Low**	
Abandoned vehicles, equipment and debris	Heavy metals, petroleum hydrocarbons, VOCs, asbestos	Groundwater	Permeation through Soil Profile	Groundwater Contamination	Severe	Possible	**Moderate**	
Abandoned vehicles, equipment and debris	Heavy metals, petroleum hydrocarbons, VOCs, asbestos	Surface Water	Perched Groundwater Flow, Surface run-off	Surface Water Contamination	Severe	Possible	**Moderate**	
Abandoned vehicles, equipment and debris	Heavy metals, petroleum hydrocarbons, VOCs, asbestos	Flora and Fauna	Leaching and uptake	Toxic, phytotoxic	Moderate	Possible	**Moderate**	

Table 15 Qualitative risk assessment, PSP Area 25								
Source Activity	**Contaminant**	**Critical Receptor**	**Pathway**	**Potential Effects**	**Potential Consequence of Contaminant-Receptor Linkage**	**Likelihood of Source-Receptor Linkage**	**Risk Classification**	**Comments**
Abandoned vehicles, equipment and debris	Heavy metals, petroleum hydrocarbons, VOCs, asbestos	Services/ Infrastructure	Permeation through Soil Profile	Physical and chemical damage to structures	Mild	Very unlikely	**Negligible**	
Fuel and solvent usage and storage	Heavy metals, petroleum hydrocarbons, VOCs	Human (Current Site Users)	Dermal Contact, Ingestion, Inhalation	Toxic, Carcinogenic, Hazardous to Human Health	Severe	Possible	**Moderate**	
Fuel and solvent usage and storage	Heavy metals, petroleum hydrocarbons, VOCs	Human (Future Site Users including construction workers)	Dermal Contact, Ingestion, Inhalation	Toxic, Carcinogenic, Hazardous to Human Health	Severe	Possible	**Moderate**	
Fuel and solvent usage and storage	Heavy metals, petroleum hydrocarbons, VOCs	Human (Adjacent Site Users)	Dermal Contact, Ingestion, Inhalation	Toxic, Carcinogenic, Hazardous to Human Health	Severe	Unlikely	**Low**	
Fuel and solvent usage and storage	Heavy metals, petroleum hydrocarbons, VOCs	Groundwater	Permeation through Soil Profile	Groundwater Contamination	Severe	Possible	**Moderate**	

Table 15 Qualitative risk assessment, PSP Area 25								
Source Activity	**Contaminant**	**Critical Receptor**	**Pathway**	**Potential Effects**	**Potential Consequence of Contaminant-Receptor Linkage**	**Likelihood of Source-Receptor Linkage**	**Risk Classification**	**Comments**
Fuel and solvent usage and storage	Heavy metals, petroleum hydrocarbons, VOCs	Surface water	Perched Groundwater Flow, Surface run-off	Surface Water Contamination	Severe	Possible	**Moderate**	
Fuel and solvent usage and storage	Heavy metals, petroleum hydrocarbons, VOCs	Flora and Fauna	Leaching and uptake	Toxic, phytotoxic	Moderate	Unlikely	**Low**	
Fuel and solvent usage and storage	Heavy metals, petroleum hydrocarbons, VOCs	Services/ Infrastructure	Permeation through Soil Profile	Physical and chemical damage to structures	Mild	Very unlikely	**Negligible**	
Small-scale agriculture	Heavy metals, pesticides, herbicides, fertilisers	Human (Current Site Users)	Dermal Contact, Ingestion, Inhalation	Toxic, Carcinogenic, Hazardous to Human Health	Severe	Unlikely	**Low**	Based on quantities of contaminants likely used
Small-scale agriculture	Heavy metals, pesticides, herbicides, fertilisers	Human (Future Site Users including construction workers)	Dermal Contact, Ingestion, Inhalation	Toxic, Carcinogenic, Hazardous to Human Health	Severe	Unlikely	**Low**	

Table 15 Qualitative risk assessment, PSP Area 25								
Source Activity	**Contaminant**	**Critical Receptor**	**Pathway**	**Potential Effects**	**Potential Consequence of Contaminant-Receptor Linkage**	**Likelihood of Source-Receptor Linkage**	**Risk Classification**	**Comments**
Small-scale agriculture	Heavy metals, pesticides, herbicides, fertilisers	Human (Adjacent Site Users)	Dermal Contact, Ingestion, Inhalation	Toxic, Carcinogenic, Hazardous to Human Health	Severe	Unlikely	**Low**	Based on quantities of contaminants likely used
Small-scale agriculture	Heavy metals, pesticides, herbicides, fertilisers	Groundwater	Permeation through Soil Profile	Groundwater Contamination	Severe	Unlikely	**Low**	
Small-scale agriculture	Heavy metals, pesticides, herbicides, fertilisers	Surface water	Perched Groundwater Flow, Surface run-off	Surface Water Contamination	Severe	Unlikely	**Low**	
Small-scale agriculture	Heavy metals, pesticides, herbicides, fertilisers	Flora and Fauna	Leaching and uptake	Toxic, phytotoxic	Severe	Unlikely	**Low**	
Small-scale agriculture	Heavy metals, pesticides, herbicides, fertilisers	Services/ Infrastructure	Permeation through Soil Profile	Physical and chemical damage to structures	Mild	Very unlikely	**Negligible**	
Animal husbandry	Nutrients, hormones, antibiotics	Human (Current Site Users)	Dermal Contact, Ingestion, Inhalation	Potentially hazardous to human health	Moderate	Possible	**Moderate**	

Table 15 Qualitative risk assessment, PSP Area 25								
Source Activity	**Contaminant**	**Critical Receptor**	**Pathway**	**Potential Effects**	**Potential Consequence of Contaminant-Receptor Linkage**	**Likelihood of Source-Receptor Linkage**	**Risk Classification**	**Comments**
Animal husbandry	Nutrients, hormones, antibiotics	Human (Future Site Users including construction workers)	Dermal Contact, Ingestion, Inhalation	Potentially hazardous to human health	Moderate	Unlikely	**Low**	
Animal husbandry	Nutrients, hormones, antibiotics	Human (Adjacent Site Users)	Dermal Contact, Ingestion, Inhalation	Potentially hazardous to human health	Moderate	Unlikely	**Low**	
Animal husbandry	Nutrients, hormones, antibiotics	Groundwater	Permeation through Soil Profile	Groundwater Contamination	Moderate	Unlikely	**Low**	
Animal husbandry	Nutrients, hormones, antibiotics	Surface water	Perched Groundwater Flow, Surface run-off	Surface Water Contamination	Moderate	Unlikely	**Low**	
Animal husbandry	Nutrients, hormones, antibiotics	Flora and Fauna	Leaching and uptake	Toxicity and antibiotic resistance	Moderate	Unlikely	**Low**	
Animal husbandry	Nutrients, hormones, antibiotics	Services/ Infrastructure	Permeation through Soil Profile	Physical and chemical damage to structures	Negligible	Very unlikely	**Negligible**	

Table 15 Qualitative risk assessment, PSP Area 25								
Source Activity	**Contaminant**	**Critical Receptor**	**Pathway**	**Potential Effects**	**Potential Consequence of Contaminant-Receptor Linkage**	**Likelihood of Source-Receptor Linkage**	**Risk Classification**	**Comments**
Off-site sources	Heavy metals, petroleum hydrocarbons, pesticides, herbicides, asbestos, VOCs	Human (Current Site Users)	Dermal Contact, Ingestion, Inhalation	Potentially hazardous to human health	Severe	Possible	**Moderate**	Age of truck stop (post 2006) limits risk from that source
Off-site sources	Heavy metals, petroleum hydrocarbons, pesticides, herbicides, asbestos, VOCs	Human (Future Site Users including construction workers)	Dermal Contact, Ingestion, Inhalation	Potentially hazardous to human health	Severe	Possible	**Moderate**	
Off-site sources	Heavy metals, petroleum hydrocarbons, pesticides, herbicides, asbestos, VOCs	Human (Adjacent Site Users)	Dermal Contact, Ingestion, Inhalation	Potentially hazardous to human health	Severe	Possible	**Moderate**	
Off-site sources	Heavy metals, petroleum hydrocarbons, pesticides, herbicides, asbestos, VOCs	Groundwater	Permeation through Soil Profile	Groundwater Contamination	Severe	Possible	**Moderate**	

Table 15 Qualitative risk assessment, PSP Area 25								
Source Activity	**Contaminant**	**Critical Receptor**	**Pathway**	**Potential Effects**	**Potential Consequence of Contaminant-Receptor Linkage**	**Likelihood of Source-Receptor Linkage**	**Risk Classification**	**Comments**
Off-site sources	Heavy metals, petroleum hydrocarbons, pesticides, herbicides, asbestos, VOCs	Surface water	Perched Groundwater Flow, Surface run-off	Surface Water Contamination	Severe	Possible	**Moderate**	Age of truck stop (post 2006) limits risk from that source
Off-site sources	Heavy metals, petroleum hydrocarbons, pesticides, herbicides, asbestos, VOCs	Flora and Fauna	Leaching and uptake	Toxicity and antibiotic resistance	Severe	Possible	**Moderate**	
Off-site sources	Heavy metals, petroleum hydrocarbons, pesticides, herbicides, asbestos, VOCs	Services/ Infrastructure	Permeation through Soil Profile	Physical and chemical damage to structures	Mild	Very unlikely	**Negligible**	

6. Summary

6.1 Site contamination

Review of the collected data indicates that the site has historic and current land use activities that have the potential to cause residual contamination in soils, surface water and groundwater. Specific potentially contaminating activities and potential areas of concern that were identified on PSP Area 25 include:

- An apparent out of production market garden on parcel 502095 (810 Summerhill Road).
- Farm equipment and abandoned automobiles stored on a number of site properties (eg 780 Donnybrook Road, 295 Brookville Drive and 220 Brookville Drive).
- Large scale intensive farming operations where fertilisers, pesticides, and herbicides may have been used (eg 30 Amaroo Road, 185 and 295 Brookville Drive).
- Small scale intensive farming operations where fertilisers, pesticides, and herbicides may have been used (eg 800 Donnybrook Road, 245 and 275 Brookville Drive, 770, 790, 835 and 840 Summerhill Road).
- Areas where abandoned vehicles, farm equipment, debris or dumping of unspecified materials have occurred (eg 720 Donnybrook Road, 30 Amaroo Road, 220 and 295 Brookville Drive, 920/920A Hume Highway and 60 Kinloch Court).
- Structures that may contain asbestos and have lead based paint and septic systems.

Specific off-site potentially contaminating activities and potential AECs that were identified in proximity to PSP Area 25 include:

- A large truck stop service station, constructed between 2006 and 2010, is located on the southwest corner of the interchange of Hume Freeway and Donnybrook Road.
- Potential transport of contamination from off-site sources hydraulically upgradient of the Area onto the site via Merri Creek or Kalkallo Creek.

6.2 Geotechnical

Limited geotechnical data are available for the site. The geology of PSP Area 25 is predominantly Pleistocene and Miocene basalts with minor scoria and ash belonging to the Newer Volcanic Group, overlain by Holocene quaternary alluvial deposits of gravel, sand and silt concentrated along existing creek courses. The site is predominantly overlain by sodosol-type soils which are found to vary in texture and depth though generally comprises clay and sand loam. Sodosols have a high clay content and high sodium which sometimes leads to dispersion and instability. Localised fill or natural reworked material deposits are likely to be present on site, especially around areas of recent development, however further investigation will be required to identify and delineate these occurrences. The key geotechnical constraints that may affect the development of PSP Area 25 are:

- Differential settlement of overlying residual clay in localised areas of extremely weathered basalt. Alluvial clay and silt deposits and localised un-engineered fill material may result in settlement of proposed road formations and structures. The alluvial sediments tend to be concentrated along existing creek courses, such as Merri Creek and Kalkallo Creek on PSP Area 25.

- Shallow soil failure (soil creep, slumping, collapse) in areas of increased gradient. Although PSP Area 25 is of a relatively gentle gradient, steeper slopes are noted in close proximity to surface water bodies such as Merri Creek. Weathered alluvial or residual material can be susceptible to shallow soil failure (soil creep, slumping and collapse) in areas of increased gradient.
- The presence of voids in scoria could result in the loss of stability or localised collapse hazard.
- Low bearing capacity within soft clay material or unconsolidated alluvial material can result in a loss of stability or potential collapse of structures during the construction phase of the development. The presence of soft material encountered at depth may result in a bearing capacity or settlement hazard for any proposed foundations.
- Clay likely to be derived from basalt rock is likely to be subject to considerable shrinkage or swelling in response to change in moisture content. Highly expansive clay can cause unexpected ground movements that are able to damage to building foundations, structures and road infrastructure. The published soils map indicates that the Area is predominantly overlain by sodosol-type soils which are found to vary in texture and depth though generally comprise clay and sand loam. Sodosols have a high clay content and high sodium which sometimes leads to dispersion and instability.
- Ephemeral creeks, primarily draining into Merri Creek, could serve as drainage channels during flood events, resulting in erosion of soft sediment and bedrock. Similar conditions could develop within the main channels of Merri Creek and Kalkallo Creek on PSP Area 25.

In general, PSP Area 25 is flat or gently undulating and soil cover is expected to be relatively thin. As such the risk of geotechnical hazards are considered low to moderate though a thorough understanding of the geological model will be required prior to development.

6.3 Hydrology

Two semi-ephemeral creeks, Merri Creek and Kalkallo Creek, are located on the northern half of the site. An unnamed semi-ephemeral creek is located on property numbers 501730 and 501779, east of Hume Freeway, in the northwest corner of the property, and drains into Kalkallo Creek. Occasional small ponds are located along each of these creeks, which generally drain toward the south. The site is within the Merri Creek catchment, a major tributary of the Yarra River Basin.

There is an UFZ at a minimum of 100 m either side of Merri Creek and Kalkallo Creek. This area has been identified as having a greater risk of flooding. A permit is required to carry out works in this area and must be consistent with the local Floodplain Development Plan.

Groundwater beneath the site is present in two main aquifers, the upper Newer Volcanics aquifer, a fractured rock basalt aquifer, and a deeper regional aquifer within the Silurian aged formation. Groundwater depth for the majority of the site is believed to be less than approximately 5 m.

The Victorian Water Resources Data Warehouse identified 30 registered boreholes within 1 km of the site. Borehole usage was primarily domestic and agricultural water supply with a small number of extractive industries boreholes.

6.4 Wetlands

Searches were conducted of the Directory of Important Wetlands in Australia and the DSE Biodiversity Interactive Map for Victoria. The South East Coastal Plain is the relevant bioregion for the Craigieburn PSP areas. No nationally important wetlands are listed for the PSP area.

The DSE Biodiversity Interactive Map provides information on the biodiversity of Victoria and displays flora and fauna data. The search was conducted for Ramsar Sites, Important Wetlands, 1788 Wetland

Categories and 1994 Wetland Categories. No wetland sites of National Environmental Significance or sites of state significance were identified within PSP Area 25.

6.5 Heritage sites

A search of the Hume Planning Scheme Heritage Overlay (sites of National, State, regional and local significance), Victoria Heritage Register/Database, Australian Heritage Database, Protected Matters Search Tool (Department of Sustainability, Environment, Water, Population and Communities) was performed to located sites of historic significance on the site. Although no heritage sites were identified on PSP Area 25, five specific heritage sites were identified immediately adjacent to PSP Area 25.

7. Recommendations

7.1 Contamination

Based upon our environmental desktop evaluation and a review of the publicly available information, we note that potential for site contamination may exist and as such further site investigations should be conducted for the subject site known as the PSP 25 Area near Craigieburn in the City of Hume, Victoria. In accordance with the Victoria DSE *Potentially Contaminated Land, General Practice Note, 2005* (DSE, 2005) recommendations for future assessment of individual site properties, based on use and potential for contamination are summarized in Table 16 and indicated on Figure 4 presented in Appendix A. Where land has been identified as potentially contaminated, a further investigation is necessary as part of the next stage of the planning process such as planning permit application or planning scheme amendment on a property by property basis (DSE, 2005).

Of the fifty-four (54) site properties, further assessment is recommended for twenty-two (22) properties, with recommendations for environmental audits on four additional properties. In general, recommendations for assessment were made based on sensitive land use, such as large-scale intensive agriculture. The presence of significant (more than 0.5 ha) small-scale agriculture, abandoned vehicles, farm equipment or unidentified debris was considered secondary indicators of the need for assessment in the case of sensitive land use. Environmental audits were recommended for the former market garden at 810 Summerhill Road and properties used for large-scale intensive agriculture at 30 Amaroo Road, 185 Brookville Drive and 295 Brookville Drive, each of which was considered at high potential for contamination based on past and present land use. Due to the limited nature of the site inspection, additional site properties may be recommended for assessment in the future based on receipt of additional information not available at the time of this assessment.

Intrusive sampling and analysis should be undertaken in accordance with *National Environment Protection (Assessment of Site Contamination) Measure* (1999 NEPM) and draft 2011 NEPM, Australian Standard (2005) *Guide to the investigation and sampling of sites with potentially contaminated soil Part 1: Non-volatile and semi-volatile compounds* (AS 4482.1-2005), Australian Standard (1999) *Guide to the sampling and investigation of potentially contaminated soil Part 2: Volatile substances* (AS 4482.2-1999) and Victoria Environment Protection Authority*, Industrial Waste Resource Guidelines* (IWRG) Soil Sampling, 2009. The results of the sampling and analysis would be compared with guideline values for protection of human health and the environment as well as waste disposal criteria (as applicable).

In addition, hazardous materials surveys should be carried out for structures identified for demolition or relocation. The surveys should address asbestos, lead-based paint, polychlorinated biphenyls in electrical fixtures, and hazardous materials storage. Should asbestos containing material be encountered during future investigations or construction, the testing, inspection and removal of asbestos materials are required by law to be undertaken by a suitably qualified and licensed asbestos specialist/removalist.

7.2 Geotechnical

It is recommended that further geotechnical assessment be undertaken across the site to aid the detailed design process for future construction in the PSP area on a project by project basis (ie road works and services on a PSP level or at the property development level for residences etc.). The purpose of the geotechnical assessment will be to undertake intrusive investigation to obtain information for the purposes of:

- Determining a better understanding of the sub-surface geological profile and hydrogeological conditions to develop an accurate geological model.
- Develop baseline geotechnical parameters to aid design, settlement and slope stability modelling (where required).
- Determine depth to rock head and degree of weathering within the upper layers of the bedrock.
- Determine the nature of factures and jointing within the underlying volcanic material.
- Determine the presence of voids within the underlying basalt material.

Appendix F (Look, 2007) provides a model to derive suitable intrusive investigation dependent on likely geological conditions and proposed structure. It is expected that all investigation within PSP Area 90 be categorised as GC1 or possibly GC2 where larger commercial structures may be required as part of the design.

7.3 Hydrology and wetlands

- UFZs should remain free of any significant development as they are at risk of flooding.
- Flood modelling should be undertaken to determine hydrologic effects that any new developments will have on the existing creek system, in particular existing culvert and bridge flow capacities.
- Waterways, including Merri Creek and Kalkallo Creek and associated low-lying areas will require feature surveys to provide detail of drainage patterns and inform planning for urban drainage systems.
- Drainage paths will need to be either maintained or diverted to ensure all areas are well drained during and after any development.

Table 16 Assessment recommendations by property, PSP Area 25						
Property No.	**Address**	**Legal description**	**Area (ha)**	**Historic Activities**	**Contamination Potential**	
					Sensitive Uses	**Other Uses**
23341	780 Donnybrook Road CRAIGIEBURN VIC 3064	Lot 1 LP 119619	8.2	Large farm buildings, small scale agriculture	Medium - B	Medium - C
23358	800 Donnybrook Road CRAIGIEBURN VIC 3064	Lot 2 LP 119619	8.2	Residential, farm buildings, small scale agriculture	Medium - B	Medium - C
23366	804 Donnybrook Road CRAIGIEBURN VIC 3064	Lot 1 TP 423925	0.4	Residential, farm buildings, small scale agriculture	Medium - B	Medium - C
26997	45 English Street DONNYBROOK VIC 3064	Lot 3 LP 119619	8.1	Residential, farm buildings, small scale agriculture	Medium - B	Medium - C
27003	65 English Street DONNYBROOK VIC 3064	Lot 4 LP 119619	8.4	Residential, farm buildings, tanks, animal husbandry	Medium - B	Medium - C
27011	90 English Street DONNYBROOK VIC 3064	CP 174104	33.3	Small scale agriculture	Low - C	Low - C
27037	80 English Street DONNYBROOK VIC 3064	Lot 1 TP 844886	30.9	Oval dirt racetrack	Low - C	Low - C
66548	25 Norman Road DONNYBROOK VIC 3064	CP 172167 RESERVE	16.1	Non-residential building and oval dirt racetrack	Low - C	Low - C
397661	750 Donnybrook Road CRAIGIEBURN VIC 3064	Lot 1 TP 125838	26.1	Residential, farm buildings, tanks, animal husbandry	Medium - B	Medium - C
411710	810 Donnybrook Road CRAIGIEBURN VIC 3064	CP 159200	0.3	Farm buildings, small scale agriculture	Medium - B	Medium - C
501719	25 Amaroo Road CRAIGIEBURN 3064	Lot 4 LP 205880	12.9	Residential and farm buildings	Low - C	Low - C
501720	65 Amaroo Road CRAIGIEBURN 3064	Lot 7 LP 205880	12.1	Residential buildings, debris	Low - C	Low - C

Table 16 Assessment recommendations by property, PSP Area 25						
Property No.	**Address**	**Legal description**	**Area (ha)**	**Historic Activities**	**Contamination Potential**	
501721	85 Amaroo Road CRAIGIEBURN 3064	Lot 8 LP 205880	11.9	Debris and soil piles, small-scale agriculture	Medium - B	Medium - C
501722	30 Amaroo Road CRAIGIEBURN 3064	Lot 2 PS 518232	8.0	Residential, farm buildings, intensive agriculture, debris	High - A	High - B
501723	50 Amaroo Road CRAIGIEBURN 3064	Lot 3 PS 518232	7.6	Intensive agriculture	Medium - B	Medium - C
501724	105 Brookville Drive CRAIGIEBURN VIC 3064	Lot 1 PS 518231	12.7	Residential buildings, small-scale agriculture	Low - C	Low - C
501725	165 Brookville Drive CRAIGIEBURN VIC 3064	Lot 10 LP 205835	12.1	Residential buildings, small-scale agriculture	Low - C	Low - C
501726	185 Brookville Drive CRAIGIEBURN VIC 3064	Lot 6 LP 205834	20.9	Farm buildings, market garden	High - A	High - B
501727	225 Brookville Drive CRAIGIEBURN VIC 3064	Lot 5 LP 205834	9.0	Residential, farm buildings, small scale agriculture	Medium - B	Medium - C
501728	245 Brookville Drive CRAIGIEBURN VIC 3064	Lot 24 PS 616391	8.7	Residential, farm buildings, small scale agriculture	Medium - B	Medium - C
501729	275 Brookville Drive CRAIGIEBURN VIC 3064	Lot 23 PS 616391	8.4	Farm buildings, small scale agriculture	Medium - B	Medium - C
501730	295 Brookville Drive CRAIGIEBURN VIC 3064	Lot 22 PS 616391	7.8	Residential, farm buildings, small scale agriculture, abandoned automobiles	High - A	High - B
501731	180 Brookville Drive CRAIGIEBURN VIC 3064	Lot 7 LP 205834	20.9	Small-scale agriculture	Low - C	Low - C
501732	220 Brookville Drive CRAIGIEBURN VIC 3064	Lot 8 LP 205834	20.6	Farm buildings, abandoned vehicles, debris	Medium - B	Medium - C

Table 16 Assessment recommendations by property, PSP Area 25						
Property No.	**Address**	**Legal description**	**Area (ha)**	**Historic Activities**	**Contamination Potential**	
501733	230 Brookville Drive CRAIGIEBURN VIC 3064	Lot 9 LP 205833	8.9	Non-residential building, small-scale agriculture	Low - C	Low - C
501734	270 Brookville Drive CRAIGIEBURN VIC 3064	Lot 10 LP 205833	9.0	Non-residential building, small-scale agriculture	Low - C	Low - C
501735	290 Brookville Drive CRAIGIEBURN VIC 3064	Lot 11 LP 205833	9.1	Non-residential building, small-scale agriculture	Low - C	Low - C
501779	315 Brookville Drive CRAIGIEBURN VIC 3064	Lot 21 PS 616391	3.7	Small-scale agriculture	Low - C	Low - C
501781	310 Brookville Drive CRAIGIEBURN VIC 3064	Lot 20 PS 616397	9.6	Farm building, small-scale agriculture	Low - C	Low - C
501782	670 Donnybrook Road CRAIGIEBURN VIC 3064	Lot 1 TP 324690 RES1 PS 616393 MUNICIPAL RESERVE RES2 LP 133012	15.7	Cricket ground and building	Low - C	Low - C
501783	700 Donnybrook Road CRAIGIEBURN VIC 3064	Lot 1 LP 71220	2.9	Residential and farm buildings, small-scale agriculture	Low - C	Low - C
501784	714 Donnybrook Road CRAIGIEBURN VIC 3064	Lot 1 LP 70557	0.5	Residential buildings	Low - C	Low - C
501785	720 Donnybrook Road CRAIGIEBURN VIC 3064	Lot 1 TP 411428	0.8	Residential, miscellaneous dumping	Medium - B	Medium - C
501955	920A Hume Highway CRAIGIEBURN 3064	Lot 2 PS 518231	17.1	Residential, farm buildings, small scale agriculture, tanks, debris	Medium - B	Medium - C

Table 16 Assessment recommendations by property, PSP Area 25						
Property No.	**Address**	**Legal description**	**Area (ha)**	**Historic Activities**	**Contamination Potential**	
501956	920 Hume Highway CRAIGIEBURN 3064	Lot 2 PS 518231	17.1	Residential, farm buildings, small scale agriculture, tanks, debris	Medium - B	Medium - C
501904	980 Hume Highway CRAIGIEBURN 3064	Lot 1 TP 830130	9.6	Small-scale agriculture	Low - C	Low - C
501953	70 Amaroo Road CRAIGIEBURN 3064	Lot 4 PS 518232	6.5	Farm building, small-scale agriculture	Low - C	Low - C
501984	10 Kinloch Court CRAIGIEBURN 3064	Lot 11 LP 205835	13.2	Farm buildings, small-scale agriculture	Low - C	Low - C
501985	20 Kinloch Court CRAIGIEBURN 3064	Lot 12 LP 205835	12.3	Farm building, abandoned equipment, debris	Medium - B	Medium - C
501986	30 Kinloch Court CRAIGIEBURN 3064	Lot 13 LP 205835	12.3	Residential and farm buildings, small-scale agriculture	Low - C	Low - C
501987	40 Kinloch Court CRAIGIEBURN 3064	Lot 14 LP 205835	12.3	Small-scale agriculture	Low - C	Low - C
501988	50 Kinloch Court CRAIGIEBURN 3064	Lot 15 LP 205835	14.3	Residential and farm buildings, small-scale agriculture	Low - C	Low - C
501989	60 Kinloch Court CRAIGIEBURN 3064	Lot 16 LP 205835	13.5	Non-residential buildings, debris, dumping	Medium - B	Medium - C
501990	70 Kinloch Court CRAIGIEBURN 3064	Lot 17 LP 205835	12.8	Farm building, small-scale agriculture	Low - C	Low - C
501991	80 Kinloch Court CRAIGIEBURN 3064	Lot 18 LP 205835	14.3	Farm building, small-scale agriculture	Low - C	Low - C

Table 16 Assessment recommendations by property, PSP Area 25						
Property No.	**Address**	**Legal description**	**Area (ha)**	**Historic Activities**	**Contamination Potential**	
502087	745 Summerhill Road CRAIGIEBURN 3064	Lot 6 LP 205880	12.1	Well building	Low - C	Low - C
502088	755 Summerhill Road CRAIGIEBURN 3064	Lot 5 LP 205880	12.0	Small-scale agriculture	Low - C	Low - C
502089	835 Summerhill Road CRAIGIEBURN 3064	Lot 1 PS 518232	8.9	Farm buildings, small scale agriculture	Medium - B	Medium - C
502093	770 Summerhill Road CRAIGIEBURN 3064	Lot 3 LP 143296	12.3	Residential and farm buildings, small scale agriculture	Medium - B	Medium - C
502094	790 Summerhill Road CRAIGIEBURN 3064	Lot 4 LP 143296	12.4	Residential and farm buildings, tanks, small scale agriculture	Medium - B	Medium - C
502095	810 Summerhill Road CRAIGIEBURN 3064	Lot 5 LP 143296	12.3	Residential and farm buildings, market garden	High - A	High - B
502096	840 Summerhill Road CRAIGIEBURN 3064	Lot 6 LP 143296	12.4	Farm buildings, small scale agriculture	Medium - B	Medium - C
502097	860 Summerhill Road CRAIGIEBURN 3064	Lot 7 LP 143296	9.0	Residential and farm buildings	Low - C	Low - C
671180	620 Donnybrook Road CRAIGIEBURN VIC 3064	RES1 PS 616391 ROADS CORPORATION RESERVE	9.2	Non-residential building, road right of way	Low - C	Low - C
Notes: Under Section 12(2)(b) and Section 60(1)(a)(iii) of the Planning and Environment Act 1987 and Victoria DSE Potentially Contaminated Land, General Practice Note, 2005; A - requires an environmental audit B - requires a site assessment C – no assessment required						

8. References

Australian and New Zealand Environment and Conservation Council (ANZECC) & National Health and Medical Research Council (NHMRC), 1992, *Guidelines for the Assessment and Management of Contaminated Sites,* January.

Australian Standards, 1999, *Guide to the sampling and investigation of potentially contaminated soil Part 2: Volatile substances* (AS 4482.2-1999).

Australian Standards, 2005, *Guide to the investigation and sampling of sites with potentially contaminated soil Part 1: Non-volatile and semi-volatile compounds* (AS 4482.1-2005).

Department of Sustainability and Environment (DSE), 2005. *Potentially Contaminated Land, General Practice Note*, June 2005.

DSE, 2012a. *Watertable Depth,* [Online]. © The State of Victoria, 1996 – 2012. Available: http://www.water.vic.gov.au/__data/assets/pdf_file/0012/55011/691S_Atlas-map_WT-depth.pdf, 16 July 2012.

DSE, 2012b. *Victoria Water Resource Data Warehouse.* © The State of Victoria, 1996 – 2012. Available: http://www.vicwaterdata.net/vicwaterdata/home.aspx Last updated 1 July 2012 .

Department of Sustainability, Environment, Water, Population and Communities (DSEWPC), 2010. *Australian Wetlands Database.* © Commonwealth of Australia. Available: http://www.environment.gov.au/water/topics/wetlands/database/diwa.html Last updated 10 May 2010.

DSEWPC, 2011. *Protected Matters Search Tool – Interactive Map.* © Commonwealth of Australia. Available: http://www.environment.gov.au/arcgis-framework/apps/pmst/pmst.jsf Last updated 15 November 2011

DSEWPC, 2012. *Australian Heritage Database.* © Commonwealth of Australia. Available: http://www.environment.gov.au/cgi-bin/ahdb/search.pl

Environment Protection Authority (EPA) Victoria 2009a. *Industrial Waste Resource Guidelines - Sampling and Analysis of Waters, Wastewaters, Soils and Wastes*, June 2009, IWRG701.

EPA Victoria 2009b, *Industrial Waste Resource Guidelines - Soil Sampling*, June 2009, IWRG702.

EPA Victoria, 2012a. *Priority Sites Register.* © The State of Victoria, 1996 – 2012. Available: http://www.epa.vic.gov.au/land/docs/PSR-access-register.pdf Date generated 23 May 2012.

EPA Victoria, 2012b. *Issued Certificates and Statements of Environmental Audits*. © The State of Victoria, 1996 – 2012. Available: http://www.epa.vic.gov.au/envaudit/search-environmental-audits.asp Last updated: 31 May 2012.

Heritage Victoria, 2012. *Victorian Heritage Database.* Available: http://vhd.heritage.vic.gov.au/ Build 91 (26489). 5 July 2012.

Isbell, R. F. 2002. The Australian Soil Classification. Revised Edition. CSIRO Publishing, Melbourne.

Look, Burt, 2007. *Handbook of Geotechnical Investigation and Design Tables.* Taylor & Francis/Balkema, London, UK.

National Environment Protection Council (NEPC). 1999. *National Environment Protection (Assessment of Site Contamination) Measure (NEPM), 1999.*

NEPC, 2011 *National Environment Protection (Assessment of Site Contamination) Measure (NEPM), draft 2011.*

National Resource Information Centre (NRIC) (1991). The Digitial Atlas of Australian Soils – scanned tracings. (unpublished).

New South Wales Department of Environment, Climate Change and Water, 1994, *Guidelines for Assessing Service Station Sites*, December.

Northcote, K. H. with Beckmann, G. G., Bettenay, E., Churchward, H. M., Van Dijk, D. C., Dimmock, G. M., Hubble, G. D., Isbell, R. F., McArthur, W. M., Murtha, G. G., Nicolls, K. D., Paton, T. R., Thompson, C. H., Webb, A. A. and Wright, M. J. (1960-1968). Atlas of Australian Soils, Sheets 1 to 10. With explanatory data (CSIRO Aust. and Melbourne University Press: Melbourne).

Planning Maps Online, Department of Planning and Community Development (DPCD) (1996-2011), [Online], Available: http://services.land.vic.gov.au/maps/pmo.jsp, 6 July 2011.

State Environment Protection Policy (SEPP), *Groundwaters of Victoria*, December 1997, No. S160.

State Environment Protection Policy (SEPP), *Prevention and Management of Contaminated Land*, June 2002, No. S95.

State Environment Protection Policy (SEPP), *Waters of Victoria*, October 2004, No. S210.

Vandenberg, A.H.M., 1997. Melbourne SJ 55-5 Edition 2, 1:250 000 Geological Map Series 1:250,000 geological map. Geological Survey of Victoria.

Victoria, 2000, *Code of Practice for the Storage and Handling of Dangerous Goods*, No. 27, 8 December.

Victoria Department of Primary Industries (DPI), 2012. GIS system, *GeoVic version 2.* Available: http://mapshare2.dse.vic.gov.au/MapShare2EXT/imf.jsp?site=geovic © The State of Victoria, 2002 – 2012. Last update: 2012/02/08