November 2014

MCPHERSON PRECINCT STRUCTURE PLAN (PSP 1055)

Environmental, Hydrological and Geotechnical Assessment Report

COMMERCIAL IN CONFIDENCE

Submitted to:
Metropolitan Planning Authority
Level 29
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REPORT

Report Number. 147612091-002-R-Rev0

Distribution:

Metropolitan Planning Authority - 1 Copy
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1.0 INTRODUCTION

The Metropolitan Planning Authority (MPA) has engaged Golder Associates Pty Ltd (Golder) to undertake a environmental, hydrological and geotechnical assessment of the McPherson Precinct (herein referred to as the 'Study Area') (Figure 1).

Works were undertaken in general accordance with our proposal (reference: P47612168-001-P-Rev0) dated 18 June 2014.

We understand that this report will be used by MPA to support preparation of the McPherson Structure Plan (PSP 1055) in partnership with the City of Casey.

Your attention is drawn to the document 'Limitations', which is included as an attachment to this report in Appendix E. The statements presented in this document are intended to advise you of what your realistic expectations of this report should be. The document is not intended to reduce the level of responsibility accepted by Golder, but rather to ensure that all parties who may rely on this report are aware of the responsibilities each assumes in so doing.

1.1 Background Definition of the Study Area and Current Planning Information

The McPherson Precinct is an area of approximately 952 hectares and is located in the urban growth boundary within the City of Casey. The general characteristics of the Study Area are as follows:

- The precinct was created as a result of the extension of the Urban Growth Boundary through Amendment V68 passed by the Victorian Government in July 2010.
- The Study Area is bound by the Thompsons Road (PSP 1053) and the Clyde Creek (PSP 1054) Precincts to the west and is located at the eastern edge of the Casey sub-corridor.
- The Study Area will be planned for residential uses supporting approximately 11,000 lots, with a regional park adjacent to Cardinia Creek.
- A review of aerial photograph shows that the Study Area is predominantly used as agricultural land.
- The Study Area is partially bounded by Cardinia Creek to the north east.

Based on available information , no specific planning zones have been designated for the Study Area. For the purpose of the assessment, we have assumed that the development will include a mix of the following land uses:

- residential (low and high density)
- commercial
- public and open space.

To assist with the assessment process, the Study Area has been sub-divided into four sub-areas (North, East, Central and South) as outlined in Table 1, which also outlines the planning scheme zones that currently apply. The current zoning and overlay maps of the Study Area are provided in Appendix C5.

Table 1: Precinct Location and Planning Information

Sub-Areas	Approx. Area (ha)	Suburb	Current Zoning*	Current Overlays**
North	265	■ Clyde North	■ UGZ ■ UFZ ■ RCZ ■ FZ2	■ LSIO ■ ESO6
East	72	■ Clyde North	■ UGZ ■ UFZ ■ RCZ	■ HO16 ■ LSIO ■ ESO6
Central	224	■ Clyde North	■ UGZ	■ LSIO
South	316	■ Clyde	■ UGZ ■ UFZ	■ HO130 ■ LSIO

* Zoning overlays: UGZ – Urban Growth Zone, UFZ - Urban Flood Zone, RCZ – Rural Conservation Zone, FZ2 – Farming Zone (Schedule 2)

**Overlay definitions: ESO6 – Environmental Significance Overlay: Schedule 6, LSIO – Land Subject to Inundation Overlay, HO – Heritage Overlay.

1.2 Existing Uses at the Study Area

The Study Area is mostly used for agricultural purposes including cropping, livestock and horse agistment/training.

1.3 Topographical Information

The MPA has supplied Golder with a topographical data set for the Study Area (Figure 3C).

In general, the Study Area slopes to the south, ranging in level from an elevation of approximately 35 m Australian Height Datum (AHD) in the north west to 10 m AHD in the south.

2.0 STUDY OBJECTIVES AND METHODOLOGY

The objective of the assessment is to undertake a geotechnical, environmental and hydrogical assessment of the Study Area and provide a summary of key geotechnical and environmental issues to support preparation of PSP 1055 for development of the Study Area, as follows:

- Potential contamination sites, geotechnical conditions and constraints within the Study Area in the context of its proposed future development.
- Implications for the future urban development of the Precinct and in particular provide recommendations regarding development constraints, remediation and potential uses.
- Areas for further investigation including areas where further assessment and/or management may be required.

Particularly, the following specific objectives were indentified for each component of the assessment:

- Geotechnical and hydrological:
  - Assess the likely subsurface conditions in the Study Area, including possible presence of fill and the expected depth to groundwater.
  - Review available aerial photography to assess the possibility of previous cut or fill earthworks, or quarrying activities, in the Study Area.
  - Comment on the Study Area geomorphology, including assessment of potential course change of Cardinia Creek over time.
  - Provide comments relating to the founding conditions likely to be encountered at the Study Area and likely footing systems and site classification (in accordance with Australian Standards AS2870 – 2011 Residential Slabs and Footings).
  - Provide comments with respect to the potential development uses of the Study Area based on the results of the findings of the desk study.
  - Identify key constraints regarding the Study Area ground conditions.
  - Provide recommendations on the need, if any, for additional geotechnical investigations to supplement the preliminary assessment information, sufficient to allow planning of geotechnical aspects for the study area.
- Environmental:
  - Identify potential contamination activities and associated contaminants for land parcels within the Study Area and adjacent (up to 150 m) to the Study Area.
  - Categorise potential level of contamination into High, Medium, Low with respect to the potential to develop the land.
  - Advise on the likely impact of the identified or potential contamination on the development scenarios being considered for the precinct.
  - Where possible provide high level information about Study Area specific contamination.
  - Recommend further assessment and/or strategies for planners to consider the identified or potential contaminated land impacts as part of the planning process.

The methodology followed to undertake the assessment and meet the above objectives included the following tasks:

- A review of available geotechnical, hydrological and environmental information (i.e. geologiocal maps, historical aerial photography, planning overlays, etc.) including previous Golder reports in (or adjacent to) the Study Area.
- A reconnaissance in the form of a 'drive-by' around the Study Area on public roads to make general observations that may be relevant to the proposed development and verify some of the data obtained as part of the desktop review.
- A high level review of the readily available Audit reports for sites within and in the vicinity of the Study Area.
- Review of relevant regulatory and planning guidelines and applicable Australian Standards.
- Undertake some limited targeted combined geotechnical and environmental investigations within the Study Area, which included:
  - Excavation of ten test pits across the McPherson PSP area using a backhoe to a maximum depth of between 3 m and 4 m. Location of test pits, description of the materials encountered, field tests and sample recovery were recorded. The locations of the test pits were measured using a hand held GPS unit. Test pits were backfilled in layers and nominally compacted using the machine bucket.
  - Collection and analysis of geotechnical samples: A Golder engineer observed and recorded the natural and fill materials encountered. Bulk disturbed samples were collected from each pit for geotechnical laboratory testing. Geotechnical testing was undertaken at Golder's NATA registered Melbourne laboratory and included particle size distribution (PSD) testing of seven representative samples.
  - Collection and analysis of environmental samples included a visual and odour assessment of the soil profile, screening soil samples with a photo ionisation detector for the presence of volatile organic compounds and collection soil samples for laboratory testing. Samples were sent to a NATA registered laboratory under chain of custody conditions within a chilled storage container.
- Presentation of findings of the above activites, assessment of risks for the proposed development and provision of recommendations, strategies and further assessents required to mitigate those risks.

2.1 References

Documents, references and other sources of information used as part of the assessment are listed in Section10.0. Key information identified during the review are provided in various appendices of this report, as follows:

- Appendix A – Drive-by Assessment Photographs
- Appendix B – Summary of Geotechnical Information
- Appendix C – Summary of Contamination Information
- Appendix D – DSE Potentially Contaminated Land – General Practice Note, June 2005
- Appendix E – Summary of Stage 2 Results
- Appendix F - Limitations

3.0 DESCRIPTION OF STUDY AREA

Golder undertook a preliminary review of available information relevant to future development of the Study Area. We have reviewed:

- published geological information
- past projects in which Golder has been involved in the immediate area surrounding the Study Area
- historical aerial photographs.

We also undertook a walkover to identify potential geotechnical aspects which may affect the proposed development of the Study Area and undertook an intrusive investigation comprising of the excavation of ten test pits.

The results of the desktop assessment and intrusinve investigation are presented below and our geotechnical recommendations are presented in Section 4.0.

3.1 Previous Experience in the Vicinity of the Study Area

Golder has access to the results of geotechnical investigation works undertaken in the vicinity of the Study Area. These include:

- environmental, hydrogeological, and geotechnical desk top studies for sites in Casey,
- due diligence assessments of land in Clyde North, and
- Phase 1 and Phase 2 Environmental Site Assessments for numerous sites in Clyde North.

The results of these investigations provide a conceptual basis for some of the findings and recommendations contained within this report.

3.2 Existing Uses within the Study Area

Based on an initial review of aerial photographs and maps of the Study Area, it is evident that the predominant land use comprises fields for agriculture. Horse stables and cattle grazing paddocks are common place.

There are several farm dams scattered across the Study Area, as well as a series of man-made drainage channels which run approximately north to south.

A major power transmission line comprising steel lattice towers and overhead power cables with an associated easement cross the north of the Study Area, from east to west.

The desalination pipeline crosses through the centre of the Study Area, approximately adjacent to the alignment of Pound Road.

A zone marked for conservation is present along the banks of Cardinia Creek, covering an area of approximately 70 hectares in the south east corner of the Study Area.

The northern most boundary is marked by the drop structure on Cardinia Creek, which extends north beyond the study area boundary.

3.3 Topographical Information

Golder has reviewed topographic information for the Study Area. In general, the Study Area slopes gently to the south east, as shown in Figure 3C. There are subtle local variations which predominantly relate to drainage, either natural historic networks or recent man-made modifications. Other subtle variations include farm dams and roads / access tracks constructed on embankments.

The topographic levels vary between approximately 28 m Australian Height Datum (AHD) in the north, to 15 m AHD in the south.

3.4 Hydrogeological Setting

The Study Area is located in the Western Port Basin. According to the hydrogeological Map of the Western Port Basin (1:100,000) (Hydrogeological Map of Western Port Basin, 1980) and associated explanatory notes, there are several hydrostratigraphic units within the Study Area which may act as aquifers. A summary of the these main units is provided in Table 2.

Table 2: Summary of regional aquifers

Geological Unit	Hydrogeological Classification	Aquifer yield potential
Strzelecki Group	Aquifer, unconfined or semi-confined, fractured rock medium (sandstone and mudstone)	Typically low
Childers Formation	Aquifer, confined to semi-confined porous medium (sands and gravels with lignite and hard carbonauceous clay beds)	Variable, potentially high where coarse sand and gravel are present
Older Volcanics	Aquifer, confined to semi-confined, fractured rock medium, hydraulic conductivity ranging from low (where unit is weathered or massive) to high (where unit is highly fractured)	Highly variable dependent on degree of weathering and development of fractures
Western Port Group (Baxter, Sherwood and Yallock formations)	Aquifer, unconfined (expect where overlayn by clayey soils), porous medium (unconsolidated sands and gravels)	Medium yielding where sandy but aquitard where clayey
Quaternary dune and alluvial deposits	Aquifer, unconfined, porous medium (clays, silts, sands and gravels)	Low yield

The majority of the Study Area is underlain by Quaternary (Recent) deposits (silt, sand, clay, peaty clay and occasional gravel) and the Tertiary (Miocene) Baxter Sandstone formation of the Western Port Group. The Baxter Sandstone consists of ferruginous sandstone, sand, sandy clay and occasional gravel.

A review of investigations undertaken in the vicinity of the Study Area and publicly available material suggests that groundwater is typically encountered within 5 m of the ground surface with total dissolved solidis (TDS) concentrations highly variable and ranging between 300 mg/L and 5,000 mg/L.

Groundwater at a regional scale is expected to discharge to the south to Western Port Bay. Cardinia Creek along the north eastern boundary of the Study Area is a potential local discharge zone for groundwater.

3.5 Geomorphology

The DEPI categorises the geomorphological unit for the Study Area as ‘sunken alluvial planes’. These regional-scale alluvial planes developed in the lower reaches of the Dandenong, Cardinia and Tynong Creeks. The drainage from the creeks flowed into swamps and lagoons across the alluvial planes. These swamps and lagoons have since been drained. These drains now confine the flows of these rivers and streams of the sunken alluvial planes.

Using this description as a starting point, the geomorphology of the Study Area, including the general slopes and the drainage patterns, was assessed using the aerial photographs, topographical map and the findings

of the Study Area walkover. The following report sections elaborate on the DEPI categorisation to present an overview of the geomorphological conditions across the Study Area.

3.5.1 Slopes and Features

With the exception of the depression at the east side of the Study Area associated with Cardinia Creek, the Study Area is generally flat with a gradual grade trending down in a south-southeast direction. These relatively flat low lying areas show evidence of swamps and soft deposits consistent with a slow moving and flooding riverine environment.

The man-made irrigation channels which drained the swamps have levees that are presumed to have been formed from the material excavated during their construction.

There are few natural slopes in the Study Area other than those associated with the banks of Cardinia Creek. These creek bank slopes show evidence of ongoing erosion and deposition, discussed further in Section 4.10. No evidence of slope instability was observed during the Study Area walkover, although ongoing erosion is likely to trigger localised oversteepening and instability of sections of the river bank over time.

3.5.2 Hydrology and Drainage

The geomorphology of the Study Area is primarily a function of the evolving drainage. The nearest surface water bodies are Cardinia Creek and Clyde Creek. Both creeks generally flow in a south-easterly direction, discharging into Western Port Bay, approximately 11 km south of the Study Area.

In general, the majority of surface water across the Study Area is inferred to drain naturally towards the south east. This includes the series of manmade drainage channels which assist in the drainage of the land. These channels, many of which pre-date the 1960s (based on aerial photograph interpretation) allow the land to be sufficiently drained to enable grazing.

In addition to the man made drainage channels, aerial photographs show the Study Area to be covered by a series of natural historical drainage paths. Many of the historical drainage paths are now dry at the surface, although their approximate location is identifiable from aerial images, whilst others are dammed by a series of small earth dams and associated ponds.

It is noted that the northern and eastern extents of the Study Area are currently categorised as ‘Land Subject to Inundation’ on the current Department of Transport, Planning and Local Infrastructures planning overlay. The extent of the land subject to the inundation overlay is shown in Figure 5.

The Hydrolgeological Map of Western Port Basin indicates that the water gauging station on Cardinia Creek (to the far south east of the Study Area and down-stream of the drop structure) recorded the flow volume in the Creek as 20.75 $m^3 * 10^4$ per year, for the 117 km^2 area of catchment.

It is evident that surface water drainage of the Study Area is likely to be one of the most important considerations for development.

Regarding the groundwater in the Study Area, the Hydrogeological Map of Western Port Basin indicates that the Study Area encompasses the northern limit of the tertiary aquifer, although water yields are anticipated to be low (< 2.5 L/s) and the water of high salinity (>2000 mg/L TDS). The flow of groundwater is anticipated to be approximately to the south east. The depth to the aquifer is anticipated to be less than 15 m below existing ground level, although perched groundwater is anticipated within the alluvial sediments. Given the topography and geomorphology of the sunken alluvial planes, we anticipate encountering some groundwater within a couple of meters of the ground surface.

3.5.3 Vegetation

The DEPI reference to vegetation of the ‘sunken alluvial planes’ describes the original vegetation as comprising swamp scrub, swampy grasslands and grasslands. Some of this swampland may have become invaded by swamp scrub following drainage.

This coincides with much of the vegetation observed during the walkover, which was predominantly swampy grasslands and grasslands for cattle grazing.

3.6 Published Geological Information

The 1:63,360 scale 'Cranbourne' map sheet; the 1:25,000 scale 'Pakenham' mapsheet; and the 1:25,000 scale 'Berwick' map sheets have been reviewed. These geological maps (published by the Geological Survey of Victoria) indicate the Study Area to be predominantly underlain by Quaternary aged alluvial materials (sand, gravel, silt and clay with some organic content). Some peaty swamp deposits may also be encountered near the south west of the Study Area, shown in an isolated region near Patterson Road and Pound Road. Cardinia sand deposits may be found near the creek to the east of the Study Area. The Cardinia sand is inferred as relating to the alluvial deposits.

The 1:25,000 scale map also provides a cross section which transects to the east of the Study Area. The section indicates that the alluvial materials are underlain by Pliocene and Miocene aged materials of the Baxter Formation and Werribee Formation. The Baxter Formation is described as a poorly consolidated sandy clay. The Werribee Formation is described similarly, though with the possible inclusion of fissile clay bands. The 1:63,360 scale geological map suggests that alluvial deposits are absent in the south western section of the Study Area, where the Baxter Formation may be encountered close to the existing ground surface.

Based on the information shown on the geological section, the thickness of the alluvial deposits is anticipated to be between about 4 m and 10 m (although this may vary with proximity to water bodies). The combined Baxter and Werribee Formations are anticipated to be between about 10 m and 20 m thick, beneath which the Silurian age Siltstone and Sandstone of the Melbourne Formation is anticipated.

3.7 Expected Subsurface Conditions

A conceptual geological model based on the available information has been created for the Study Area. This conceptual geological model has been broken down into units which are summarised below. The units described are based on findings of the desktop study. Further information regarding soil properties is included in Section 4, which discusses the findings of the intrusive test pit investigation in conjunction with the desktop study.

Unit 1 – Fill and Topsoil

At the majority of locations within the Study Area, it is expected that a variably thick layer of fill or topsoil will be present. Farming areas may have a layer of topsoil associated with farming and grazing activities. The thickness and extent of topsoil is generally expected to be approximately 100 mm to 500 mm.

In the vicinity of Cardinia Creek, Clyde Creek, or other current or relict drainage channels, the topsoil may be less prominent, with alluvial soils exposed on the surface due to flooding or rain wash.

The thickness of fill (where present) is less predictable. Based on our experience at sites with a similar history, we would expect that fill materials, where they exist, would generally extend between about 0.5 m to 3 m below the ground surface level. However, in the vicinity of road embankments, levees, or backfilled quarry pits/ ponds/depressions the fill may be considerably thicker.

The findings of the intrusive test pit investigation are generally consistent with the expected subsurface conditions and identified fill and or topsoil at all ten test pit locations.

Unit 2 – Swamp Deposits

The 1:63,360 scale geological map suggest that recent swamp deposits may be present within the Study Area, overlying the Baxter Formation in some locations. Published information suggests the swamp deposits are likley to comprise peaty clay and clay.

The recently deposited materials are anticipated to be normally consolidated and very soft to firm in consistency. The associated sands are also anticipated to be normally consolidated and are likely to have a loose to medium dense consistency.

We would expect that Unit 4 materials would increase in strength and/or density with depth.

Unit 3 – Alluvial Soils

In the northern and eastern areas of the Study Area, recent alluvial deposits are expected to be encountered underlying the Unit 1 fill materials and topsoil. These materials are expected to consist of varying quantities of sediment including sand, gravel, silt and clay. There may also be some organic content, particularly where the deposits are saturated.

Based on the inferred depositional environment of these materials (e.g. slow moving river environment with occasional flood events) we would generally expect that they would have been deposited in sequences, with the size of particles deposited a function of the depth or energy of water at the time.

Historically, the location and course of drainage channels would have been prone to change with time, particularly within slow moving riverine environments such as the sunken alluvial planes.

The published extent of Unit 3 alluvial soils appears to correspond to a general increase in topographic elevation (See Figure 3A and Figure 3C). A comparison of the flood inundation overlay map with the topographic contour map suggests the extent of Unit 3 alluvial material roughly corresponds to the extent of the local flood inundation overlay (See Figure 3A and Figure 5).

The recently deposited fine grained clay units are anticipated to be normally consolidated and very soft to firm in consistency. The sand and gravels are also anticipated to be normally consolidated and are likely to be loose to medium dense.

We would expect that Unit 3 materials would increase in strength and/or density with depth.

Unit 4 – Baxter Formation

The 1:63,360 scale geological maps suggest that alluvial deposits are absent in the south western section of the Study Area, where the Baxter Formation may be encountered close to the existing ground surface. The Baxter Formation is generally described as comprising ferruginous sandstone, sand, sandy clay and occasional gravel.

Baxter Formation sediments are typically encountered as mottled grey and orange brown zones of clays and sands of limited extent. The clays and sands are anticpated to be slightly overconsolidated on account of erosion of the upper portion of the formation and are likely to be encountered as medium dense to very dense sands and stiff to hard clays.

Unit 5 – Werribee Formation

Underlying the Baxter Formation is the Werribee Formation, a poorly consolidated sandy clay with fissile clay bands. The Werribee Formation is not anticipated to be encountered within 10 m of the ground surface across the Study Area.

3.8 Intrusive Geotechnical Investigation

The intrusive geotechnical investigation was undertaken in conjunction with the environmental sampling investigation on 4 September and 5 September 2014 and comprised the excavation of ten test pits across the Study Area. The approximate locations of the Test Pits are presented on Figures 3A, 3B and 3C.

Reports of Test Pits and photographs of test pits are presented in Appendix B, along with the particle size distribution results of samples recovered during the geotechnical investigation from the test pits. The following information sheets relevant to the interpretation of the Reports of Test Pits are also presented in Appendix B:

- Explanation of notes, abbreviations and terms used on Reports of Test Pits
- Method of soil description used on Reports of Test Pits

The subsurface conditions encountered during the intrusive investigation are generally consistent with the descriptions presented in published geotechnical references and described in Section 3.7.

Test Pit TP08 encountered a profile of inferred fill material over the full depth of the test pit. The local topography and observation of the material encountered suggests TP08 may be located in an area that has been backfilled. Backfilling, such as that inferred at this location, may be present at other sites within the Study Area corresponding to former sand pits and farm ponds. Plate 1 presents a photo of the TP08 site.

Plate 1: Site photograph of the location of Test Pit TP08

3.9 Cardinia Creek

Golder has undertaken a review of historic aerial photographs of Cardinia Creek and compared the results with recent aerial phtographs to assess the possible locations and extent of the creek over recent time. A 1975 set of aerial photographs (1:10000 Run 23 Photo 34) were compared with recent aerial photographs taken from online aerial photograph database Nearmap.com (January 2014). Plate 2 below presents a recent (4 August 2014, Nearmap.com) aerial image of the Study Area and highlights four areas for further discussion. The results of the aerial image comparison of these four areas is presented below.

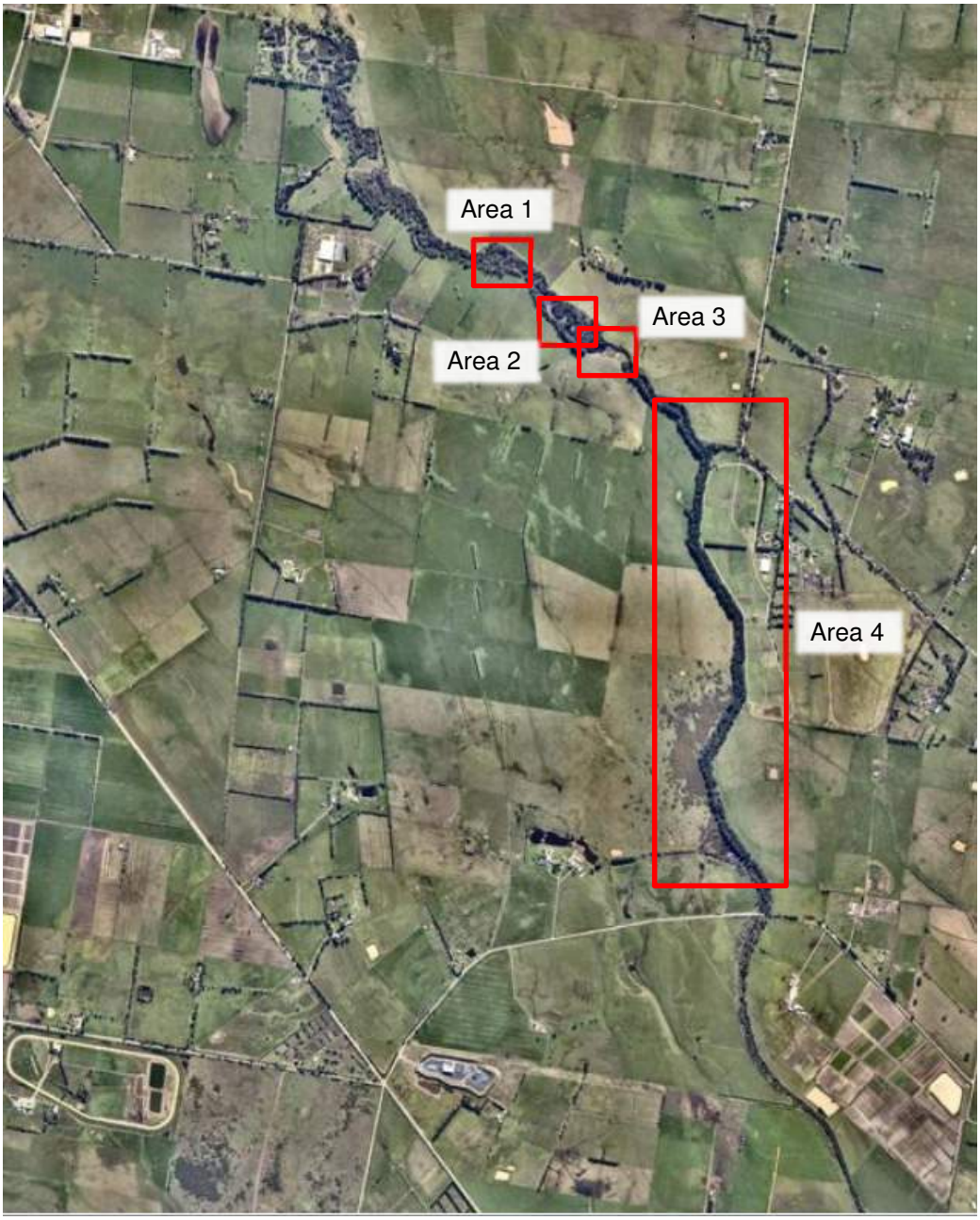

Plate 2: Recent aerial image showing alignment of Cardinia Creek on 4 August 2014

Table 3: Cardinia Creek Area 1

A comparison of the aerial images taken in 1975 and in 2014 suggests that the alignment of Cardinia Creek has evolved in Area 1. The aerial images suggest the main flow path of the creek has translated west, resulting in a less pronounced bend in the creek.

This translation is likely the result of a combination of erosion of the eastern bank of the creek and deposition of alluvial sediments in the former western extent of the creek.

The total change in alignment in this area is estimated to be in the order of 10 m to 15 m.

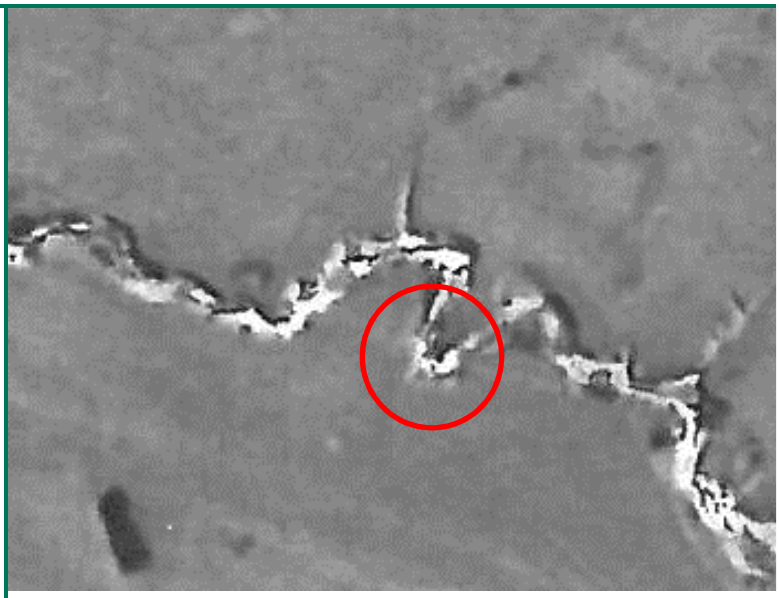

Plate 3: Cardinia Creek Area 1 circa 1975

Plate 4: Cardinia Creek Area 1 circa August 2014

Table 4: Cardinia Creek Area 2

A comparison of the aerial images taken in 1975 and in 2014 suggests that a billabong like feature on the eastern river bank of Cardinia Creek may no longer be present.

The inferred billabong is not visible in recent aerial images of the site. The location is partially obscured by vegetation but based on the available information we infer that the billabong like feature has either been infilled as a result of low energy deposition of sediment or that the creek has eroded away part of the eastern river bank.

Both the historic and recent aerial images indicate the water flow path towards the creek from the farm property to the east.

The evolution of the creek in this area may have been influenced by changes in water flow as a result of farming practices east of the creek.

The total change in alignment in this area is estimated to be less than 10 m.

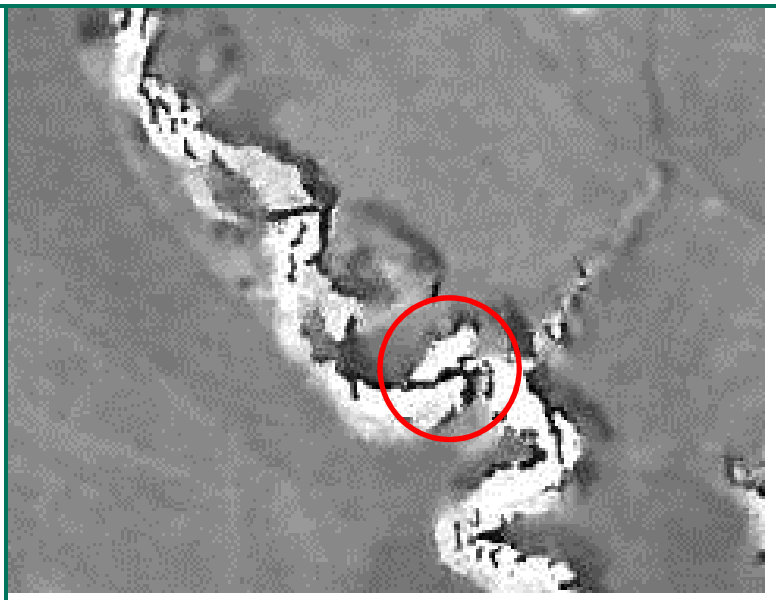

Plate 5: Cardinia Creek Area 2 circa 1975

Plate 6: Cardinia Creek Area 2 circa August 2014

Table 5: Cardinia Creek Area 3

A comparison of the aerial images taken in 1975 and in 2014 suggests that the alignment of the creek has changed in Area 3 resulting in a less pronounced bend in the creek.

The aerial images show the alignment of overhead power lines above the creek in this location. The overhead lines correspond to an area of less dense vegetation along the creek bank.

It is possible that minor earthworks were undertaken in this area and that ongoing vegetation clearance may be occurring. Both activities have the potential to result in realignment of the creek.

The aerial images indicate that a former tributary to Cardinia Creek is no longer present (or is less evident) to the north east of the creek. It is likely that this feature was backfilled as a result of farming activities. The removal of this feature is also likely to have influenced the alignment of the creek.

The total change in alignment in this area is estimated to be in the order of 10 m.

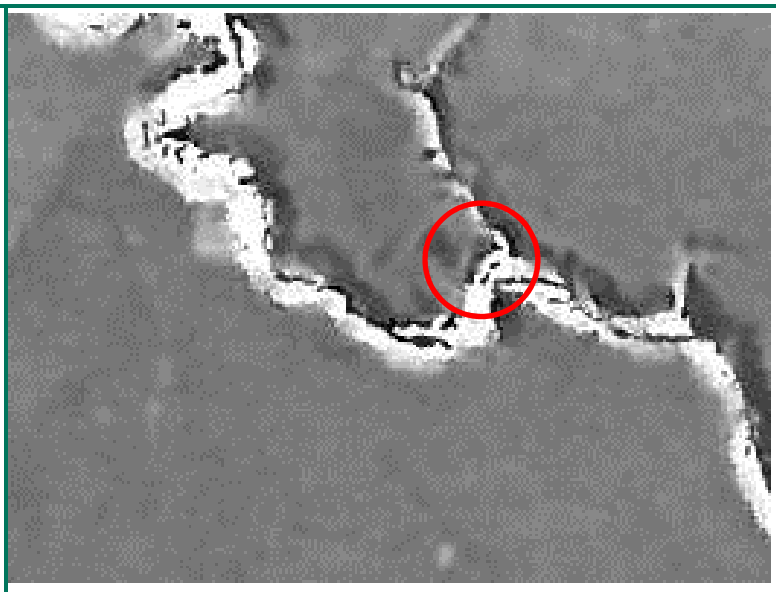

Plate 7: Cardinia Creek Area 3 circa 1975

Plate 8: Cardinia Creek Area 3 circa August 2014

Table 6: Cardinia Creek Area 4

A comparison of the aerial images taken in 1975 and in 2014 suggests that the alignment of Cardnina Creek has not changed significantly in Area 4.

The aerial images show that vegetation had been present along the creek bank in this area since 1975. The vegetation may have contributed to the preservation of the creek alignment over this time.

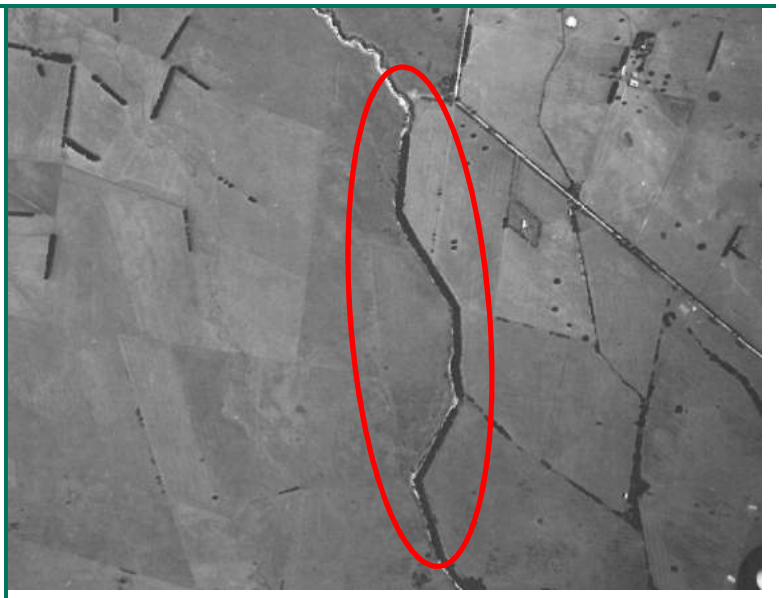

Plate 9: Cardinia Creek Area 4 circa 1975

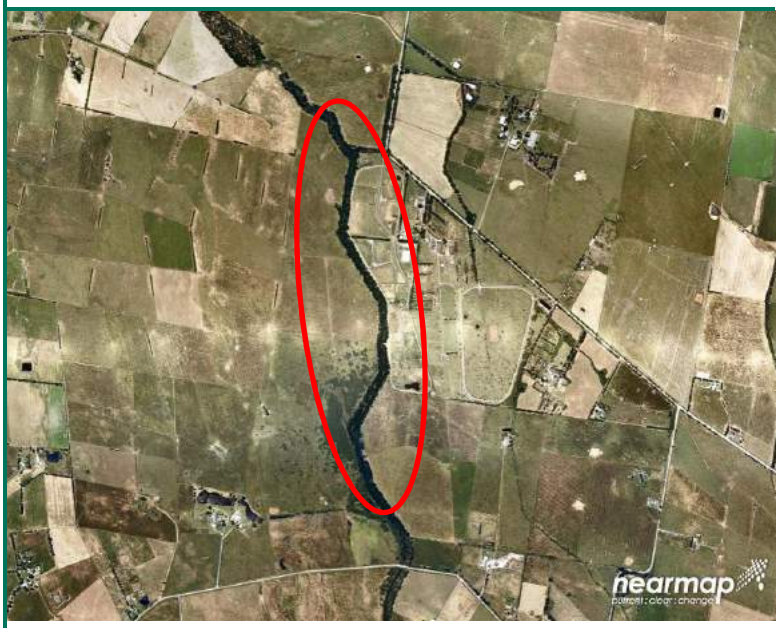

Plate 10: Cardinia Creek Area 4 circa August 2014

The aerial images presented in Plate 2 to Plate 10 indicate area where deposition and erosion are thought to have contributed to the evolution of the alignment of Cardinia Creek over the last 40 years. Changes were mainly observed towards the north east of the Study Area within the conservation area on either side of the creek.

We note that in the late 1980s and 1990s a drop structure was constructed in the upper section of Cardinia Creek (north of the Study Area). The construction of the conservation area around the creek is also thought

to have been established at around this time. The photograph interpretation suggests much of the erosion highlighted occurred prior to the construction of the retarding basin. However, the available information does not provide conclusive evidence to suggest whether the inferred changes to the creek alignment occurred prior to or following the construction of the retarding basin and conservation area.

The available evidence suggests the the evolution of Cardinia Creek has been limited in extent to less than 10 m from the current alignment of the creek in the last 40 years. It may also be inferred that the presence of vegetation around the creek may further constrain or slow changes to the creek alignment.

3.10 Quarries

We have reviewed the aerial photos and the relevant geological maps and found no evidence of historical quarrying activities within the Study Area. However, there may have been historic sand pits excavated to the south east of the Study Area, exploiting localised pockets of Cardinia Sand despoits. These may now be infilled or mark the location of farm ponds.

4.0 FINDINGS OF THE GEOTECHNICAL ASSESSMENT

The geotechnical assessment of the Study Area has considered publically available information, information made available to Golder specifically for the purposes of this assessment and information obtained through the Stage 2 intrusive geotechnical investigation.

The geotechnical assessment of the Study Area has not identified any geotechnical issues likely to present critical limitations to the development of the Study Area for residential purposes.

4.1 Geotechnical Zones

Based on our assessment of the publicly available geological information and the geotechnical investigations undertaken in the vicinity of the Study Area, we have used the geological and topographical contour maps to subdivide the proposed development area into two geotechnical zones (Geotechnical Zone 1 and Geotechnical Zone 2). The approximate extent of the zones is delineated by the southern extent of the Quaternary Age sediments as shown in Figure 3A, where Geotechnical Zone 1 generally encompasses areas expected to comprise Quaternary Age Unit 3 sediments and Geotechnical Zone 2 generally comprises areas expected to comprise near surface Miocene Age Unit 4 materials.

The zones are presented as a guide to identify areas where a typically thicker profile of loose and or soft natural soils may be present over higher strength soils. The looser or softer soils may include a combination of Unit 2 swamp deposits, Unit 3 alluvial deposits and softened Unit 4 Baxer Formation, as described in Section 3.7.

The depth of softer and looser soils indentified in the test pit investigation (described in Section 3.8) did not necessarily match the expectations described by the published geological map sheets. Namely the subsurface profile in Test Pit TP03, where a minimal quantity of inferred Unit 3 alluvial material was encountered. The variability in consistency of the near surface soil profile is more likely to reflect the area subject to flood inundation, as shown in Figure 5. The delineation of Geotechnical Zone 1 and Geotechnial Zone 2 has been roughly aligned with the published geological map sheet extent of Unit 3 alluvial material but has been modified to reflect the findings of the test pit investigation in conjunction with the inundation overlay. With increasing elevation to the north east and closer proximity to Cardinia Creek, Geotechnical Zone 1 is considered more likely to comprise a thicker profile of loose and soft soils over stronger Unit 4 material.

4.2 Footing Options

The footing solution for a particular structure will depend on the type of structure, the loads imposed on the footings by the structure, the subsurface conditions and the allowable total and differential settlements for the structure. Based on our current understanding of the geotechnical setting of the Study Area, the following comments are provided for the range of footing solutions which typically would be considered for the proposed low-rise development envisaged.

The depth of loose and soft near surface sediments will control the individual lot classification of land parcels in accordance with Table D1 of AS2870-2011, Residential Slabs and Footings.

4.2.1 Shallow Foundations – Strip and Pad Footings

A discussed earlier, a variable layer of fill and topsoil is expected to be present across the majority of the Study Area. We do not recommend that shallow footings are founded within uncontrolled fill or topsoil materials. Shallow footings should be founded below any uncontrolled fill or topsoil and generally at least 0.3 m below the surface of the underlying natural materials. Some excavation works to remove these materials should therefore be expected for foundations at most development locations.

Perched water may accumulate at the base of topsoil and fill materials. Where present, this water may result in localised softening of the underlying soils. Wet, softened soils should be excavated and replaced with engineered fill materials (if required, to raise the level of the site).

Zone 1 – North East

Based on the geotechnical information currently available, we believe the natural materials likely to be present across much of Geotechnical Zone 1 may be able to support an allowable bearing pressure of between about 50 to 100 kPa, which would likely be suitable for settlement tolerant structures up to two storeys in height. Localised variability is expected and allowable bearing pressures will need to be confirmed by site and structure specific geotechnical investigation.

Laboratory testing and in situ testing undertaken at test locations within Zone 1 indicates that in certain locations, the upper extent of the natural soil profile may have insufficient bearing capacity (less than 50 kPa) to be utilised as a founding layer for structures (as per AS2870-2011 Cl 2.4.5b). Should this be the case, the placement of engineered fill or ground improvement may be required for low level structures to be supported on shallow footings. Appropriate ground improvement methods for soft clays and loose sands such as those found within the Study Area may include preloading of the soil, dynamic compaction and replacement and dry lime cement mixing (LCM). We note that these methods are relatively expensive and may need to be undertaken over large areas to be economically viable. Should soil improvement not be an option, piled foundations may be required even for low level structures.

Zone 2 – South West

Based on the geotechnical information currently available, we believe the natural materials likely to be present across much of Geotechnical Zone 2 will be able to support an allowable bearing pressure of between about 50 to 100 kPa. Localised variability is expected and allowable bearing pressures will need to be confirmed by site specific and structure specific geotechnical investigation.

4.2.2 Raft Foundations

Where particularly soft soils are encountered within the Study Area (e.g.deep Unit 4 swamp deposits or Unit 2 alluvial deposits), raft foundations may be an appropriate building foundation solution for lightly loaded residential and commercial structures. Whilst more expensive than pad or strip foundations, stiffened raft foundations may be a cheaper alternative than piled foundations for these types of structures.

4.2.3 Deep Foundations - Piled Footings

Based on the conceptual geological model for the Study Area, piles will be required to penetrate through the Unit 1, Unit 2 and Unit 3 materials to more competent underlying units (founding stratum) in Geotechnical Zone 1 for any non-settlement tolerant structures. This may include single or two level buildings in Geotechnical Zone 1 depending on the plan dimensions of the building and a particular structure's tolerance for differential settlement. The required penetration of piles into the founding stratum will depend on pile size and load and the properties and thickness of the founding stratum. The types of piled footing solutions which would typically be considered for these conditions are as follows:

- Driven square precast concrete piles (250 mm, 350 mm and 400 mm) founding in the Unit 3 Baxter Formation for non-settlement tolerant structures (including low rise) and high rise structures in Geotechnical Zones 1 and 2.
- Driven steel pipe piles or H-piles founding in the Unit 3 Baxter Formation for bridges and high rise structures in Geotechnical Zones 1 and 2.
- Continuous Flight Auger (CFA) piles (600 mm, 750 mm, 900 mm, 1200 mm diameter) founding in Unit 3 Baxter Fomation materials for high rise structures in Geotechnical Zones 1 and 2.

4.3 Ongoing Creep Settlement

Creep settlement of the soft soils is likely to occur irrespective of any development works undertaken in the area due to ongoing secondary consolidation. Particularly if the drainage of the Study Area is improved. As a general guide, settlement of a couple of mm per year could be expected in soft alluvial sediments and swamp deposits within the Study Area. Settlement rates could be expected to increase if additional loads are applied to the soil. This includes additional load from the placement of fill or load applied to the soil by newly

constructed structures. Furthermore, settlement rates could be expected to increase if there was drawdown of the groundwater table, which again should be considered when planning drainage of the area.

While stand alone, settlement tolerant low rise buildings supported on appropriately designed raft slabs may perform satisfactorily in these conditions, non-settlement tolerant structures and particularly structures of larger plan dimensions may experience some cracking or tilting as a result of differential settlement across the footrprint of the structure.

Other potential issues which may need to be taken into consideration due to ongoing creep settlement include:

- Variable levels of differential settlement caused by the ongoing secondary consolidation.
- Differential settlement of services and the subsequent need to allow generous falls for gravity flow structures.
- The need to take downdrag loads into consideration for any piled structures constructed over these materials.
- The design requirements for service connections to piled buildings to prevent services from being pulled out over time.
- The potential to trigger additional consolidation if the groundwater table is lowered during the construction of basement excavations or deep utility trenches.

4.4 Basements

In areas where the water table is near the surface, increased risks are associated with basement construction and maintenance. As such, we expect that the costs associated with building deep basements across the Study Area could be prohibitive.

For these reasons, basement construction is likely to be limited to shallow basements for parking or avoiding basement construction altogether by placing parking levels above ground. It is also possible for gas (methane and hydrogen sulphide) to build up in basement excavations if the organic content within the soft alluvial soils is high.

4.5 Excavation Conditions

In general, excavation of the surface materials (Unit 1, Unit 2, and Unit 4 materials) across the Study Area is not expected to be difficult for standard sized excavation machinery. Without Study Area specific information, we would suggest that permanent batter slopes excavated in these materials be limited to a maximum of 3H:1V for initial planning purposes. It may be possible to achieve steeper temporary and permanent batter slopes within the Unit 3 soils.

The following potential issues may arise where excavations are required:

- Shallow groundwater or presence of perched water at shallow depth
  - The presence of perched water or a shallow water table in the vicinity of an excavation may result in water ingress into the excavation during or following excavation works, requiring extraction and disposal.
  - Sudden or gradual changes in pore water pressure in the vicinity of an excavation may result in a loss of soil shear strength around the excavation, leading to collapse.
  - The inflow of water into an excavation may wash out soil around the crest of the excavation leading to local instability.
  - Where saturated soils exist around an excavation, surface water (including rainfall) may readily flow into the excavation, requiring extraction and disposal.

- Generation of acidic groundwater and surface water if acid sulphate soils are present at the site and are exposed to air (refer to Section 6.4.1 for further details). If acid sulphate soils are present, then the potential for chemical attack on any buried concrete on the Study Area will also need to be considered.

4.6 Trafficability

Considering the potential swampy nature of Geotechnical Zone 1, we expect that trafficability of this area during the winter months or after heavy rainfall could be difficult. Specially constructed access paths may be required for vehicles which do not have four- wheel drive capability.

The use of heavy machinery may require the construction of working platforms for stability purposes. This is particularly relevant for machinery which exerts large localised loads on the ground, for example, piling rigs and mobile cranes.

We expect that trafficability issues within Zone 2 will be less although the trafficability may also be poor during the winter months or after heavy rainfall where cohesive soils are exposed at the surface or where topsoil cover is relatively thick.

4.7 Geothermal Considerations

The ground at a shallow depth can provide a heat source or sink for the heating and cooling of buildings. Because the temperature of the ground is more stable than that of the air, shallow geothermal energy exchange systems can be an energy efficient alternative to conventional heating and cooling systems. Heat can be extracted from or re-injected into the ground by circulating a heat transfer fluid (usually water) through a closed loop of pipe embedded in the ground. A heat pump is typically used to efficiently transfer heat between the circulating fluid and the building to be heated or cooled.

For residential developments, pipe loops would typically be installed in vertical boreholes (typically 50 m to 100 m deep) or trenches (typically about 2 m deep). Pipe loops could also be placed beneath areas to be filled, or submerged in water features.

4.8 Site Classification AS2870

Zone 1

Based on the available information and laboratory testing undertaken on Unit 2 and Unit 3 material collected during the Stage 2 geotechnical investigation, the residential site classification for Geotechnical Zone 1 is likely to be Class M (moderately reactive clay or silt site which may experience moderate ground movement from moisture change) or more highly reactive. However, where clay soils are encountered at a depth of less than 0.6 m below the surface, the site classification may be as high as Class H1 (highly reactive site, which may experience high ground movement from moisture changes).

Zone 2

Geotechnical Zone 2 is more likely to comprise clay soils near the surface than Geotechnical Zone 1. Where clayey areas of the Unit 3 Baxter Formation are present at or near the surface, the residential site classification is likely to range from Class M to Class H1.

4.9 Study Area Hazard Assessment AS1170.4-2007

The methods of assessing earthquake risk classification and consequential design implications are outlined in Australian Standard AS 1170.4 (2007), 'Structural Design Actions - Part 4: Earthquake Actions in Australia'. The standard uses a number of factors in assessing an earthquake design category for a particular structure at a given site.

The subsurface conditions at the Study Area are expected to comprise variable fill, overlying alluvium and variably cemented sandy clay. For master planning purposes based upon this typical profile, a site sub-soil class of C_e - Shallow Soil is suggested.

The hazard factor (Z) depends on the geographical location of the site. Figure 3.2(A) of AS 1170.4-2007 recommends a hazard factor of 0.09 for the Study Area.

4.10 Cardinia Creek

Based on aerial photographs since 1975, the reshaping of Cardinia Creek along the eastern boundary of the Study Area appears to be limited to variations of less than 10 m from it's current alignment. The major changes in alignment appear to have occurred at bends in the creek. Future changes in alignment may be limited by the presence of vegetation around the creek bank and the construction of the retarding basin.

Alluvial soils adjacent to the creek may be prone to erosion during flood events or high flow periods.

5.0 KEY GEOTECHNICAL RISKS AND OPPORTUNITIES

As discussed previously, potential geotechnical issues are not likely to impose critical limitations on the development of the Study Area for residential purposes. However, some issues that will need to be considered prior to development of the Study Area include the influence of large scale site drainage, the presence of fill areas within the Study Area and the potential for waterlogged, softened soils in the vicinity of dams and irrigation channels.

Based on our understanding of the geology of the Study Area, the key geotechnical risks and opportunities which will need to be considered in the master planning process are as follows:

5.1 Key Risks

- The variable strength, quality and thickness of the fill and top soil across the Study Area.
- The weak nature of some near surface soils. This may be particularly problematic near standing water bodies and drainage channels (including Cardinia Creek).
- The potential for ongoing creep settlement in the soft alluvial soils caused by secondary consolidation, which may result in differential settlement of buildings. The potential for creep movements may also require that the service connections to pile buildings be carefully designed to prevent pull out and that generous falls are provided for gravity flow structures to accommodate the potential for differential movement.
- The relatively high groundwater table which will increase the risk and cost associated with excavations and the construction and maintenance of basements.
- The potential to trigger consolidation of the soft alluvial soils if the groundwater table is lowered during the construction of basement excavations or deep utility trenches.
- The potential to encounter Potential Acid Sulphate Soil (PASS) and Actual Acid Sulphate Soil (AASS) within excavations.
- The potential for gas build up in basement excavations within the soft alluvial soils if they are rich in organics.
- Trafficability of the Study Area, particularly in lower lying areas during the winter months, may be difficult.
- Backfilled sand pits (eg. inferred at Test Pit TP08) may be obscured by vegetation and not identified until construction.

5.2 Key Opportunities

- Potential for shallow spread foundations to be utilised across Geotechnical Zone 2 for building heights up to five storeys depending on the findings of Study Area specific investigations.
- Potential for shallow spread footings to be utilised across Geotechnical Zone 1 for building up to two storeys, depending on the findings of Study Area specific investigations.
- Good founding materials (Unit 3 Baxter Formation) at relatively shallow depths for piling purposes.
- The potential to improve the energy efficiency of the proposed developments by considering shallow geothermal energy exchange systems such as energy piles in the building design requirements.

6.0 FINDINGS OF THE ENVIRONMENTAL ASSESSMENT

This section summarises the findings of the environmental assessment. Detalied information supporting the assessment and its findings is provided in Appendix C, as outlined in Table 7 below.

Table 7: Information Supporting Environmental Assessment

Reference	Information Source and Type of Information
C1	Summary table of historical and current uses that brings together information gathered during review of street directories, aerial photographs and review of publically available Environmental Audits reports.
C2	Regulatory review summary table that brings together the findings of the EPA Statutory Environmental Audits, Priority Sites Register, National Pollution Inventory. This information has been used to assist in developing the assumptions for the likely contamination rankings for the Study Area.
C3	Aerial photos georeferenced to the Study Area and table summarising the findings.
C4	Information relating to acid sulphate soils (ASS).
C5	Council planning and zoning documents.

6.1 Overview of Study Area Historical Development

Based on anecdotal information reviewed online at www.melbourne.net/au, the earliest European settlers to the area date back to the late 1830s. However, early settlement and development of the region was hindered by the Koo Wee Rup swamp. Further settlement progressed following the draining of the swamp to make it usable as farmland in the late 1860s. Clyde Post Office was opened January 1864 and renamed Clyde North in 1915. Predominant past uses of the general surrounding area was agriculture, namely dairy farming. The general area has remained relatively rural in nature, and current predominant land uses in the region include a mixture of market gardening, beef cattle farming and horse agistment/training.

6.2 Land Uses

At present, the majority of the Study Area (estimated between 80% to 90%) is undeveloped and used for agricultural purposes including beef cattle, fodder cultivations and horse stud farming. Based on anecdotal information, it is understood that beef cattle farming has been the predominant use in the Study Area since the late 1970s to early 1980s.

Prior to that, it is likely that portions of the Study Area were used for dairy farming. Remnants of diary activities, such as milking sheds and trenches were observed in the aerial photographs.

Based on observations made during the site walkover ('drive-by' on public roads), no livestock dips were observed, however may be present.

With the exception of some larger developed areas or allotments, the entire area is considered to have been divided into large paddocks with limited residential dwellings or structures in place by 1962. It is considered likely that primary agricultural use of the Study Area was for livestock grazing, however, it is possible that cropping activities would have occurred within the Study Area. The historic and current land uses are outlined in Appendix C1.

6.3 Potential Sources of Contamination

A range of potential contamination sources and associated contaminants have been identified based on:

- Review of historical and current land uses within the Study Area,
- Information obtained during site walkover, and
- Golder's experience and knowledge of practises associated with the identified industries and activities.

It is noted that for the purpose of this assessment, specific information about the type and nature of operations, processes and chemical uses within individual sites of the Study Area was not assessed. Consequently, the contaminatns listed below should be considered as indicative of the typical historical and current uses identified within the Study Area and the relevance or likelihood of the below contaminants to be present at individual sites has not been ascertained.

The potential sources and types of contaminants identified within the Study Area are presented in Table 8.

Table 8: Potential Sources and Types of Contaminants

Source	Source Extent	Type of Contaminant
Agricultural activities	Widespread	■ Arsenic and sulphur based insecticides ■ Copper and arsenic from fungicides used for viticulture used until approximately the 1940s ■ Organochlorine pesticides such as chlordane, dichlorodiphenyltrichloroethane (DDT), dieldren, endrin, lindane and heptachlor (restricted by 1988 but potentially used within the Study Area prior to 1988)
Imported fill	Widespread	■ Metals and metalloids (arsenic, cadmium, copper, chromium, mercury, lead, nickel and zinc) ■ Nutrients (ammonia, nitrate) and sulfates
ASS	Limited to lower lying swamp areas	■ Acidity, metals and sulfates
Solid inert waste and agricultural waste	Medium to small extent	■ Organic material ■ Metals and inorganics such as nitrate and ammonia
Uncontrolled fill	Two land parcels (E1 and S9) were observed with evidence of imported soil and earth moving activities is present	■ Hydrocarbons (Including polycyclic aromatic hydrocarbons (PAHs)) ■ Metals ■ Solvents ■ Nitrate and ammonia
Road making materials and/or fires	Medium to small extent	■ PAHs ■ Dioxins and furans
Buildings (construction and demolitions)	Medium to small extent	■ Asbestos ■ Building waste ■ Metals
Use and storage of fuels and oils	Point Source (i.e. homestead, workshops)	■ Total petroleum hydrocarbons (TPH) ■ Monocyclic aromatic hydrocarbons (MAHs) ■ Phenols ■ Solvents
Use and storage of	Point Source (i.e.	■ TPH

Source	Source Extent	Type of Contaminant
lubricating oils, hydraulic oils and degreasers	homestead, workshops)	■ PAHs ■ Solvents (non-chlorinated solvents (e.g. kerosene, petroleum ether, white spirit, turpentine, phenol and acetone)) ■ Chlorinated solvents (e.g. tetrachloroethylene (PCE), trichloroethylene (TCE) and breakdown products)
Septic tank systems	Point Source (i.e. houses)	■ Metals ■ Nitrate and ammonia ■ Viruses and bacteria

6.4 Limited Intrusive Investigation

The results of the limited Stage 2 intusive soil sampling (Table 9 and Plate 11) are presented in Appendix E

Table 9: Identification of Test Pits and Sampling Depths

Test Pit ID	Sample ID	Sampling Depth Interval (m)	Sampling Date
TP01	TP01/1001	0.1 - 0.2	5/09/2014
	TP01/1002	0.25 - 0.35	5/09/2014
TP02	TP02/1001	0.1 - 0.15	5/09/2014
TP03	TP03/1001	0.1 - 0.2	5/09/2014
	TP03/1002	0.3 - 0.4	5/09/2014
TP04	TP04/1001	0.1 - 0.2	5/09/2014
TP05	TP05/1001	0.1 - 0.3	5/09/2014
TP06	TP06/1001	0.1 - 0.2	5/09/2014
	TP06/1002	0.3 - 0.35	5/09/2014
TP07	TP07/1001	0.05 - 0.1	4/09/2014
	TP07/1002	0.3 - 0.35	4/09/2014
TP08	TP08/1001	0.1 - 0.2	4/09/2014
TP09	TP09/1001	1.3 – 1.5	4/09/2014
TP10	TP10/1001	0.05 - 0.1	4/09/2014
	TP10/1002	0.3 - 0.35	4/09/2014

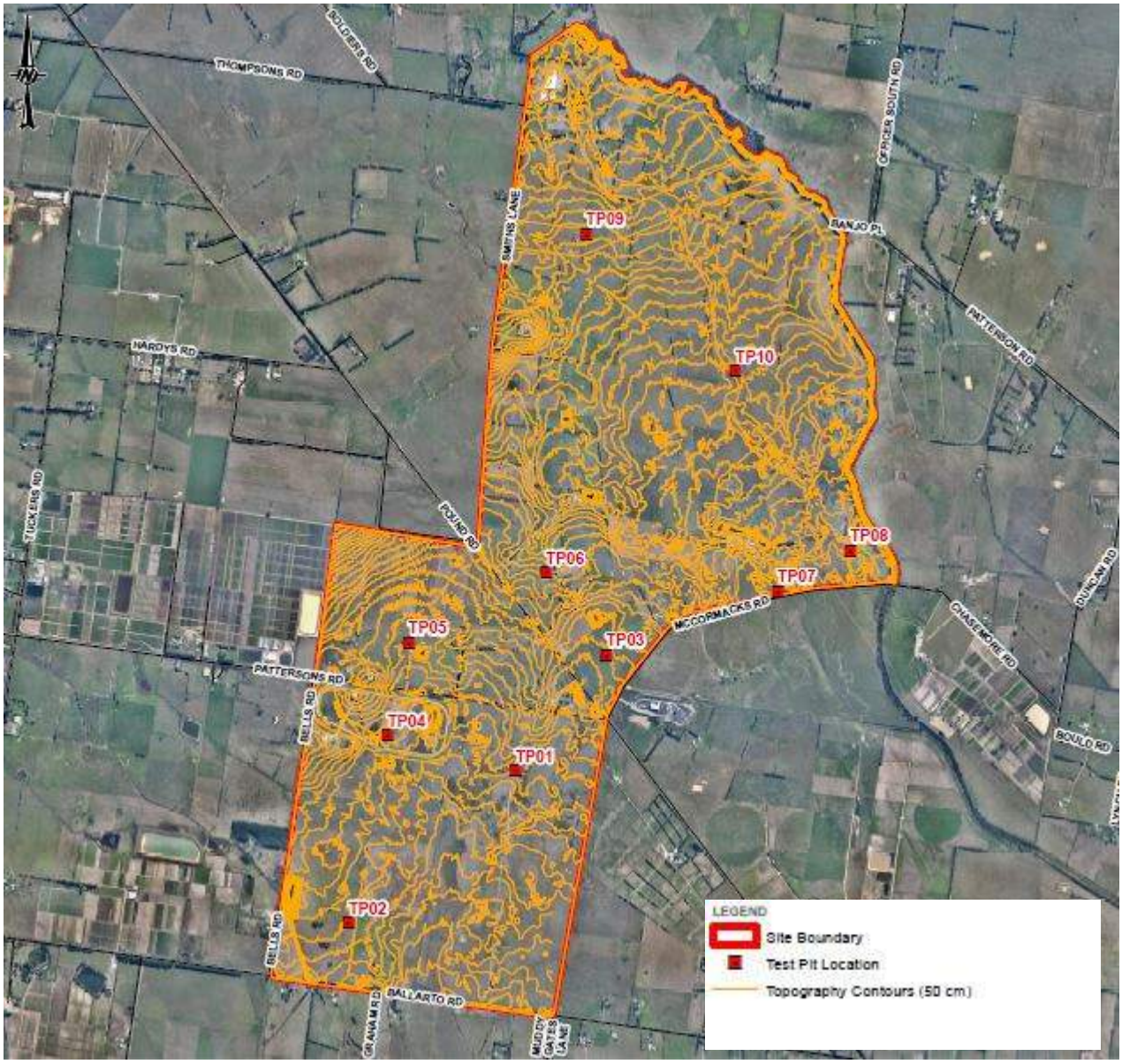

Plate 11: Location of Test Pits Within Study Area (not to scale)

The results indicated the following:

- *Presence of potential fill soils* - associated with the raised area around a water feature, which was confirmed at a single location within land parcel E1 (refer to Figure 2 and Figure 3). The localised filling at a test pit location TP08 included gravel and wire. In addition, car bodies were observed partially buried in vicinity of the test pit location. The fill comprises wastes which have the potential to present a source of contamination or asthetic issue associated with general dometic/commercial wastes or imported fill.
- *No detectable chemical concetrations in the limited soils sampled above background levels that present an unacceptable risk* – the chemical background concentrations of metals, organochlorine pesticides, organophosphate pesticides and pH were measured to be below the guidelines adopted for the assessment of human health and ecological risk in the low density land use setting.

6.5 Significance of Potential Contamination Issues

The following section outlines the potential for the identified sources to have impacted soil and groundwater in the Study Area. Study Area contamination rankings are discussed in Section 6.6.2.

6.5.1 Soil

- The key contamination risks to soils within the Study Area are primarily associated with the use of pesticides, herbicides and fungicides in agriculture.
- Activities on land adjacent to the boundary of the Study Area are considered to have low potential to have caused impacts to the Study Area via the migration of airborne particulates, soil gas and/or groundwater.
- The storage and use of hydrocarbon fuels and solvents associated with small scale (hobby) agricultural practices represent an activity with a low contamination risk. Given that agricultural practices have occurred on a low intensity, the frequency of application and likelihood of spills does not represent a substantial risk to soil. The use of hydrocarbon fuel and solvents are expected to be confined to the areas in which they have been stored, handled and used.
- The use or storage of pesticides, herbicides and fungicides, associated with small scale (hobby) agricultural practices represents an activity with a low contamination risk. Golder consider it a low risk for the following reasons:
  - the expected low intensity and frequency use associated with the size of operations.
  - the expected low intensity and frequency use associated with the grazing practice.
- The use of pesticides, herbicides and fungicides in larger scale grazing (areas used primarily for agricultural) practices also represents a low risk of contamination.
- Point sources of contamination where storage of fuels, solvents and chemicals may be present in some land parcels presenting isolated areas of medium risk to soil. The location and extent of the medium risk point sources can only be identified by conducting an inspection of identified parcels where these sources may be located. Golder consider the overall risk to land parcels where point sources may be present remains relatively low to medium due to the following factors:
  - The point sources are likely to be of limited extent and typically associated with homestead and workshop locations.
  - The intensity of use of chemicals within this point source areas is likely to be low to high where chemicals are stored, handled and mixed.
  - The relative amount of land subject to medium risk of contamination represents a small proportion of the overall extent of a particular land parcel.
- Potential importation of fill associated with the construction of buildings and roads within the Study Area is expected to present a relatively low risk of soil contamination.
- Earth moving and filling activities associated within the agricultural activity on a small scale represents low risk of contamination. The expected volume of soil moved to land used as hobby farms is low.
- Solid inert waste (potentially buried) associated with agricultural land and activity represents a low risk of contamination. Within a considerable number of paddocks, solid inert waste (usually, fencing, corrugated iron and bricks) was observed. This small volume and relatively inert nature of material represents a low risk.
- Buried Waste (animal carcase domestic waste) associated with historical agricultural practices represents a medium to high risk of contamination. Given that the land has been used for agricultural

purposes since the 1800s, it is possible that site occupiers disposed of rubbish within land parcels. Further it is likely that (in the past) on site disposal of dead livestock may have occurred.

- Evidence of some filling activity within the Study Area, this is supported by the findings of the intrusive investigation.
- The near surface stratigraphy for the northern portion of the Study Area is anticipated to consist of alluvial sediments associated with Cardinia Creek. Under anaerobic conditions, soils of the alluvial former swamp area comprisepotential acid sulfate soils (PASS). The presence of PASS should be assessed where soil is likely to be disturbed (i.e. excavated) which may be the case should a basement or other subsurface infrastructure be proposed. This may also impact on any excavation required for soil remediation (if required). Further information regarding the risks associated with acid sulfate soil (ASS) and management measures is provided in Appendix C4.

6.5.2 Groundwater

- Based on the historical information reviewed to date, the main contamination risks related to groundwater will be from the following:
  - potential point source of contamination from hydrocarbons and / or other stored chemicals from underground storage tanks or above ground storage tanks should these be present on individual sites.
  - potential point source contamination from nitrate, sulphate, ammonia and other nutrients from underground septic tank systems.
  - potential diffuse source of fertilisers (particularly nitrogen) applied across the Study Area which tend to be readily mobilised.
- Groundwater depth within the study area is reported to be within 5 m from the surface. The variable sequence of soil material over the Study Area is expected to comprise a low to moderate vertical permeability. This shallow groundwater is considered to be potentially vulnerable to contaminants applied or spilled to land from general agricultural practices, above ground or below ground chemical storage features and/or leaching of contaminants from buried waste.
- In general, the contamination risks to groundwater are considered to be relatively low (except for those associated with buried undergoundwater features (i.e. USTs)):
  - in light of the current development status of the Study Area and the absence of activities (i.e. industrial sites);
  - depth to groundwater; and the
  - potential attenuation factors through the soil profile.

6.5.3 Aesthetics

- The desktop review and intrusive investigation identified that there is potential aesthetic impacts in fill (e.g. visual and olfactory contamination such building rubble). The evaluation of aesthetic impacts is relatively subjective assessment. Therefore, depending on the extent of the aesthetic impact, they may require management during redevelopment by removal of those soils deemed aesthetically unsuitable in sensitive areas such as in low density residential developments with access to soils.

6.6 Ranking of Land Contamination

6.6.1 Approach

Land contamination rankings within the Study Area have been evaluated using a qualitative methodology. The approach involved the following key steps:

1) Subdivision of the Study Area into homogeneous land parcels based on current and/or past land use.

2) For each parcel, ranking of the potential for the land to be contaminated (soil and/or groundwater) based on the findings of the environmental assessment, particularly current and/or historical use of the land parcels.

3) Assessment of the likelihood to uncovering contamination that requires significant soil and/or groundwater remediation to achieve the following potential land uses:

   - Low Density Residential / School / Kindergarten
   - High Density Residential
   - Recreational
   - Commercial / Industrial.

The ranking of the potential for the land to be contaminated was divided into three broad and subjective categories (High, Medium and Low) based on subjective and objective factors.

The ***subjective factors*** that were considered as part of assigning contamination rankings included the following:

- Buildings and structures used or potentially used for storage of chemicals.
- Age, size and date of operations (size of allotments).
- Likelihood of large volumes of chemicals used on the land parcel including potential underground storage tanks (USTs).
- Fate and transport characteristics of contaminants potentially present in the land parcel (i.e. more volatile/mobile contaminants such as petroleum hydrocarbons or chlorinated solvent) versus less mobile contaminants (i.e. metals).
- Intensity of agricultural production.

The ***objective factors*** that were considered as part of assigning contamination ranking were taken from the DSE Practice Note (provided at Appendix D (DSE, 2005)). The DSE practice note indicates ways in which land can be identified as being potentially contaminated. This includes a list of generic land uses considered to have low, medium and high potential, as well as indicators such as site history or the presence of an Environmental Audit Overlay (EAO) at the site. Table 1 in the DSE practice note lists land uses that are considered to pose a high potential for contamination and medium potential for contamination.

High Potential for Contamination is indicated by the following potential activities on site.

- Waste Treatment / Disposal / Incineration
- Underground Storage Tanks
- Stock dip sites.

Medium Potential for Contamination considers the nature of the products used or stored on Study Area, the quantity stored, and the location of use or storage and includes:

- Chemical storage
- Fuel Storage
- Market gardens
- Filling (imported soil)
- Waste Disposal
- Other industrial activities (such as warehousing of chemicals that may be split during loading and unloading)

Table 10 summarises the ranking system developed for the land parcels within the Study Area.

Table 10: Land Contamination Ranking

Land Contamination Rank	Definition of Land Contamination Rank	Likelihood of Significant Remediation required to Achieve Identified Land Use			
		Low Density Residential / School / Kindergarten	High Density Residential	Recreational	Commercial / Industrial
Low	**Soil Contamination is Unlikely and Groundwater Contamination is Unlikely:** The information suggests that the land parcel is "greenfield" and/or residential had has no significant use that is likely to have caused land or groundwater.	Unlikely	Unlikely	Unlikely	Unlikely
Medium	**Soil Contamination is Possible and Groundwater Contamination is Possible but Unlikley:** The information suggests that site activities may have contaminated the land and/or groundwater. Some remediation of soil will potentially be required and it is possible although unlikely there will be a need for groundwater remediation.	Possible with some restriction	Possible	Possible	Unlikely
High	**Soil and Groundwater Contamination is Likely:** The information suggests that activities may have caused contamination of the land and/or groundwater. Some remediation of soil will likely be required and there will be a potential that groundwater remediation &/or management will be required.	Likely	Likely	Likely	Possible

The ranking definitions use the terms "unlikely", "possible" and "likely" to represent an increasing level of risk. This ranking structure has been used to assess **relative risk** based on available "desk top" information. As there has only been limited intrusive investigation to support our subjective judgements, there is limited evidence that contamination or pollution has actually occurred.

6.6.2 Summary of Potential Contaminants and Impact Areas

The subdivision of the Study Area in land parcels and the contaminaton ranking of each parcel (as defined in Table 10) is presented in Figure 4.

The rankings are based on the limited readily available information, our judgement as to the relative potential for land contamination given the current or historic use of a given land parcel within the Study Area and the findings of the limited intrusive soil investigation . These rankings are not quantitative.

As presented in Figure 4, the majority of the Study Area is characterised as having a **low contamination** ranking due to the undeveloped nature of the use comprising predominantly low intensity agricultural / grazing land**.**

Possible ***High Rank*** and ***Medium Rank*** zones may exist within the land parcels currently defined as ***Low Rank.*** Activities/features that may lead to an increase of the contaminantion ranking of specific portions of land within each parcel may comprise the following:

- Former and present Underground Storage Tanks (high);
- Areas used for disposal of household waste, solid inert waste and potentially asbestos (medium);
- Areas used for the disposal of animal carcases (medium); and
- Areas filled with soil sourced outside of the Study Area (medium).

These features would not necessarily categorise the land parcel in which they are located to an higher contamination category. They represent potential point sources of contamination that would required further assessment and/or management as part of development. Further investigation of land parcels in which these activities/features may be present would be required to verify their potential existence and assign specific contamination ranking to the portion of the land parcel in which they are present.

Additionally, Potential Acid Sulfate Soil (PASS) may be present in low lying zone within the Study Area which will need to planned and managed for as part of development.

7.0 CONTAMINATION STRATEGIES TO SUPPORT DEVELOPMENT

The following sections provide information on potential contamination strategies to support precinct scale development considerations. These are provided on the basis that MPA intend to develop the surrounding greater McPherson Precinct area for a mix of open space, residential and commercial uses.

7.1 Further Assessment of Specific Land Parcels

Further assessment of land parcels identified with higher intensity agricultural activities should be undertaken. This should target the following areas:

- areas where machinery and fuel is stored
- areas used for high intensity agricultural practices (i.e. milking sheds) and cropping
- areas known to have been filled (i.e area within parcel E1).

7.2 Classification of Soil for the Purpose of Use or Disposal

The EPA guidelines have been used to assist in establishing remedial strategies and off-site disposal requirements (EPA, 2009) for soils classified as Fill Material, Category A, Category B and Category C.

At present, Fill Material can be disposed of without restriction provided there are no environmental impacts. Category B and C must be disposed of to nominated landfills licensed to accept such waste, while Category A must be pre-treated before disposal. The National Environment Protection Measure (NEPM, 2013) also provides criteria for various land uses which can be used to assess remediation scope once more information is available from the further investigation works.

As a general guide, contaminated soils (i.e. Category A to C) which do not present a vapour or leachable risk to groundwater may be suitable to remain on site for High Density Residential, Commercial, Open Space and Industrial land uses as long as:

- direct contact with these soils is prevented, i.e. they are located beneath building slabs and footings or they are covered, in open areas, with 0.5 to 1 metres of “clean” top soil
- these soils do not come into direct contact with groundwater
- the risks to human health and environment can be shown to be acceptable for the proposed on site management
- management controls including a long term environmental management plan (EMP) are implemented to achieve a site condition that presents an acceptable risk to human health and the environment.

7.3 Overview of Potential Remediation Strategies for Various Land Uses

Remediation strategies have been outlined in the context of the range of possible land uses that are likely to be part of the proposed mixed used development of the Study Area. The following section outlines land use specific remediation strategies.

Low Density Residential

With this most sensitive land use, development typically means that there is less opportunity to manage contamination on the land. It is not as easy to restrict the future owners in terms of excavations that they may do on their land or in terms of where they might position building footings or slabs. Formal planning tools to implement such restrictions can be used, but this can lead to reduced land value and/or increase cost to Council or an owner’s corporation who might be responsible for monitoring adherence to the restrictions. As a result, sensitive use sites particularly low density residential land development often results

in the highest level of clean up being required from a practicality point of view. To reflect this, the remediation strategy would typically need to include:

- Remediation of any targeted features within the land parcel.
- In general, the removal, treatment or disposal of any identified Category A, B or C material.
- Replacement of the volume of material removed with "clean" imported Fill Material.
- Remediation of any source of groundwater pollution to the "extent practicable".
- Remediation of groundwater pollution, if required, such that pollution no longer exists on the land and emanating from the land, if the land was the source of the pollution.

It is noted that there may be more of an opportunity to manage contaminated material in government owned sensitive use sites such as schools and parks where there is a responsible authority to manage potential long term environmental management conditions.

High Density Residential and Commercial / Industrial

High Density Residential and Commercial / Industrial land use development typically means that there is more opportunity to manage contamination on that land.

The intensity of development in such land uses often means that extensive areas of the land become sealed or capped with pavement or building slabs. These features can help to reduce access to contaminated soils and associated human health risk. They also reduce the infiltration of rainwater which has the potential to carry contaminants within the soil to depth including groundwater where they might then migrate off site. As there is usually one owner for a larger portion of land, environment management plans (EMPs) to maintain the long term integrity of any capping system can be implemented and monitored more readily for such developments.

To reflect this, the remediation strategy would generally need to include:

- Remediation of any targeted features within the land parcel.
- Removal, treatment or disposal of any identified Contaminated Soil. We note that on a site specific basis, some contaminated soil may be able to remain depending on the toxicity and mobility of the particular contaminant and soil mixture.
- Replacement of the volume of material removed with "clean" imported fill.
- Remediation of any source of groundwater pollution to the "extent practicable".
- Remediation of groundwater pollution, if required, such that pollution no longer exists on the land and emanating from the land, if the land was the source of the pollution. We note that in some circumstances, groundwater contamination can be monitored and managed via a Site Environment Management Plan (EMP), which is the responsibility of the owner. This may obviate the need for immediate remediation. This is particularly the case where groundwater is contaminated but not currently "polluted" but may become so in the future if not monitored or controlled.

Open Space

It is likely that open space areas will remain the responsibility of the local Council. In general, remediation of open space areas are likely to be similar to those proposed above for Commercial / Industrial and High Density Residential land uses. However, areas of contaminated soil would need to be covered (i.e. within 0.5 m to 1 m thickness) with 'clean' fill to reduce the potential for people to make contact with the contamination. Management plans would need to be implemented to control the long term integrity of such caps and any encapsulation mounds.

7.4 Additional Council Permit/Scheme Conditions

Responsible Council planning authorities have the power to implement conditions associated with planning permits. While Golder cannot provide legal advice as to whether potential permit requirements (as outlined below) may apply, some permit conditions have been historically used to control environmental management of land development (usually associated with an audit). As such, it may be possible to include conditions on a permit for subdivision of land, or any other permits leading to a land use change:

A construction management plan could be used to control the remedial works associated with the land use change. Given that the majority of the land is zoned as ***Low Rank*** and that discreet areas of ***Medium Rank*** and ***High Rank*** may exist within these areas, a construction management plan could be used to require identification and management/removal of these discreet ***Medium Rank*** zones. For instance, a condition of the construction management plan may require validation of these zones.

8.0 STATUTORY PLANNING AND CONTAMINATION

The degree to which statutory authorities (associated with contamination) are involved in the land use planning change depends on both the land contamination rank and the sensitivity of end use. The planning authority's obligations with respect to re-zoning of potentially contaminated land are discussed below.

8.1 Regulatory Obligations

The Planning and Environment Act 1987 requires the responsible authority, before deciding on a planning permit application, to consider '*any significant effects which the responsible authority considers the use or development may have on the environment or which the responsible authority considers the environment may have on the use or development*' (Section 60). The permit may be a permit for works, use or subdivision.

We have made reference to the following Department of Sustainability and Environment (DSE) document in relation to planning and process:

- DSE General Practice Note on *"Potentially Contaminated Land"*, dated June 2005 (see appendix D).

The document was prepared to assist planning authorities and others in identifying contaminated land and determining the appropriate level of assessment required for permit purposes.

It is noted that The Minister for Planning appointed an Advisory Committee under Section 151 of the Planning and Environment Act 1987 to examine the existing planning controls and processes for potentially contaminated land. While the Committee Report is publically available (GoV, 2013). The Minister has not yet made any changes to regulations in this Area. However, small changes could potentially be made and the General Practice Note revised.

8.2 Land Use Sensitivity and Recommended Level of Assessment

The DSE Practice Note also provides a framework for identifying potential contamination risk, sensitivity of land use and in turn what the associated planning response should be including whether a Statutory Environmental Audit or environmental site assessment is required. The matrix presented in the Practice Note is shown below as Table 11.

Table 11: DSE Practice Note Assessment Matrix

PROPOSED LAND-USE	**POTENTIAL FOR CONTAMINATION (as indicated in Table 1 of DSE Note)**		
	High	***Medium***	***Low***
Sensitive Uses			
Child care centre, Pre-school or Primary school	A	B	C
Dwellings, residential buildings etc.	A	B	C
Other Uses			
Open Space	B	C	C
Agriculture	B	C	C
Retail or office	B	C	C
Industry or warehouse	B	C	C

There are three outcomes as follows:

A) Require an environmental audit.
B) Require a site assessment from a suitably qualified environmental professional if insufficient information is available to determine if an audit is appropriate. If advised that an audit is not required, default to (c).
C) General duty under Section 12(2)(b) and Section 60(1)(a)(iii) of the *Planning and Environment Act* 1987.

Most of the proposed development for the site would be considered a sensitive use. Table 11 above provides the recommended level of assessment. Which, based on the predominantly low potential for contamination (Figure 4), would require, at the very least, a general duty under Section 12(2)(b) and Section 60(1)(a)(iii) of the *Planning and Environment Act* 1987 (Vic).

Golder notes the Victorian Department of Transport, Planning and Local Infrastructure have appointed an Advisory Committee under Section 151 of the Planning and Environment Act 1987 to examine the existing planning controls and processes for potentially contaminated land. The committee proposes to review the guidance for assessment of potentially contaminated land. As such, it is likely that the DSE Practice note referred to above will be updated.

However, the general duty under Section 12(2)(b) and Section 60(1)(a)(iii) of the *Planning and Environment Act 1987* (Vic) applies at the current time. Golder notes that in recent years it has become more common within the industry for planning authorities to recommend that some limited intrusive investigations are undertaken to support planning permits that would allow sensitive use of site ever where the site history review suggests that the previous activities present a low contamination risk.

9.0 CONCLUSIONS AND RECOMMENDATIONS

9.1 Geotechnical

The geotechnical assessment has developed the following **conclusions**:

- *Presence of potential fill* – Fill stockpiles and infilled sand pits and farm dams may be present across the Study Area. The incidence, depth and nature of fill materials may be concealed by surface vegetation and may not be apparent until construction has commenced. It is not recommended that structures are founded on fill materials.
- *Cardinia Creek* – The current alignment of Cardinia Creek may be expected to evolve and reshape over time. The extent of the reshaping is expected to be similar to that inferred over the last 40 years and may be limited to within 10 m of the current creek alignment.
- *Areas potentially prone to flood inundation* – The flood inundation overlay suggests that approximately half the Study Area may be prone to flooding in the current conditions. Mitigation measures against flood inundation may be required (eg. earthworks to raise the Study Area above the inundation level, construction of local flood defences or increase capacity of drainage structures).
- *Dewatering* – Dewatering of the Study Area may induce consolidation settlement of the underlying clay soils.

It is **recommended** that additional geotechnical investigations are undertaken to confirm the extent of soft and loose near-surface Unit 2 and Unit 3 materials. For master planning purposes further investigation into the lateral extent, depth and nature of the recent alluvial sediments and swamp deposits could be considered.

Information relating to the depth and level fluctuation of the local groundwater table may also be required to assess the potential impact of dewatering during construction.

Residential lot classification in accordance with AS2870 'Residential slabs and footings' will be required for each lot proposed in the subdivision of the Study Area. Typically this would require an intrusive investigation consisting of one or two shallow boreholes within the footprint of each plot.

For larger scale developments, site and development specific geotechnical investigations will be required.

Additionally, we recommend a zone of vegetation is maintained around Cardinia Creek to stabilise the creek bank against erosion. The drop structure upstream of the Study Area should also be maintained to control the flow of water in Cardinia Creek. To reduce the risk of erosion encroaching on the Study Area, we recommend a development exclusion zone be established in close proximity to the creek. We recommend

no development takes place within approximately 50 m of the current creek alignment to allow for some potential reshaping over time.

9.2 Environmental

The following **conclusions** have been developed considering MPA position as the planning authority and the potential development facilitator. The further assessment recommendations have been provided with respect to the land contamination assessment as defined in Figure 4.

- *Presence of potential fill soils* - associated with raised area around a water feature, which was confirmed at a single location within land parcel E1 (refer Figure 2). The localised filling at test pit location TP08 included gravel and wire, in addition, car bodies were observed partially buried in vicinity of the test pit location. The fill comprises wastes which have the potential to present a source of contamination or asthetic issue associated with general dometic/commercial wastes or imported fill.
- *No detectable chemical concentrations (in the limited soil sampled) above background levels that present an unacceptable health risk* - chemical background concentrations of metals, organochlorine pesticides, organophosphate pesticides and pH were measured to be below the guidelines adopted for the assessment of human health and ecological risk in a low density land use setting.
- *The overall land contamination ranking for the study area is considered to be low.* Within the land parcels with low contamination rankings there is potential for there to be point source features that classify as medium to high such as associated with:
  - bulk storage of fuels (above ground storage tanks or underground storage tanks)
  - areas known to have been filled (i.e area within parcel E1)
  - stock dips (it is noted that the entire precinct has not been surveyed for stock dips).
- Medium risk activities that would trigger further investigation under the DSE Practice Note were identified within the Study Area. High risk activities that would trigger a statutory environmental audit were not identified within the Study Area. However, it is possible that high risk activities do exist within the land parcels, however, the absence/presence of these activities uses, cannot be confidentially ascertained without a site specific environmental assessment.

Golder notes that in recent years, for land subject to sensitive uses, it has become more common for planning authorities to recommend that a degree intrusive investigation is undertaken even for sites used historically for low contamination risk activities.

With respect to environmental issues, the following **recommendations** are provided**:**

- As part of the precinct planning works, we recommend that applicants carry out further assessment to confirm the absence or identify the presence of the following activities:
  - former and present Underground Storage Tanks (high ranking)
  - areas used for disposal of household waste, solid inert waste and potentially asbestos (medium ranking)
  - areas used for the disposal of animal carcases (medium ranking)
  - areas filled with soil sourced from off Study Area (medium risk).
- As part of the development process, the responsible planning authority should consider requesting a preliminary site investigation (PSI) as a condition of the planning permit process. Golder recommends that a Construction Management Plan (CMP) be recommended as a condition on a planning permit to manage the removal of contamination features/wastes should they be identified to be present or possibly present onsite.

- Further assessment is undertaken by a suitably qualified environmental consultant who is a member of the Australian Contaminated Land Consultants Association (ACLCA).
- As a minimum we recommend that following requirements of a PSI:
  - Details of the nature of the land uses previously occupying the site and the activities associated with these land uses. Identifying the duration of each land use.
  - A review of previous assessments of the site and surrounding sites, including details of on-site or off-site sources of contaminated materials. This includes a review of previous reports of the site or area surrounding the site.
  - Limited intrusive soil sampling based on the size of land parcel and contamination ranking.
  - An appraisal of the data obtained following soil sampling in accordance with ecological, health based guidelines (i.e. currently the NEPM 2013).

If the PSI indicates high potential for contamination or actual contamination then a Detailed Site investigation (DSI) should be undertaken to delineate the extent of contamination and potential remediation requirements.

The planning authority will also need to consider the need to require an Environmental Audit for high risk sites, in order to satisfy themselves that the land is suitable for the proposed sensitive use as per the obligiations set out under the *Planning and Environment Act*.

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Report Signature Page

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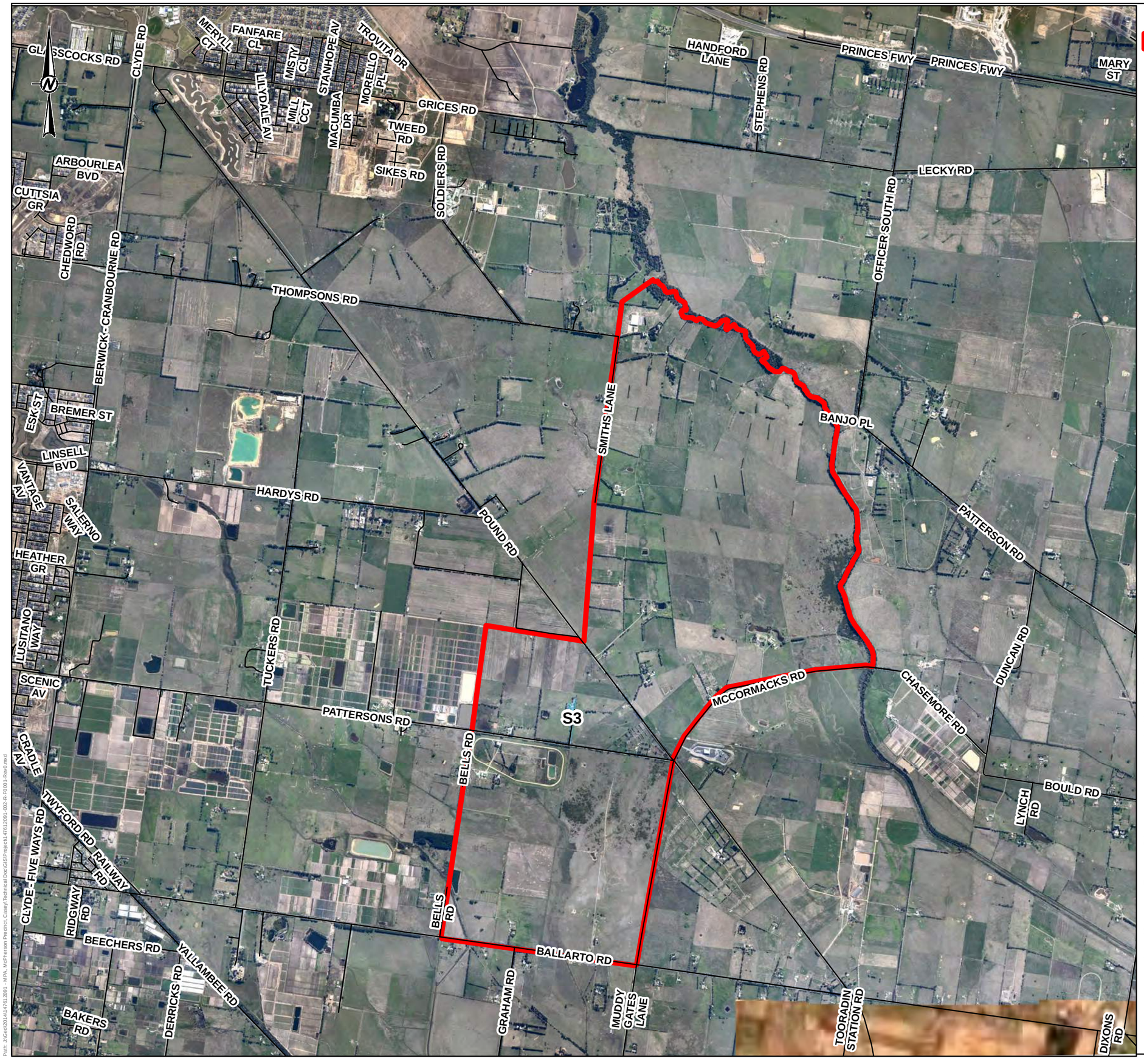
FIGURES



LEGEND

Site Boundary

NOTES

1. Aerial Photograph sourced from Nearmap. Date of capture 14/05/2014.
2. Road data sourced from VicMap.
3. Geological sourced from Cranbourne(1967).

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0 900 1,800
METRES

REFERENCE SCALE: 1:30,000 (at A3)

PROJECTION: GDA 1994 MGA Zone 55

CLIENT
METROPOLITAN PLANNING AUTHORITY

PROJECT
MCPHERSON PRECINCT STRUCTURE PLAN (PSP 1055)

TITLE
STUDY AREA

CONSULTANT
Golder Associates

YYYY-MM-DD	2014-09-12
PREPARED	JPH
DESIGN	N/A
REVIEW	JAGM
APPROVED	CJW

PROJECT No.	CONTROL	Rev.	FIGURE
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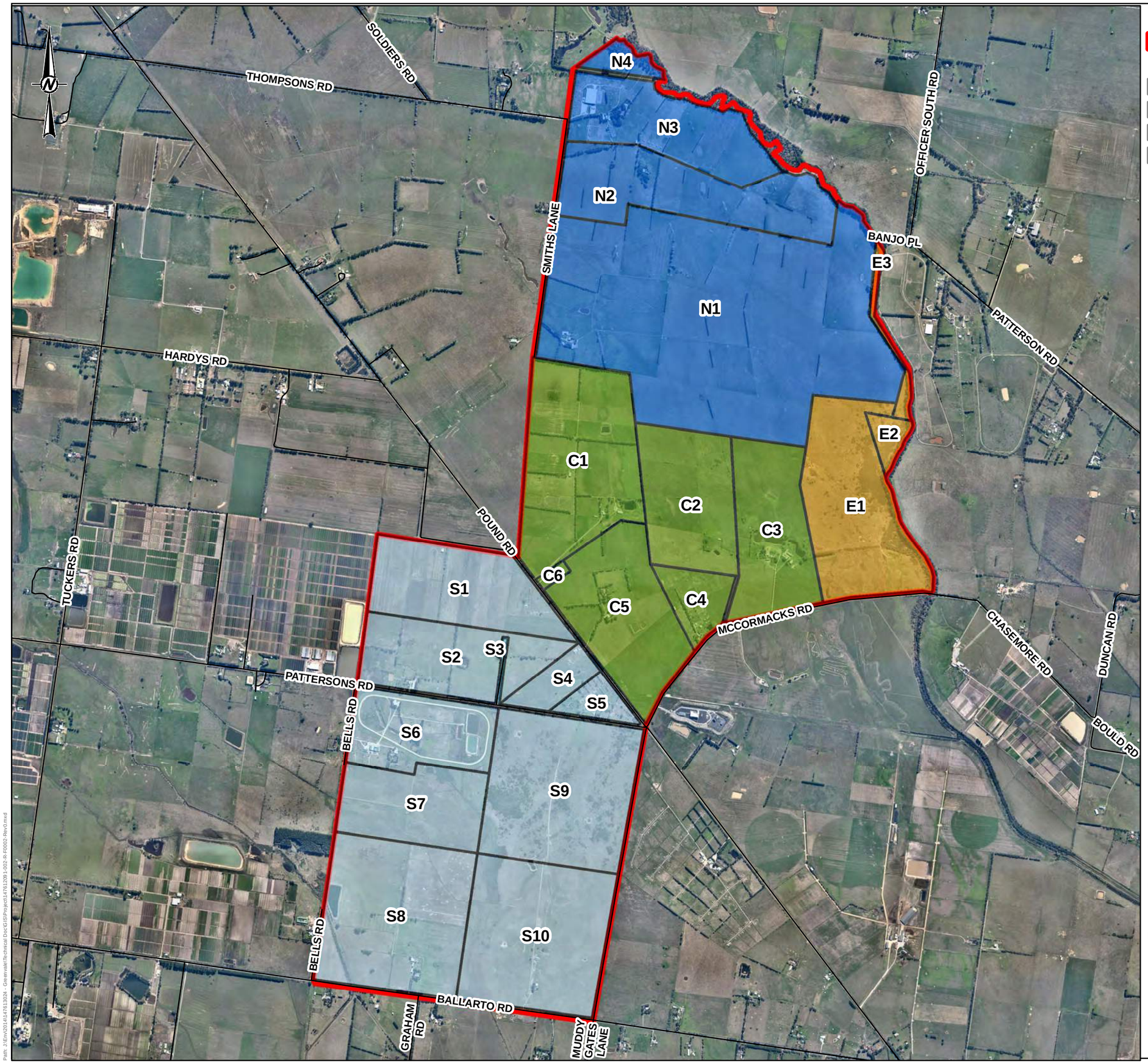

LEGEND

- Site Boundary

Precinct Sub Area

- Central
- East
- North
- South
- E1 Parcel ID

NOTES

1. Aerial Photograph sourced from Nearmap. Date of capture 14/05/2014.
2. Road data sourced from VicMap.
3. Geological sourced from Cranbourne(1967).

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REFERENCE SCALE: 1:21,000 (at A3)

PROJECTION: GDA 1994 MGA Zone 55

CLIENT
METROPOLITAN PLANNING AUTHORITY

PROJECT
MCPHERSON PRECINCT STRUCTURE PLAN (PSP 1055)

TITLE
PRECINCT SUB AREAS

CONSULTANT
Golder Associates

YYYY-MM-DD	2014-09-12
PREPARED	JPH
DESIGN	N/A
REVIEW	JAGM
APPROVED	CJW

PROJECT No.	CONTROL	Rev.	FIGURE
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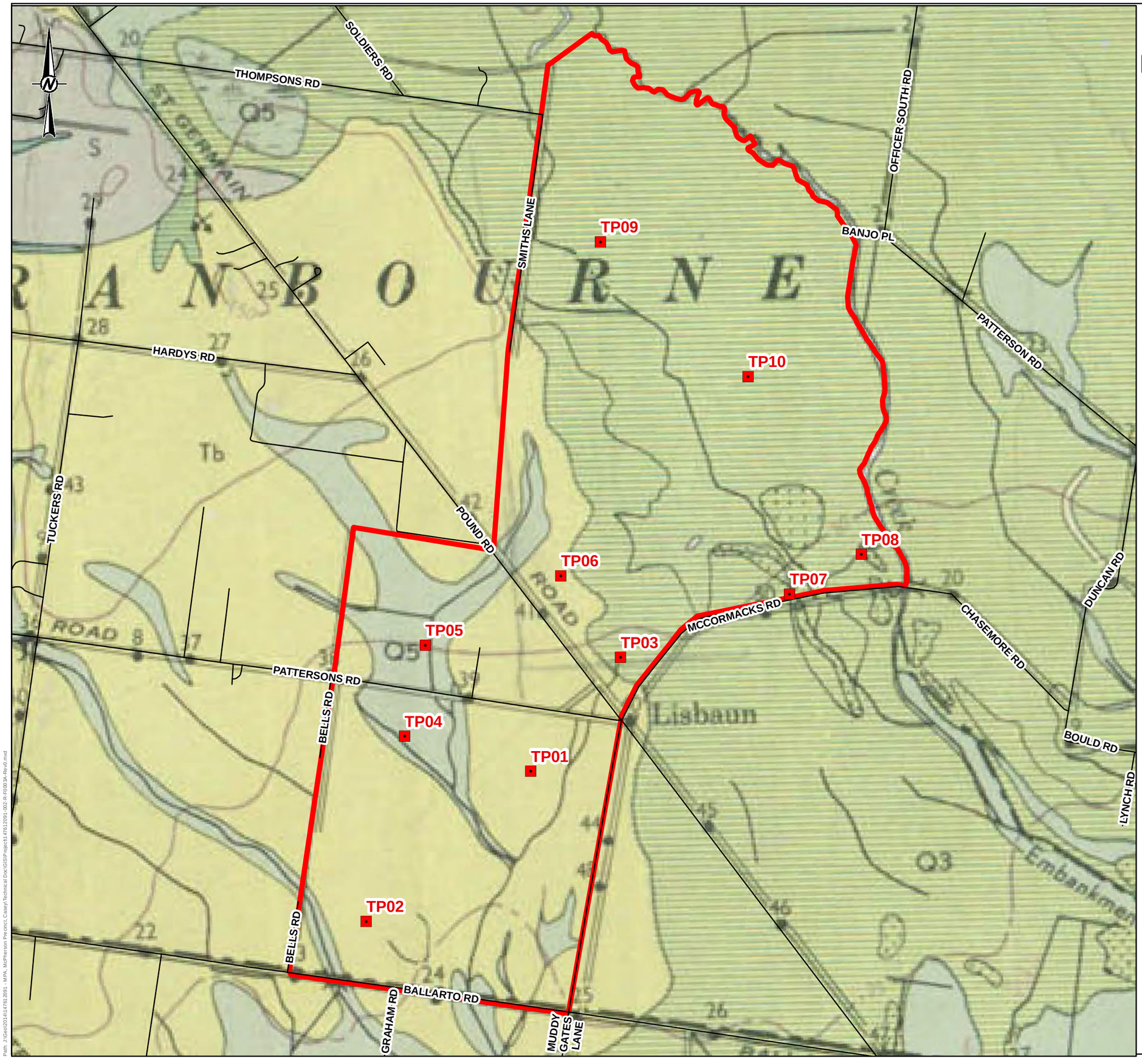

LEGEND

- Test Pit Location
- Site Boundary

Site Geology - Cranbourne 63K

Q7	Sand, clayey sand (mangrove swamp)
Q6	Mud, sand, peat (salt marsh)
Q5	Peaty clay, clay (mainly swamp deposits)
Q4	Siliceous and calcareous sand (dune and beach deposits)
Q3	Silt, sand, clay and occasional gravel (including Cardinia Sand shown stippled)
Q2	Siliceous sand dunes and sheets (including Cranbourne Sand) Thin sand cover on older rocks shown stippled
Q1	Warneet Beds. Sand, silt, clay
Tb	Baxter Sandstone. Ferruginous sandstone, sand, sandy clay, occasional gravel
Tm	Balcombe Clay. Silty clay, marl
Tob	Older Volcanics. Basalt, tuff
M	Felspathic sandstone and mudstone (in shore platform)
Dgd / Dg	Granodiorite (Dgd), granite (Dg)
S	Sandstone, siltstone, mudstone, shale
Ou	Sandstone, slate, chert
Om	Sandstone, slate, chert

NOTES

1. Aerial Photograph sourced from Nearmap. Date of capture 14/05/2014.
2. Road data sourced from VicMap.
3. Geological sourced from Cranbourne(1967).
4. The Potential Contamination Ranking is based on the assessment methodology (including subjective and objective factors). This ranking should be considered in conjunction with the assessment methodology.

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REFERENCE SCALE: 1:21,000 (at A3)

PROJECTION: GDA 1994 MGA Zone 55

CLIENT
METROPOLITAN PLANNING AUTHORITY

PROJECT
MCPHERSON PRECINCT STRUCTURE PLAN (PSP 1055)

TITLE
SITE GEOLOGY AND TEST PIT LOCATIONS

CONSULTANT
Golder Associates

YYYY-MM-DD	2014-09-15
PREPARED	JAGM
DESIGN	N/A
REVIEW	AJH
APPROVED	CJW

PROJECT No.	CONTROL	Rev.	FIGURE
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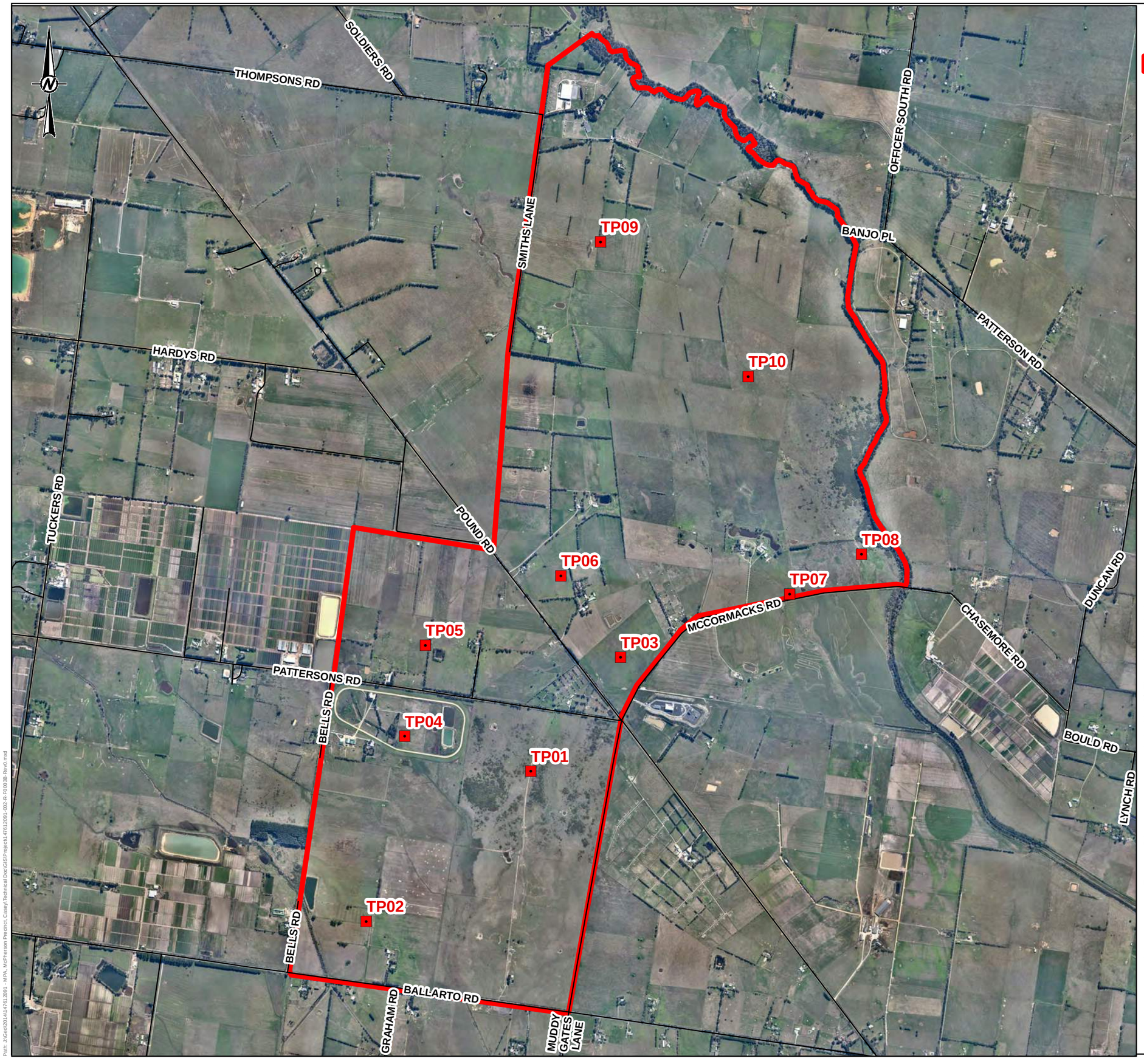

LEGEND

- Test Pit Location
- Site Boundary

NOTES

1. Aerial Photograph sourced from Nearmap. Date of capture 14/05/2014.
2. Road data sourced from VicMap.
3. Geological sourced from Cranbourne(1967).
4. The Potential Contamination Ranking is based on the assessment methodology (including subjective and objective factors). This ranking should be considered in conjunction with the assessment methodology.

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REFERENCE SCALE: 1:21,000 (at A3)

PROJECTION: GDA 1994 MGA Zone 55

CLIENT
METROPOLITAN PLANNING AUTHORITY

PROJECT
MCPHERSON PRECINCT STRUCTURE PLAN (PSP 1055)

TITLE
TEST PIT LOCATIONS

CONSULTANT
Golder Associates

YYYY-MM-DD	2014-09-15
PREPARED	JAGM
DESIGN	N/A
REVIEW	AJH
APPROVED	CJW

PROJECT No.	CONTROL	Rev.	FIGURE
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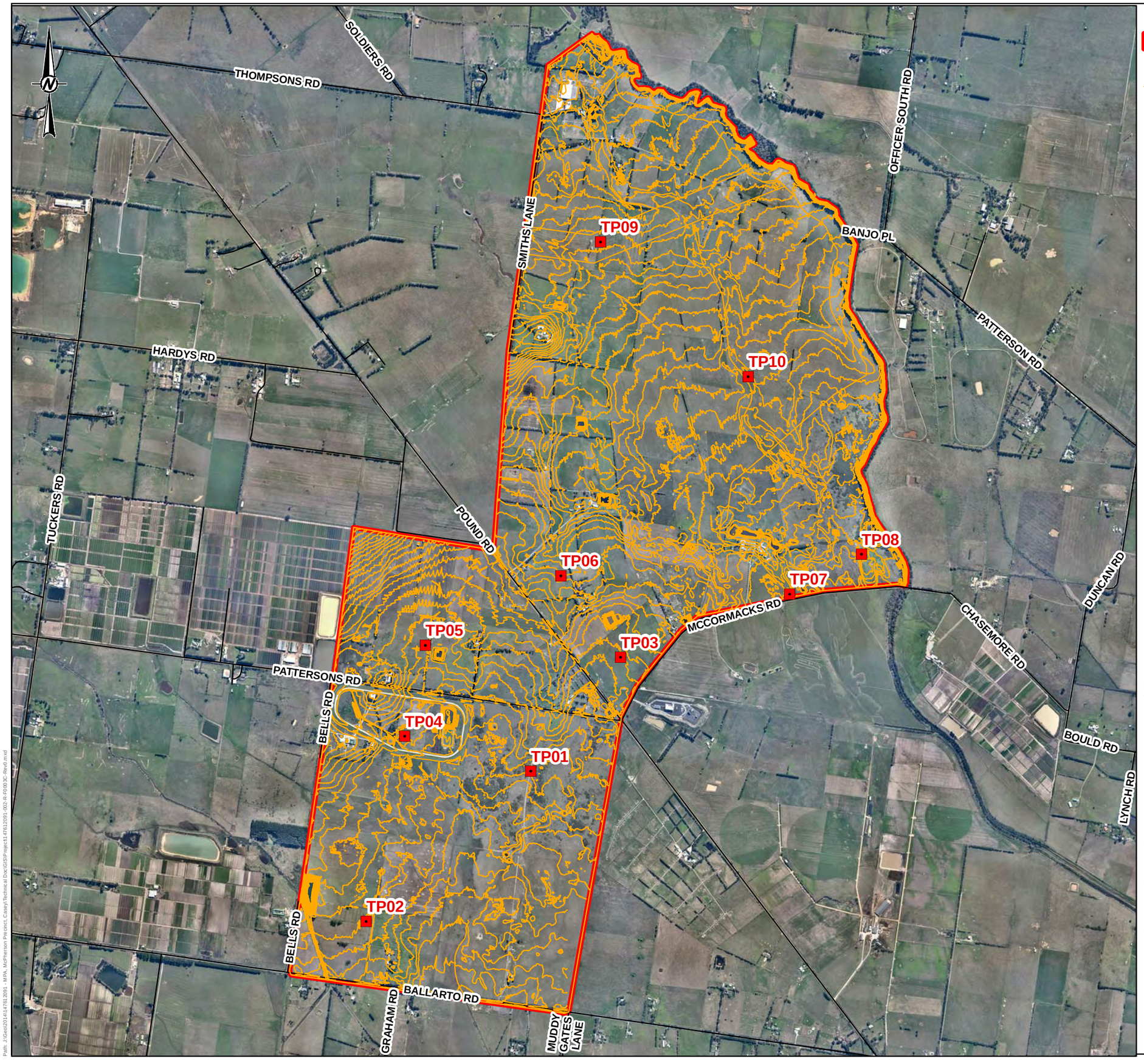

LEGEND

- Site Boundary
- Test Pit Location
- Topography Contours (50 cm)

NOTES

1. Aerial Photograph sourced from Nearmap. Date of capture 14/05/2014.
2. Road data sourced from VicMap.
3. Geological sourced from Cranbourne(1967).
4. The Potential Contamination Ranking is based on the assessment methodology (including subjective and objective factors). This ranking should be considered in conjunction with the assessment methodology.

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REFERENCE SCALE: 1:21,000 (at A3)

PROJECTION: GDA 1994 MGA Zone 55

CLIENT
METROPOLITAN PLANNING AUTHORITY

PROJECT
MCPHERSON PRECINCT STRUCTURE PLAN (PSP 1055)

TITLE
SITE TOPOGRAPHY

CONSULTANT
Golder Associates

YYYY-MM-DD	2014-09-15
PREPARED	JAGM
DESIGN	N/A
REVIEW	AJH
APPROVED	CJW

PROJECT No.	CONTROL	Rev.	FIGURE
147612091	002-R	0	**3C**

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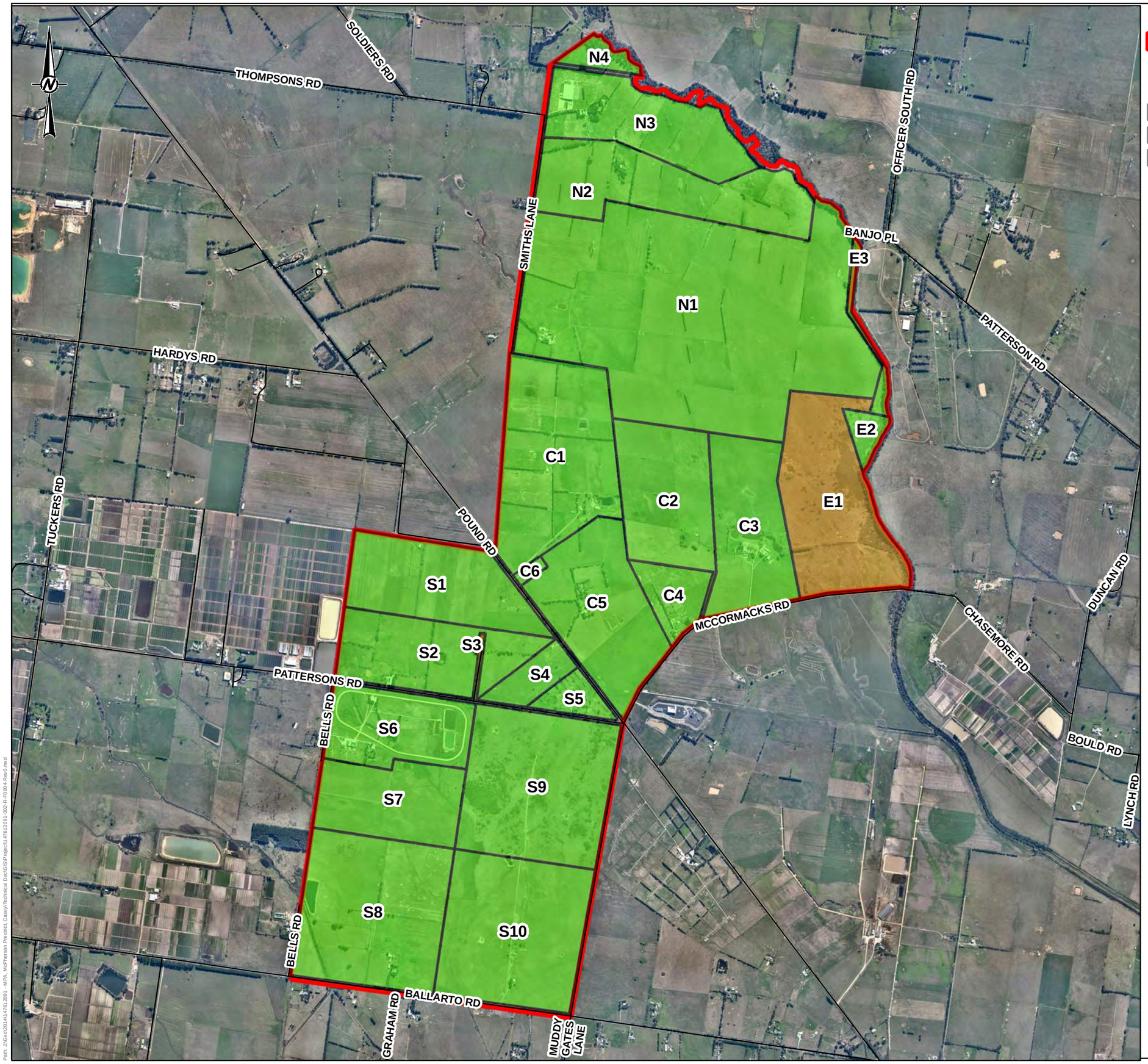

LEGEND

Site Boundary

Potential Land Contamination Ranking

Risk

- Low
- Medium
- High

E1 Parcel ID

NOTES

1. Aerial Photograph sourced from Nearmap. Date of capture 14/05/2014.
2. Road data sourced from VicMap.
3. Geological sourced from Cranbourne(1967).
4. The Potential Contamination Ranking is based on the assessment methodology (including subjective and objective factors). This ranking should be considered in conjunction with the assessment methodology.

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0 625 1,250 METRES

REFERENCE SCALE: 1:21,000 (at A3)

PROJECTION: GDA 1994 MGA Zone 55

CLIENT
METROPOLITAN PLANNING AUTHORITY

PROJECT
MCPHERSON PRECINCT STRUCTURE PLAN (PSP 1055)

TITLE
POTENTIAL LAND CONTAMINATION RANKINGS

CONSULTANT
Golder Associates

YYYY-MM-DD	2014-09-12
PREPARED	JPH
DESIGN	N/A
REVIEW	JAGM
APPROVED	CJW

PROJECT No.	CONTROL	Rev.	FIGURE
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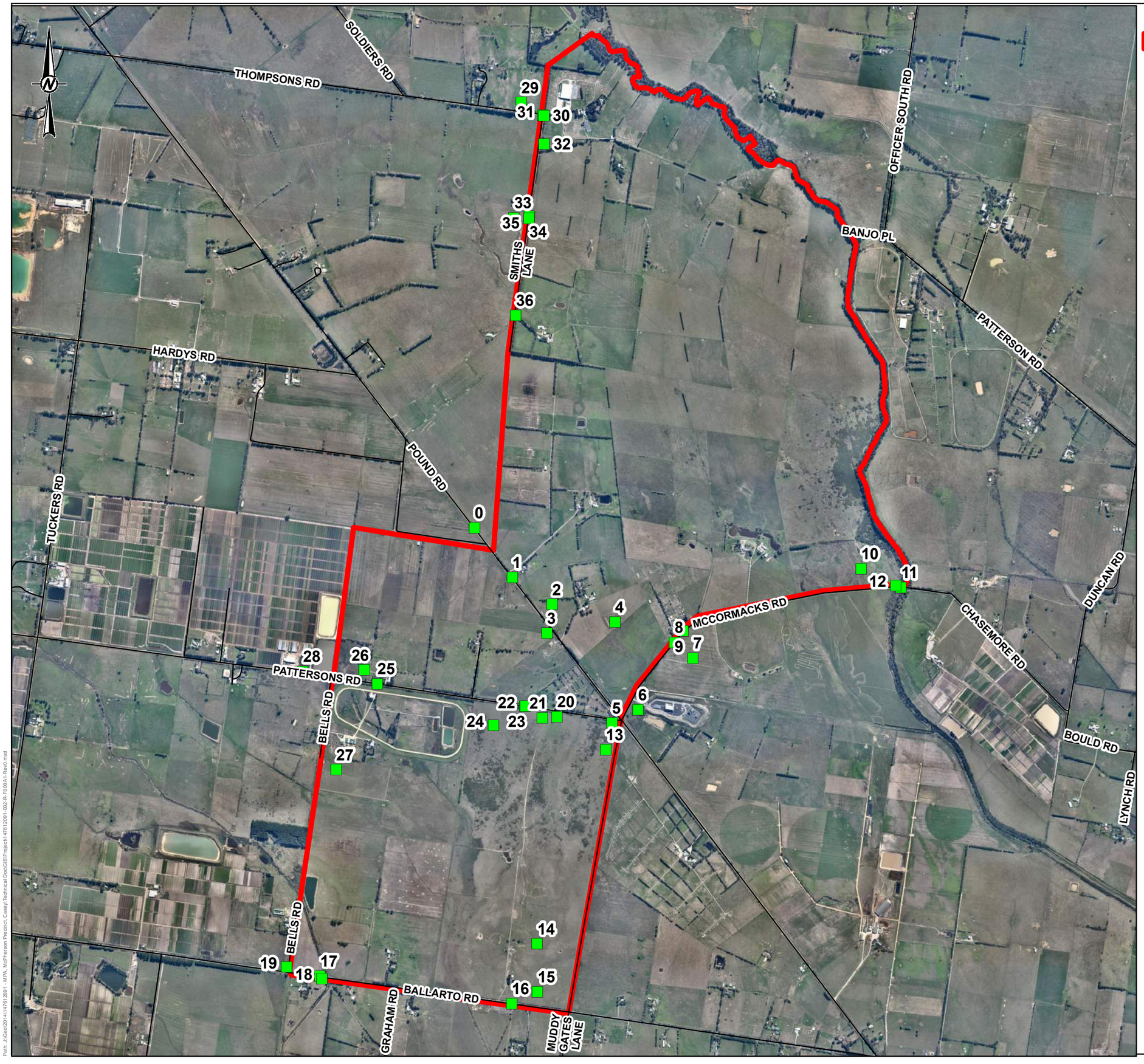
APPENDIX A

Drive- By Photographs



LEGEND

- Site Boundary
- Location of Site Drive-By Photograph

NOTES

1. Aerial Photograph sourced from Nearmap. Date of capture 14/05/2014.
2. Road data sourced from VicMap.
3. Geological sourced from Cranbourne(1967).
4. The Potential Contamination Ranking is based on the assessment methodology (including subjective and objective factors). This ranking should be considered in conjunction with the assessment methodology.

0 625 1,250
METRES

REFERENCE SCALE: 1:21,000 (at A3)

PROJECTION: GDA 1994 MGA Zone 55

CLIENT
METROPOLITAN PLANNING AUTHORITY

PROJECT
MCPHERSON PRECINCT STRUCTURE PLAN (PSP 1055)

TITLE
SITE DRIVE-BY PHOTOGRAPHS

CONSULTANT
Golder Associates

YYYY-MM-DD	2014-09-19
PREPARED	JAGM
DESIGN	N/A
REVIEW	AJH
APPROVED	CJW

PROJECT No.	CONTROL	Rev.	FIGURE
147612091	002-R	0	**A1**

Table 1: Drive-by Photographs

Location ID	Photograph
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Location ID	Photograph
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Location ID	Photograph
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APPENDIX B

Summary of Geotechnical Information

REPORT OF TEST PIT: TP01

CLIENT:	Metropolitan Planning Authoirty	COORDS: 357797 m E 5778719 m N MGA94 55	SHEET: 1 OF 1
PROJECT:	McPherson Precinct Structure Plan	SURFACE RL: DATUM: AHD	MACHINE: Backhoe
LOCATION:	Clyde and Clyde North	LENGTH: 2.00 m WIDTH: 0.60 m DIRECTION: 000°	CONTRACTOR: Kingston Plant Hire
JOB NO:	147612091	PIT DEPTH: 3.00 m	LOGGED: CJL DATE: 5/9/14
		BUCKET TYPE: Toothed-600mm	CHECKED: ASR DATE: 18/9/14

Excavation					Sampling		Field Material Description					
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	DCP TEST (AS1289.6.3.2) Blows per 100 mm
BH	L		0.0					SM	TOPSOIL: Silty SAND fine grained, dark grey, trace organics	M	L	0 5 10 15 20 25
				0.25								
				0.40				SP	SAND fine - medium grained, grey, with some silt			
			0.5					CI	Sandy CLAY medium plasticity, grey and orange brown		F	
											St	
			1.0								VSt	
			1.5									
				2.10				CI	Silty CLAY medium plasticity, pale grey with orange brown pockets		H	
	M		2.5									
				2.60					with some fine to coarse grained quartz sand			
			3.0						TEST PIT DISCONTINUED @ 3.00 m GROUNDWATER NOT ENCOUNTERED BACKFILLED			
			3.5									
			4.0									
			4.5									
			5.0									

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GAP gINT FN. F01f
RL3

Project No: 147612091	**Test Pit TP01**	Golder Associates
Date: 5 September 2014	**McPherson Precinct Structure Plan** **PSP 1055**	

REPORT OF TEST PIT: TP02

Golder Associates

CLIENT: Metropolitan Planning Authoirty
PROJECT: McPherson Precinct Structure Plan
LOCATION: Clyde and Clyde North
JOB NO: 147612091

COORDS: 356868 m E 5777875 m N MGA94 55
SURFACE RL: DATUM: AHD
LENGTH: 2.00 m WIDTH: 0.60 m DIRECTION: 000°
PIT DEPTH: 2.90 m
BUCKET TYPE: Toothed-600mm

SHEET: 1 OF 1
MACHINE: Backhoe
CONTRACTOR: Kingston Plant Hire
LOGGED: CJL DATE: 5/9/14
CHECKED: ASR DATE: 18/9/14

Excavation					Sampling		Field Material Description					
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	DCP TEST (AS1289.6.3.2) Blows per 100 mm
BH	L		0.0	0.15				SP	TOPSOIL: SAND fine - medium grained, grey, trace silt, trace rootlets	M - W	MD - D	0 5 10 15 20 25
									rootlets not observed			
			0.5	0.90								
			1.0	1.10	DS 0.90-1.10 m PP = 300 kPa			SC	Clayey SAND fine - medium grained, orange brown and pale grey, medium to high plasticity fines, sand is quartz based		D	
	M		1.5	1.90				SP	SAND fine - medium grained, grey and orange brown, with some fines	M		26 26
			2.0						medium - coarse grained, fines <5%, orange brown with trace grey pockets		VD	
			2.5	2.70					grey quartz sand	M - W		
			3.0						TEST PIT DISCONTINUED @ 2.90 m GROUNDWATER NOT ENCOUNTERED BACKFILLED			
			3.5									
			4.0									
			4.5									
			5.0									

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GAP gINT FN. F01f
RL3

Project No: 147612091	**Test Pit TP02**	Golder Associates
Date: 5 September 2014	**McPherson Precinct Structure Plan** **PSP 1055**	

REPORT OF TEST PIT: TP03

Golder Associates

CLIENT: Metropolitan Planning Authoirty
PROJECT: McPherson Precinct Structure Plan
LOCATION: Clyde and Clyde North
JOB NO: 147612091

COORDS: 358302 m E 5779361 m N MGA94 55
SURFACE RL: DATUM: AHD
LENGTH: 2.00 m WIDTH: 0.60 m DIRECTION: 000°
PIT DEPTH: 2.80 m
BUCKET TYPE: Toothed-600mm

SHEET: 1 OF 1
MACHINE: Backhoe
CONTRACTOR: Kingston Plant Hire
LOGGED: CJL DATE: 5/9/14
CHECKED: ASR DATE: 18/9/14

Excavation					Sampling		Field Material Description					
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	DCP TEST (AS1289.6.3.2) Blows per 100 mm
BH	L	inferred perched water	0.0					SC	TOPSOIL: Clayey SAND fine - medium grained, dark brown, trace organics	M	VL	
				0.30	DS 0.30-0.40 m			SC	Clayey SAND fine - medium grained, grey, low plasticity fines	W		
			0.5	0.50				CI	CLAY medium plasticity, pale orange brown and pale grey	M	St	
			1.0	1.10				CI / ML	silty CLAY / clayey SILT. pale grey with pockets of orange brown	D	VSt	
	M		1.5									
			2.0	2.00	DS 2.00-2.10 m			CI-CH	Silty CLAY medium plasticity, pale grey with pockets of orange brown, friable		H	
			2.5									
									TEST PIT DISCONTINUED @ 2.80 m GROUNDWATER NOT ENCOUNTERED BACKFILLED Inferred perched water at 0.3 m depth			
			3.0									
			3.5									
			4.0									
			4.5									
			5.0									

DCP TEST (AS1289.6.3.2) Blows per 100 mm: 0 5 10 15 20 25

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GAP gINT FN. F01f
RL3

Project No: 147612091	**Test Pit TP03**	Golder Associates
Date: 5 September 2014	**McPherson Precinct Structure Plan** **PSP 1055**	

REPORT OF TEST PIT: TP04

CLIENT:	Metropolitan Planning Authoirty	COORDS: 357041 m E 5778917 m N MGA94 55	SHEET: 1 OF 1
PROJECT:	McPherson Precinct Structure Plan	SURFACE RL: DATUM: AHD	MACHINE: Backhoe
LOCATION:	Clyde and Clyde North	LENGTH: 2.00 m WIDTH: 0.60 m DIRECTION: 000°	CONTRACTOR: Kingston Plant Hire
JOB NO:	147612091	PIT DEPTH: 1.00 m	LOGGED: CJL DATE: 5/9/14
		BUCKET TYPE: Toothed-600mm	CHECKED: ASR DATE: 18/9/14

Excavation					Sampling		Field Material Description					
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	0 5 10 15 20 25
BH	L	inferred perched water	0.0					SC-SM	TOPSOIL: Silty Clayey SAND dark brown	M	L	
				0.30				SM	Silty SAND fine - medium grained, pale grey			
			0.5	0.50				CI	CLAY medium plasticity, pale grey and orange brown		St - VSt	
			1.0						TEST PIT DISCONTINUED @ 1.00 m GROUNDWATER NOT ENCOUNTERED BACKFILLED Inferred perched water at 0.3 m depth. Test Pit terminated at 1.0 m at the request of the property manager			
			1.5									
			2.0									
			2.5									
			3.0									
			3.5									
			4.0									
			4.5									
			5.0									

Project No: 147612091	**Test Pit TP04**	Golder Associates
Date: 5 September 2014	**McPherson Precinct Structure Plan** **PSP 1055**	

REPORT OF TEST PIT: TP05

Golder Associates

CLIENT: Metropolitan Planning Authoirty
PROJECT: McPherson Precinct Structure Plan
LOCATION: Clyde and Clyde North
JOB NO: 147612091

COORDS: 357202 m E 5779429 m N MGA94 55
SURFACE RL: DATUM: AHD
LENGTH: 2.00 m WIDTH: 0.60 m DIRECTION: 000°
PIT DEPTH: 3.00 m
BUCKET TYPE: Toothed-600mm

SHEET: 1 OF 1
MACHINE: Backhoe
CONTRACTOR: Kingston Plant Hire
LOGGED: CJL DATE: 5/9/14
CHECKED: ASR DATE: 18/9/14

Excavation					Sampling		Field Material Description					
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	DCP TEST (AS1289.6.3.2) Blows per 100 mm
BH	L	inferred perched water	0.0					SC-SM	TOPSOIL: Clayey Silty SAND fine grained, well graded, dark brown, trace organic material	M	L	0 5 10 15 20 25
				0.30				SM	Silty SAND fine grained, well graded, pale grey	M - W		
			0.5	0.50	PP = 250 kPa DS 0.80-1.00 m PP = 250 kPa			CH	CLAY high plasticity, grey with some orange, with some fine to coarse grained sand, trace gravel		VSt - H	
			1.0									
				1.30					with some fine to medium grained sand			
	M		1.5	1.50					with some dark grey pockets, 50% orange brown, 50% grey	M	H	
			2.0									
			2.5									
				2.90				CL-CI	Silty CLAY low to medium plasticity, pale grey, with some clayey SILT			
			3.0						TEST PIT DISCONTINUED @ 3.00 m GROUNDWATER NOT ENCOUNTERED BACKFILLED Inferred perched water at 0.3 m depth			
			3.5									
			4.0									
			4.5									
			5.0									

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GAP gINT FN. F01f
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Project No: 147612091	**Test Pit TP05**	Golder Associates
Date: 5 September 2014	**McPherson Precinct Structure Plan** **PSP 1055**	

REPORT OF TEST PIT: TP06

Golder Associates

CLIENT: Metropolitan Planning Authoirty
PROJECT: McPherson Precinct Structure Plan
LOCATION: Clyde and Clyde North
JOB NO: 147612091

COORDS: 357965 m E 5779820 m N MGA94 55
SURFACE RL: DATUM: AHD
LENGTH: 2.00 m WIDTH: 0.60 m DIRECTION: 000°
PIT DEPTH: 1.70 m
BUCKET TYPE: Toothed-600mm

SHEET: 1 OF 1
MACHINE: Backhoe
CONTRACTOR: Kingston Plant Hire
LOGGED: CJL DATE: 5/9/14
CHECKED: ASR DATE: 18/9/14

Excavation					Sampling		Field Material Description					
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	DCP TEST (AS1289.6.3.2) Blows per 100 mm
BH	L	inflow ~ 1L/sec	0.0					SC-SM	TOPSOIL: Clayey Silty SAND fine to medium grained, well graded, dark brown, trace organic material	M	MD	0 5 10 15 20 25
				0.40				SW	SAND fine to medium grained, well graded, grey, trace silt, organics not observed		D - VD	
			1.0								D	
			1.5							W	L - MD	
									TEST PIT DISCONTINUED @ 1.70 m GROUNDWATER ENCOUNTERED @ 1.30 m DEPTH Test Pit discontinued due to collapse. BACKFILLED			
			2.0									
			2.5									
			3.0									
			3.5									
			4.0									
			4.5									
			5.0									

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GAP gINT FN. F01f
RL3

Project No: 147612091	**Test Pit TP06**	Golder Associates
Date: 5 September 2014	**McPherson Precinct Structure Plan** **PSP 1055**	

REPORT OF TEST PIT: TP07

Golder Associates

CLIENT: Metropolitan Planning Authoirty
PROJECT: McPherson Precinct Structure Plan
LOCATION: Clyde and Clyde North
JOB NO: 147612091

COORDS: 359253 m E 5779717 m N MGA94 55
SURFACE RL: DATUM: AHD
LENGTH: 2.00 m WIDTH: 0.60 m DIRECTION: 000°
PIT DEPTH: 2.20 m
BUCKET TYPE: Toothed-600mm

SHEET: 1 OF 1
MACHINE: Backhoe
CONTRACTOR: Kingston Plant Hire
LOGGED: CJL DATE: 4/9/14
CHECKED: ASR DATE: 18/9/14

Excavation					Sampling		Field Material Description					
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	DCP TEST (AS1289.6.3.2) Blows per 100 mm
BH	L		0.0	0.20				SC-SM	TOPSOIL: Silty Clayey SAND fine to medium grained, brown, with some organic material	M	L	0 5 10 15 20 25
				0.40				SM	Silty SAND fine grained, well graded, brown grey, with some clay, trace organic material			
			0.5						pale grey, organic material not observed			
	M			0.85				CI	CLAY medium plasticity, orange brown and grey, trace sand		VSt	
			1.0	1.40								
	M-H		1.5					SC	Clayey SAND fine to medium grained, orange brown, with some pockets of very stiff to hard, dark grey fissured clay, weakly to strongly cemented			
				1.80					fine grained, pale grey		VD	
			2.0						TEST PIT DISCONTINUED @ 2.20 m GROUNDWATER NOT ENCOUNTERED BACKFILLED			
			2.5									
			3.0									
			3.5									
			4.0									
			4.5									
			5.0									

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GAP gINT FN. F01f
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Project No: 147612091	**Test Pit TP07**	Golder Associates
Date: 4 September 2014	**McPherson Precinct Structure Plan** **PSP 1055**	

REPORT OF TEST PIT: TP08

Golder Associates

CLIENT: Metropolitan Planning Authoirty
PROJECT: McPherson Precinct Structure Plan
LOCATION: Clyde and Clyde North
JOB NO: 147612091

COORDS: 359658 m E 5779943 m N MGA94 55
SURFACE RL: DATUM: AHD
LENGTH: 2.00 m WIDTH: 0.60 m DIRECTION: 000°
PIT DEPTH: 2.10 m
BUCKET TYPE: Toothed-600mm

SHEET: 1 OF 1
MACHINE: Backhoe
CONTRACTOR: Kingston Plant Hire
LOGGED: CJL DATE: 4/9/14
CHECKED: ASR DATE: 18/9/14

Excavation					Sampling		Field Material Description					
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	DCP TEST (AS1289.6.3.2) Blows per 100 mm
BH	L	▽	0.0					ML	TOPSOIL: Sandy SILT brown, with some organic material, trace rootlets, low liquid limit, fine to medium grained sand		MD	
			0.5	0.60	DS 0.30-0.40 m			SP	FILL: Gravelly Clayey SAND fine to coarse grained, well graded, brown and pale grey, weakly cemented, inferred granitic sands with trace extremely weathered and extremely low strength granite	M	D	
			1.0	1.10	DS 0.80-1.00 m				trace wire, inferred quartz sand		MD	
			1.5	1.90							L	
			2.0							W		
									TEST PIT DISCONTINUED @ 2.10 m GROUNDWATER NOT ENCOUNTERED Test Pit discontinued due to collapse. Inferred perched water within fill at 1.9 m depth. BACKFILLED			
			2.5									
			3.0									
			3.5									
			4.0									
			4.5									
			5.0									

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GAP gINT FN. F01f
RL3

Project No: 147612091	**Test Pit TP08**	Golder Associates
Date: 4 September 2014	**McPherson Precinct Structure Plan** **PSP 1055**	

REPORT OF TEST PIT: TP09

CLIENT: Metropolitan Planning Authoirty
PROJECT: McPherson Precinct Structure Plan
LOCATION: Clyde and Clyde North
JOB NO: 147612091

COORDS: 358190 m E 5781706 m N MGA94 55
SURFACE RL: DATUM: AHD
LENGTH: 2.00 m WIDTH: 0.60 m DIRECTION: 000°
PIT DEPTH: 2.50 m
BUCKET TYPE: Toothed-600mm

SHEET: 1 OF 1
MACHINE: Backhoe
CONTRACTOR: Kingston Plant Hire
LOGGED: MGW DATE: 4/9/14
CHECKED: ASR DATE: 18/9/14

Excavation					Sampling		Field Material Description					
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	DCP TEST (AS1289.6.3.2) Blows per 100 mm
EX	L		0.0	0.10				CI	TOPSOIL: Silty CLAY medium plasticity, grey brown, trace sand, trace rootlets	M	F - St	0 5 10 15 20 25
								CI	Silty CLAY medium plasticity, brown and dark grey brown			
			0.5	0.75				CI-CH	Silty CLAY medium - high plasticity, grey with orange brown pockets			
			1.0	1.00					with some medium grained sand		VSt	
			1.5									
			2.0								H	
			2.5						TEST PIT DISCONTINUED @ 2.50 m GROUNDWATER NOT ENCOUNTERED BACKFILLED			
			3.0									
			3.5									
			4.0									
			4.5									
			5.0									

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Project No: 147612091	**Test Pit TP09**	Golder Associates
Date: 4 September 2014	**McPherson Precinct Structure Plan** **PSP 1055**	

REPORT OF TEST PIT: TP10

Golder Associates

CLIENT: Metropolitan Planning Authoirty
PROJECT: McPherson Precinct Structure Plan
LOCATION: Clyde and Clyde North
JOB NO: 147612091

COORDS: 359026 m E 5780948 m N MGA94 55
SURFACE RL: DATUM: AHD
LENGTH: 2.00 m WIDTH: 0.60 m DIRECTION: 000°
PIT DEPTH: 2.20 m
BUCKET TYPE: Toothed-600mm

SHEET: 1 OF 1
MACHINE: Backhoe
CONTRACTOR: Kingston Plant Hire
LOGGED: MGW DATE: 4/9/14
CHECKED: ASR DATE: 18/9/14

Excavation					Sampling		Field Material Description					
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	DCP TEST (AS1289.6.3.2) Blows per 100 mm
EX	L		0.0	0.10				SM	Silty SAND fine to coarse grained, sub-angular, dark brown, trace rootlets, trace clay rootlets no longer observed		L	
			0.5	0.60				CH	Sandy CLAY sub-angular, high plasticity, brown with dark grey and dark orange pockets, fine to coarse grained sand	M	MD	
			1.0		DS 1.00-1.30 m							
			1.5									
			2.0	2.00				CI-CH	Sandy CLAY medium - high plasticity, dark brown and black, trace wood fibres, trace weakly cemented sand lenses		St - VSt	
			2.5						TEST PIT DISCONTINUED @ 2.20 m GROUNDWATER NOT ENCOUNTERED BACKFILLED			
			3.0									
			3.5									
			4.0									
			4.5									
			5.0									

DCP TEST (AS1289.6.3.2) Blows per 100 mm: 0 5 10 15 20 25

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GAP gINT FN. F01f
RL3

Project No: 147612091	**Test Pit TP10**	Golder Associates
Date: 4 September 2014	**McPherson Precinct Structure Plan** **PSP 1055**	

Particle size distribution and consistency limits test report

AS 1289 2.1.1, 3.1.2, 3.2.1, 3.3.1, 3.4.1, 3.6.1 and AS 1726 Appendix A (Sec. A2)

Golder Associates Pty Ltd
MELBOURNE GEOTECHNICAL LABORATORY
Building 7, Botanicca Corporate Park
570 - 588 Swan Street
Richmond, Victoria 3121

Test request #:	**TR-140294**	**Lab sample ID:**	1402885
Client:	Metropolitan Planning Authority		
Client address:	Level 29, 35 Collins St, Melbourne, VIC 3000		
Project ID:	**147612091**	**Location ID:**	BH 02
Project name:	McPherson Precinct	**Sample depth:**	0.9-1.1m
		Client sample ref:	Sa02 - Bulk
Location:	Clyde and Clyde North, Victoria	**Phase / Locale:**	-

Sample description (AS1726 App. A, Sec. 2): (includes visual, tactile classification in the absence of relevant test results)

SC, Clayey SAND, fine to coarse, grey brown, high plasticity fines, trace fine gravel

Sampling co-ordinates Easting (m)	Northing (m)	Reduced Level
-	-	-

PARTICLE SIZE DISTRIBUTION AS1289 3.6.1

Sieve Size	% Passing	LB S	UB S
125 mm	100		
75 mm	100		
63 mm	100		
53 mm	100		
37.5 mm	100		
26.5 mm	100		
19.0 mm	100		
13.2 mm	100		
9.5 mm	100		
6.7 mm	100		
4.75 mm	100		
2.36 mm	99		
1.18 mm	96		
600 µm	86		
425 µm	81		
300 µm	75		
150 µm	56		
75 µm	45		

Method:	AS 1289 2.1.1	AS1289 3.1.2	AS1289 3.2.1	AS 1289 3.3.1	AS 1289 3.4.1	AS 1289 3.4.1
	Moisture content (%)	Liquid limit (%)	Plastic limit (%)	Plasticity index (%)	Linear shrinkage (%)	Curling/ Crumbling/ Cracking
Result:	**20.4**	**ND**	**ND**	**ND**	**ND**	**ND**
LB S:						-
UB S:						-

Preparation method: Dry Sieved **LSM length (mm):** N/A

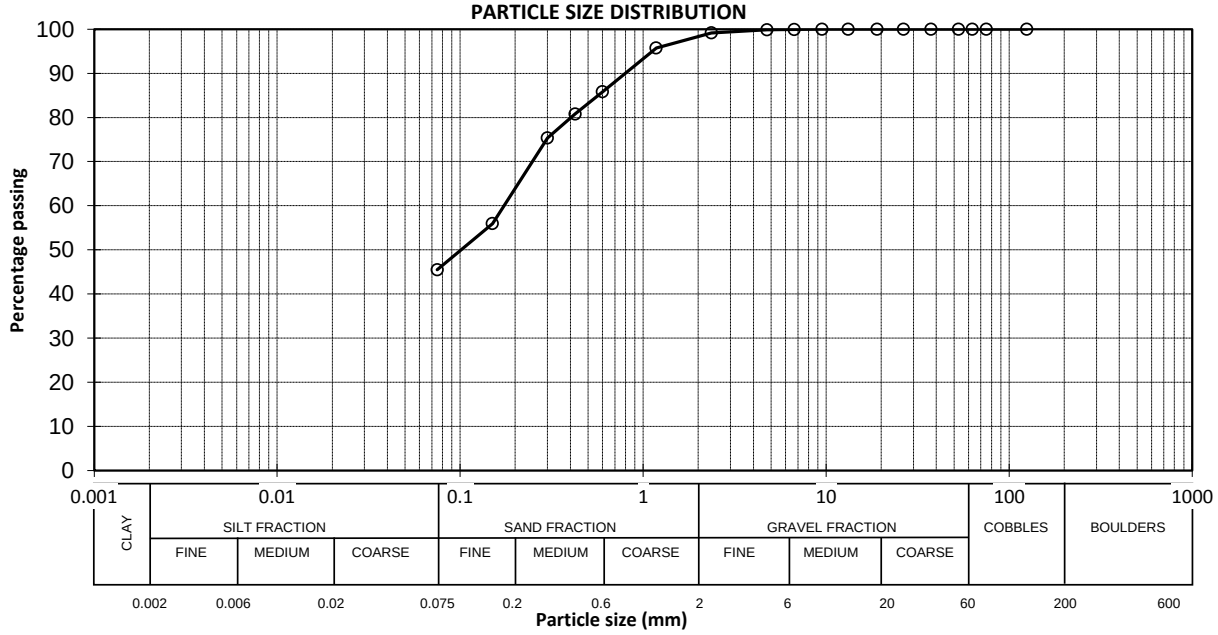
Sample history & comments: Oven Dried

Definitions: LB S = Lower bound specification; UB S = Upper bound specification
NP = Non plastic; NO = Not obtainable; ND = Not determined
N/A = Not applicable; Sec. = Section; LSM = Linear shrinkage mould

GRADING SUMMARY

Fines (<75 µm)	Sand (>75 µm - <2 mm)	Gravel (>2 mm - <60 mm)	Cobbles (>60mm - <200 mm)
45.5 %	**53.7 %**	**0.9 %**	**-**

PARTICLE SIZE DISTRIBUTION



Testing performed by: DLP **Results reviewed by:** DJG **Date reported:** **17-Sep-14**

Certificate reference: **147612091_1402885_TR-140294_PSD_Rev0**

Approved signatory:

NATA accreditation number: 1961 Melbourne

Accredited for compliance with ISO/IEC 17025

D.L.Pamment

These tests were carried out in general accordance with the Australian standards identified in this certificate.

Particle size distribution and consistency limits test report

AS 1289 2.1.1, 3.1.2, 3.2.1, 3.3.1, 3.4.1, 3.6.1 and AS 1726 Appendix A (Sec. A2)

Golder Associates Pty Ltd
MELBOURNE GEOTECHNICAL LABORATORY
Building 7, Botanicca Corporate Park
570 - 588 Swan Street
Richmond, Victoria 3121

Test request #:	**TR-140294**	**Lab sample ID:**	1402886
Client:	Metropolitan Planning Authority		
Client address:	Level 29, 35 Collins St, Melbourne, VIC 3000		
Project ID:	**147612091**	**Location ID:**	BH 03
Project name:	McPherson Precinct	**Sample depth:**	0.3-0.4m
		Client sample ref:	Sa02 - Bulk
Location:	Clyde and Clyde North, Victoria	**Phase / Locale:**	-

Sample description (AS1726 App. A, Sec. 2): (includes visual, tactile classification in the absence of relevant test results)

SC, Clayey SAND, fine to coarse, grey brown, low plasticity fines

Sampling co-ordinates Easting (m)	Northing (m)	Reduced Level
-	-	-

PARTICLE SIZE DISTRIBUTION AS1289 3.6.1

Sieve Size	% Passing	LB S	UB S
125 mm	100		
75 mm	100		
63 mm	100		
53 mm	100		
37.5 mm	100		
26.5 mm	100		
19.0 mm	100		
13.2 mm	100		
9.5 mm	100		
6.7 mm	100		
4.75 mm	100		
2.36 mm	100		
1.18 mm	93		
600 µm	71		
425 µm	61		
300 µm	53		
150 µm	46		
75 µm	42		

Method:	AS 1289 2.1.1	AS1289 3.1.2	AS1289 3.2.1	AS 1289 3.3.1	AS 1289 3.4.1	AS 1289 3.4.1
	Moisture content (%)	Liquid limit (%)	Plastic limit (%)	Plasticity index (%)	Linear shrinkage (%)	Curling/ Crumbling/ Cracking
Result:	**13.1**	**ND**	**ND**	**ND**	**ND**	**ND**
LB S:						-
UB S:						-

Preparation method: Dry Sieved **LSM length (mm):** N/A

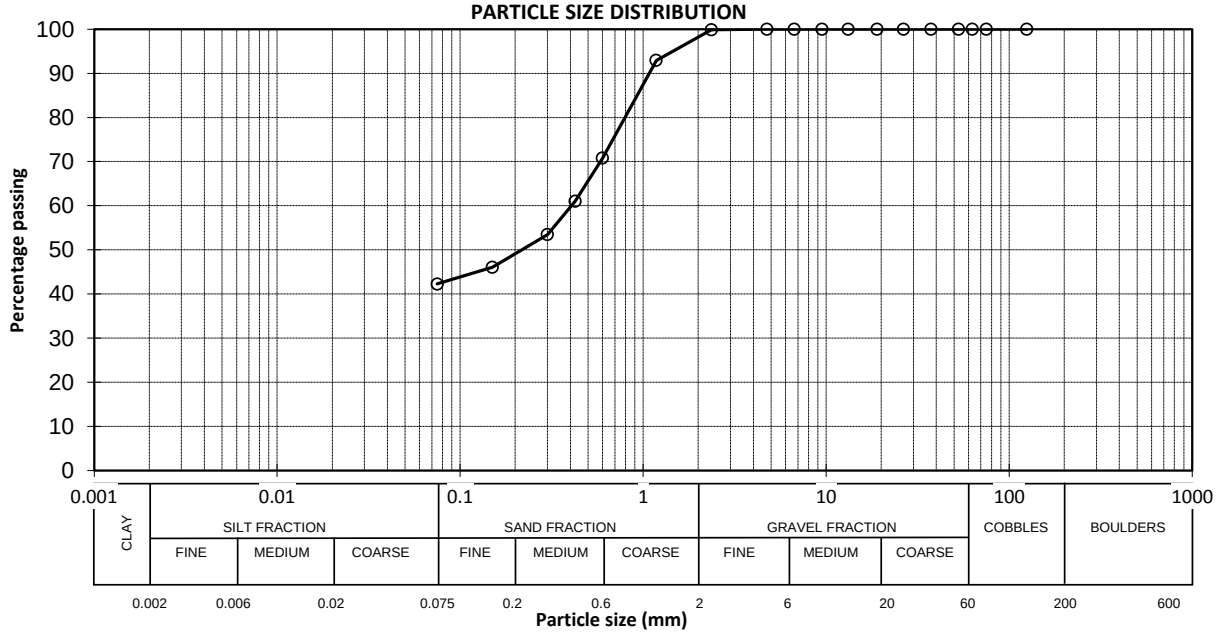
Sample history & comments: Oven Dried

Definitions: LB S = Lower bound specification; UB S = Upper bound specification
NP = Non plastic; NO = Not obtainable; ND = Not determined
N/A = Not applicable; Sec. = Section; LSM = Linear shrinkage mould

GRADING SUMMARY

Fines (<75 µm)	Sand (>75 µm - <2 mm)	Gravel (>2 mm - <60 mm)	Cobbles (>60mm - <200 mm)
42.3 %	**57.6 %**	**0.1 %**	**-**

PARTICLE SIZE DISTRIBUTION



Testing performed by: DLP **Results reviewed by:** DJG **Date reported:** **17-Sep-14**

Certificate reference: **147612091_1402886_TR-140294_PSD_Rev0**

Approved signatory:

NATA accreditation number: 1961 Melbourne

Accredited for compliance with ISO/IEC 17025

D.L.Pamment

These tests were carried out in general accordance with the Australian standards identified in this certificate.

Particle size distribution and consistency limits test report

AS 1289 2.1.1, 3.1.2, 3.2.1, 3.3.1, 3.4.1, 3.6.1 and AS 1726 Appendix A (Sec. A2)

Golder Associates Pty Ltd
MELBOURNE GEOTECHNICAL LABORATORY
Building 7, Botanicca Corporate Park
570 - 588 Swan Street
Richmond, Victoria 3121

Test request #:	**TR-140294**	**Lab sample ID:**	1402891
Client:	Metropolitan Planning Authority		
Client address:	Level 29, 35 Collins St, Melbourne, VIC 3000		
Project ID:	**147612091**	**Location ID:**	BH 03
Project name:	McPherson Precinct	**Sample depth:**	2.0-2.1m
		Client sample ref:	Sa04 - Bulk
Location:	Clyde and Clyde North, Victoria	**Phase / Locale:**	-

Sample description (AS1726 App. A, Sec. 2): (includes visual, tactile classification in the absence of relevant test results) CH, CLAY, high plasticity, grey brown, trace fine to coarse sand

Sampling co-ordinates Easting (m)	Northing (m)	Reduced Level
-	-	-

PARTICLE SIZE DISTRIBUTION AS1289 3.6.1

Sieve Size	% Passing	LB S	UB S
125 mm	100		
75 mm	100		
63 mm	100		
53 mm	100		
37.5 mm	100		
26.5 mm	100		
19.0 mm	100		
13.2 mm	100		
9.5 mm	100		
6.7 mm	100		
4.75 mm	100		
2.36 mm	100		
1.18 mm	100		
600 µm	98		
425 µm	97		
300 µm	95		
150 µm	92		
75 µm	87		

Method:	AS 1289 2.1.1	AS1289 3.1.2	AS1289 3.2.1	AS 1289 3.3.1	AS 1289 3.4.1	AS 1289 3.4.1
	Moisture content (%)	Liquid limit (%)	Plastic limit (%)	Plasticity index (%)	Linear shrinkage (%)	Curling/ Crumbling/ Cracking
Result:	**19.1**	**ND**	**ND**	**ND**	**ND**	**ND**
LB S:						-
UB S:						-

Preparation method: Dry Sieved **LSM length (mm):** N/A

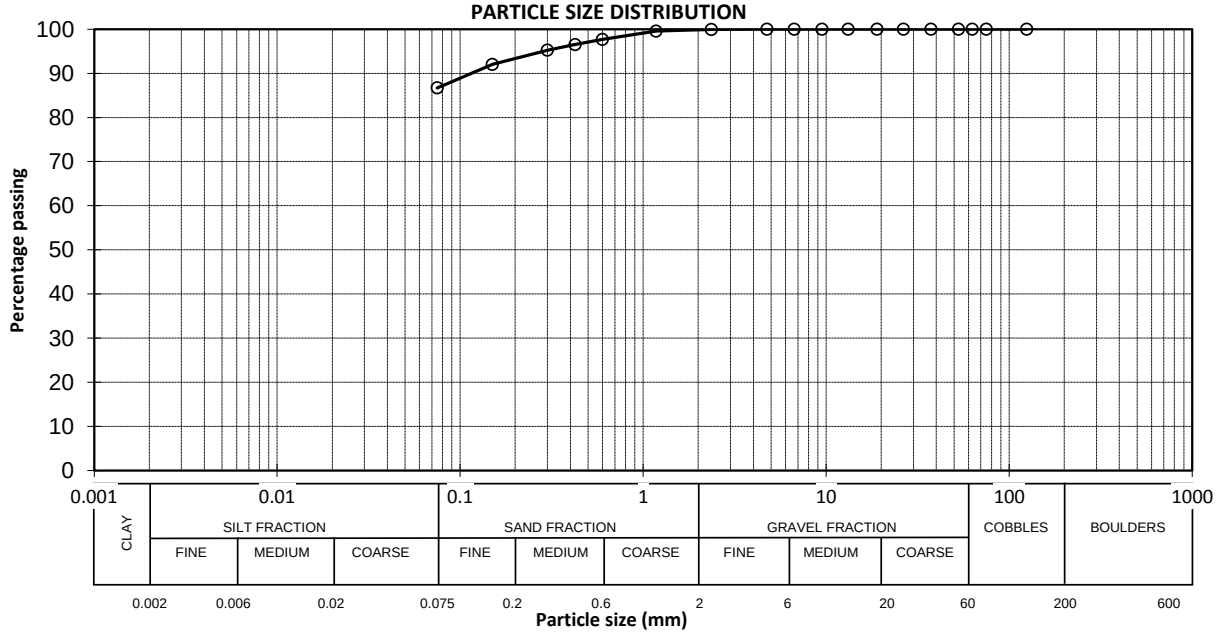
Sample history & comments: Oven Dried

Definitions: LB S = Lower bound specification; UB S = Upper bound specification
NP = Non plastic; NO = Not obtainable; ND = Not determined
N/A = Not applicable; Sec. = Section; LSM = Linear shrinkage mould

GRADING SUMMARY

Fines (<75 µm)	Sand (>75 µm - <2 mm)	Gravel (>2 mm - <60 mm)	Cobbles (>60mm - <200 mm)
86.7 %	**13.3 %**	**-**	**-**

PARTICLE SIZE DISTRIBUTION



Testing performed by: DLP **Results reviewed by:** DJG **Date reported:** **17-Sep-14**

Certificate reference: **147612091_1402891_TR-140294_PSD_Rev0**

Approved signatory:

NATA accreditation number: 1961 Melbourne

Accredited for compliance with ISO/IEC 17025

D.L.Pamment

These tests were carried out in general accordance with the Australian standards identified in this certificate.

Particle size distribution and consistency limits test report

AS 1289 2.1.1, 3.1.2, 3.2.1, 3.3.1, 3.4.1, 3.6.1 and AS 1726 Appendix A (Sec. A2)

Test request #:	**TR-140294**	**Lab sample ID:**	1402887
Client:	Metropolitan Planning Authority		
Client address:	Level 29, 35 Collins St, Melbourne, VIC 3000		
Project ID:	**147612091**	**Location ID:**	BH 05
Project name:	McPherson Precinct		
Location:	Clyde and Clyde North, Victoria	**Phase / Locale:**	-

Golder Associates Pty Ltd
MELBOURNE GEOTECHNICAL LABORATORY
Building 7, Botanicca Corporate Park
570 - 588 Swan Street
Richmond, Victoria 3121

Sample depth: 0.8-1.0m
Client sample ref: Sa01 - Bulk

Sample description (AS1726 App. A, Sec. 2): (includes visual, tactile classification in the absence of relevant test results)
CH, CLAY, high plasticity, grey brown, with some fine to coarse sand, trace fine gravel

Sampling co-ordinates Easting (m)	Northing (m)	Reduced Level
-	-	-

PARTICLE SIZE DISTRIBUTION AS1289 3.6.1

Sieve Size	% Passing	LB S	UB S
125 mm	100		
75 mm	100		
63 mm	100		
53 mm	100		
37.5 mm	100		
26.5 mm	100		
19.0 mm	100		
13.2 mm	100		
9.5 mm	100		
6.7 mm	100		
4.75 mm	100		
2.36 mm	99		
1.18 mm	98		
600 µm	95		
425 µm	93		
300 µm	90		
150 µm	77		
75 µm	72		

Method:	AS 1289 2.1.1	AS1289 3.1.2	AS1289 3.2.1	AS 1289 3.3.1	AS 1289 3.4.1	AS 1289 3.4.1
	Moisture content (%)	Liquid limit (%)	Plastic limit (%)	Plasticity index (%)	Linear shrinkage (%)	Curling/ Crumbling/ Cracking
Result:	**25.7**	**ND**	**ND**	**ND**	**ND**	**ND**
LB S:						-
UB S:						-

Preparation method: Dry Sieved **LSM length (mm):** N/A

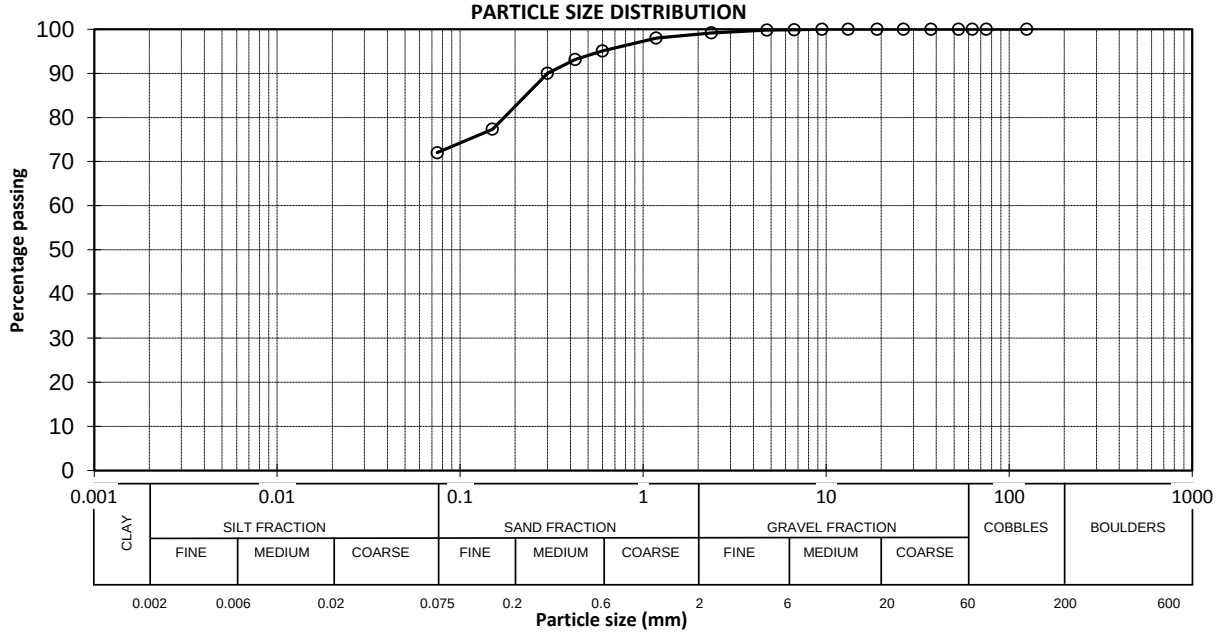
Sample history & comments: Oven Dried

Definitions: LB S = Lower bound specification; UB S = Upper bound specification
NP = Non plastic; NO = Not obtainable; ND = Not determined
N/A = Not applicable; Sec. = Section; LSM = Linear shrinkage mould

GRADING SUMMARY

Fines (<75 µm)	Sand (>75 µm - <2 mm)	Gravel (>2 mm - <60 mm)	Cobbles (>60mm - <200 mm)
72 %	**27.1 %**	**0.9 %**	**-**

PARTICLE SIZE DISTRIBUTION



Testing performed by: DLP **Results reviewed by:** DJG **Date reported:** 17-Sep-14

Certificate reference: 147612091_1402887_TR-140294_PSD_Rev0

Approved signatory:

NATA accreditation number: 1961 Melbourne
Accredited for compliance with ISO/IEC 17025

D.L.Pamment

These tests were carried out in general accordance with the Australian standards identified in this certificate.

Particle size distribution and consistency limits test report

AS 1289 2.1.1, 3.1.2, 3.2.1, 3.3.1, 3.4.1, 3.6.1 and AS 1726 Appendix A (Sec. A2)

Test request #:	**TR-140294**	**Lab sample ID:**	1402888
Client:	Metropolitan Planning Authority		
Client address:	Level 29, 35 Collins St, Melbourne, VIC 3000		
Project ID:	**147612091**	**Location ID:**	BH 08
Project name:	McPherson Precinct		
Location:	Clyde and Clyde North, Victoria	**Phase / Locale:**	-

Golder Associates Pty Ltd
MELBOURNE GEOTECHNICAL LABORATORY
Building 7, Botanicca Corporate Park
570 - 588 Swan Street
Richmond, Victoria 3121

Sample depth: 0.3-0.4m
Client sample ref: Sa01 - Bulk

Sample description (AS1726 App. A, Sec. 2): (includes visual, tactile classification in the absence of relevant test results) ML, Sandy SILT, low liquid limit, dark brown, fine to coarse sand, trace fine gravel, trace root matter, topsoil

Sampling co-ordinates Easting (m)	Northing (m)	Reduced Level
-	-	-

PARTICLE SIZE DISTRIBUTION AS1289 3.6.1

Sieve Size	% Passing	LB S	UB S
125 mm	100		
75 mm	100		
63 mm	100		
53 mm	100		
37.5 mm	100		
26.5 mm	100		
19.0 mm	100		
13.2 mm	100		
9.5 mm	100		
6.7 mm	100		
4.75 mm	99		
2.36 mm	98		
1.18 mm	92		
600 µm	80		
425 µm	74		
300 µm	69		
150 µm	58		
75 µm	50		

Method:	AS 1289 2.1.1	AS1289 3.1.2	AS1289 3.2.1	AS 1289 3.3.1	AS 1289 3.4.1	AS 1289 3.4.1
	Moisture content (%)	Liquid limit (%)	Plastic limit (%)	Plasticity index (%)	Linear shrinkage (%)	Curling/ Crumbling/ Cracking
Result:	**18.7**	**ND**	**ND**	**ND**	**ND**	**ND**
LB S:						-
UB S:						-

Preparation method: Dry Sieved **LSM length (mm):** N/A

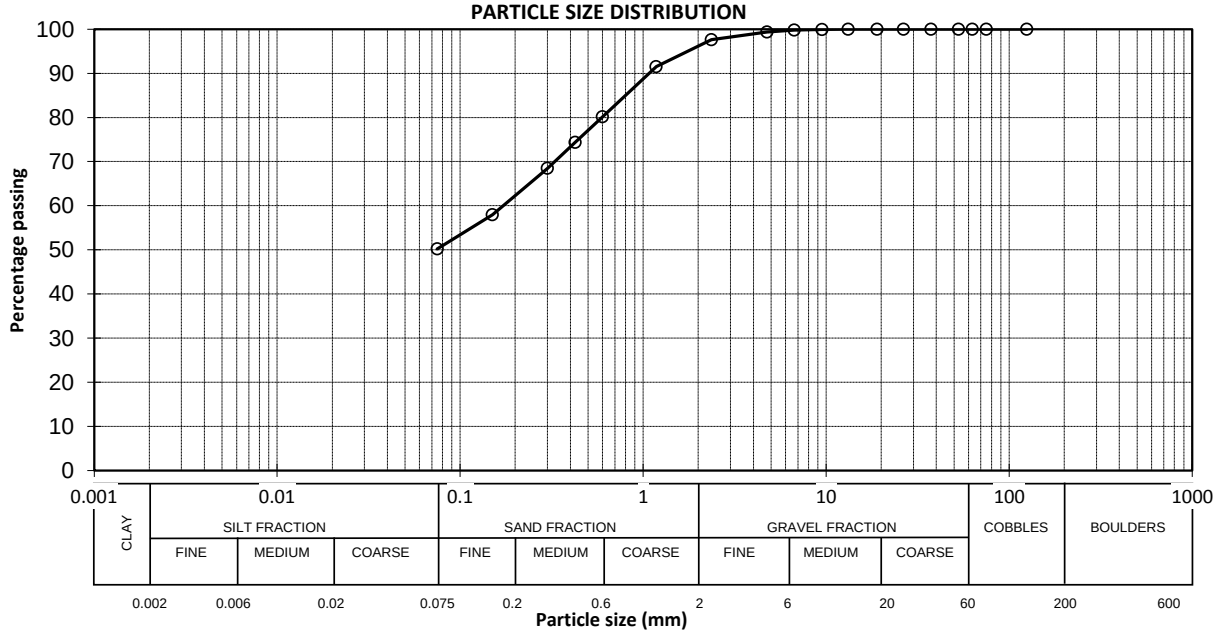
Sample history & comments: Oven Dried

Definitions: LB S = Lower bound specification; UB S = Upper bound specification
NP = Non plastic; NO = Not obtainable; ND = Not determined
N/A = Not applicable; Sec. = Section; LSM = Linear shrinkage mould

GRADING SUMMARY

Fines (<75 µm)	Sand (>75 µm - <2 mm)	Gravel (>2 mm - <60 mm)	Cobbles (>60mm - <200 mm)
50.2 %	**47.4 %**	**2.4 %**	**-**

PARTICLE SIZE DISTRIBUTION



Testing performed by: DLP **Results reviewed by:** DJG **Date reported:** 17-Sep-14

Certificate reference: 147612091_1402888_TR-140294_PSD_Rev0

Approved signatory:

NATA accreditation number: 1961 Melbourne
Accredited for compliance with ISO/IEC 17025

D.L.Pamment

These tests were carried out in general accordance with the Australian standards identified in this certificate.

Particle size distribution and consistency limits test report

AS 1289 2.1.1, 3.1.2, 3.2.1, 3.3.1, 3.4.1, 3.6.1 and AS 1726 Appendix A (Sec. A2)

Test request #:	**TR-140294**	**Lab sample ID:**	1402889
Client:	Metropolitan Planning Authority		
Client address:	Level 29, 35 Collins St, Melbourne, VIC 3000		
Project ID:	**147612091**	**Location ID:**	BH 08
Project name:	McPherson Precinct		
Location:	Clyde and Clyde North, Victoria	**Phase / Locale:**	-

Golder Associates Pty Ltd
MELBOURNE GEOTECHNICAL LABORATORY
Building 7, Botanicca Corporate Park
570 - 588 Swan Street
Richmond, Victoria 3121

Sample depth: 0.8-1.0m
Client sample ref: Sa02 - Bulk

Sample description (AS1726 App. A, Sec. 2): (includes visual, tactile classification in the absence of relevant test results)

SC, Clayey Gravelly SAND, fine to coarse, grey brown, fine to coarse gravel, low plasticity fines, high pyrite content.

Sampling co-ordinates Easting (m)	Northing (m)	Reduced Level
-	-	-

PARTICLE SIZE DISTRIBUTION AS1289 3.6.1

Sieve Size	% Passing	LB S	UB S
125 mm	100		
75 mm	100		
63 mm	100		
53 mm	100		
37.5 mm	100		
26.5 mm	100		
19.0 mm	95		
13.2 mm	93		
9.5 mm	91		
6.7 mm	91		
4.75 mm	89		
2.36 mm	80		
1.18 mm	60		
600 µm	44		
425 µm	37		
300 µm	32		
150 µm	23		
75 µm	19		

Method:	AS 1289 2.1.1	AS1289 3.1.2	AS1289 3.2.1	AS 1289 3.3.1	AS 1289 3.4.1	AS 1289 3.4.1
	Moisture content (%)	Liquid limit (%)	Plastic limit (%)	Plasticity index (%)	Linear shrinkage (%)	Curling/ Crumbling/ Cracking
Result:	**9.2**	**ND**	**ND**	**ND**	**ND**	**ND**
LB S:						-
UB S:						-

Preparation method: Dry Sieved **LSM length (mm):** N/A

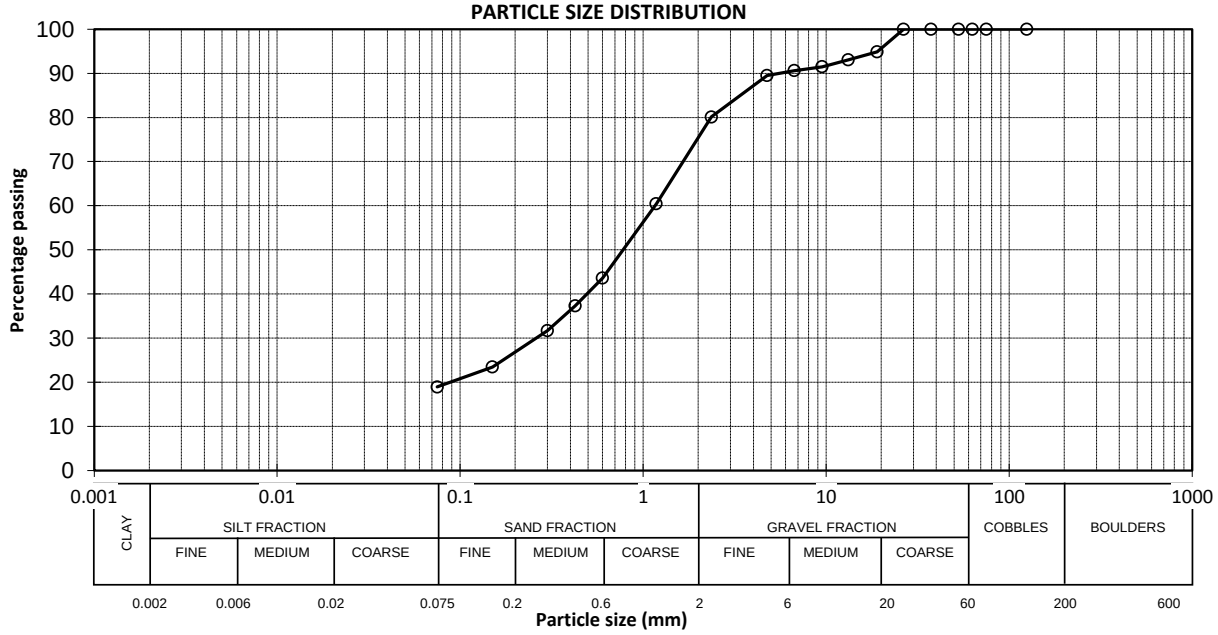
Sample history & comments: Oven Dried

Definitions: LB S = Lower bound specification; UB S = Upper bound specification
NP = Non plastic; NO = Not obtainable; ND = Not determined
N/A = Not applicable; Sec. = Section; LSM = Linear shrinkage mould

GRADING SUMMARY

Fines (<75 µm)	Sand (>75 µm - <2 mm)	Gravel (>2 mm - <60 mm)	Cobbles (>60mm - <200 mm)
18.9 %	**61.2 %**	**19.9 %**	**-**

PARTICLE SIZE DISTRIBUTION



Testing performed by: DLP **Results reviewed by:** DJG **Date reported:** 17-Sep-14

Certificate reference: 147612091_1402889_TR-140294_PSD_Rev0

Approved signatory:

NATA accreditation number: 1961 Melbourne

Accredited for compliance with ISO/IEC 17025

D.L.Pamment

These tests were carried out in general accordance with the Australian standards identified in this certificate.

Particle size distribution and consistency limits test report

AS 1289 2.1.1, 3.1.2, 3.2.1, 3.3.1, 3.4.1, 3.6.1 and AS 1726 Appendix A (Sec. A2)

Test request #:	**TR-140294**	**Lab sample ID:**	1402890
Client:	Metropolitan Planning Authority		
Client address:	Level 29, 35 Collins St, Melbourne, VIC 3000		
Project ID:	**147612091**	**Location ID:**	BH 10
Project name:	McPherson Precinct		
Location:	Clyde and Clyde North, Victoria	**Phase / Locale:**	-

Golder Associates Pty Ltd
MELBOURNE GEOTECHNICAL LABORATORY
Building 7, Botanicca Corporate Park
570 - 588 Swan Street
Richmond, Victoria 3121

Sample depth: 1.0-1.3m
Client sample ref: Sa01 - Bulk

Sample description (AS1726 App. A, Sec. 2): (includes visual, tactile classification in the absence of relevant test results) CH, Sandy CLAY, high plasticity, grey, fine to coarse sand

Sampling co-ordinates Easting (m)	Northing (m)	Reduced Level
-	-	-

PARTICLE SIZE DISTRIBUTION AS1289 3.6.1

Sieve Size	% Passing	LB S	UB S
125 mm	100		
75 mm	100		
63 mm	100		
53 mm	100		
37.5 mm	100		
26.5 mm	100		
19.0 mm	100		
13.2 mm	100		
9.5 mm	100		
6.7 mm	100		
4.75 mm	100		
2.36 mm	100		
1.18 mm	94		
600 µm	72		
425 µm	64		
300 µm	60		
150 µm	57		
75 µm	55		

Method:	AS 1289 2.1.1	AS1289 3.1.2	AS1289 3.2.1	AS 1289 3.3.1	AS 1289 3.4.1	AS 1289 3.4.1
	Moisture content (%)	Liquid limit (%)	Plastic limit (%)	Plasticity index (%)	Linear shrinkage (%)	Curling/ Crumbling/ Cracking
Result:	**14.4**	**ND**	**ND**	**ND**	**ND**	**ND**
LB S:						-
UB S:						-

Preparation method: Dry Sieved **LSM length (mm):** N/A

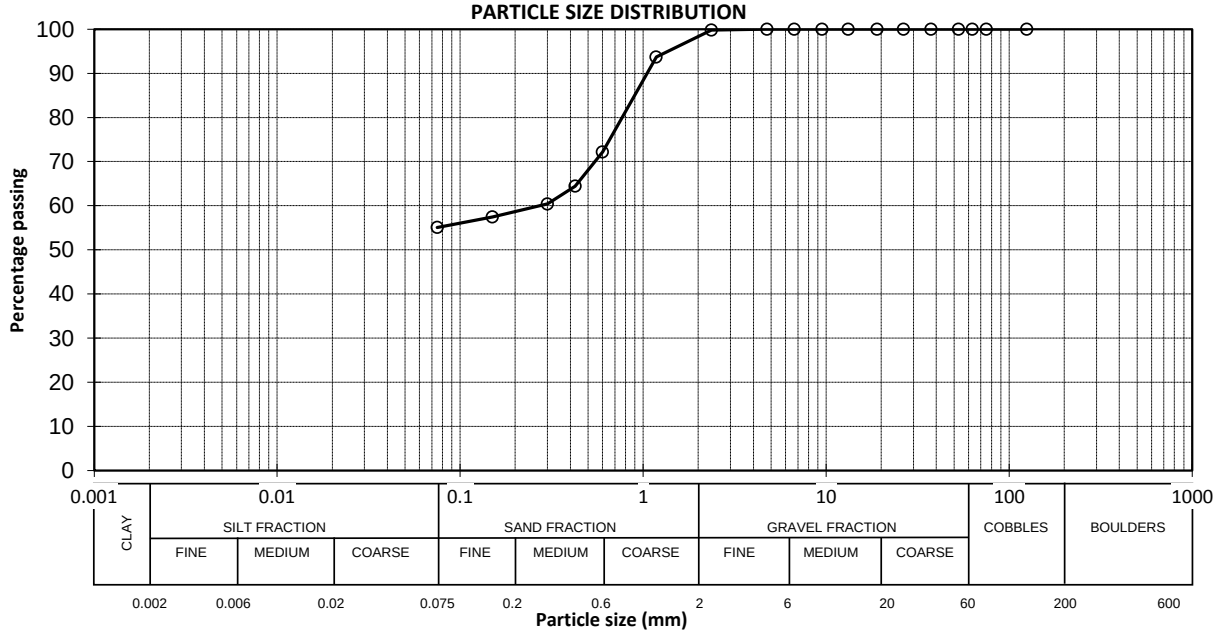
Sample history & comments: Oven Dried

Definitions: LB S = Lower bound specification; UB S = Upper bound specification
NP = Non plastic; NO = Not obtainable; ND = Not determined
N/A = Not applicable; Sec. = Section; LSM = Linear shrinkage mould

GRADING SUMMARY

Fines (<75 µm)	Sand (>75 µm - <2 mm)	Gravel (>2 mm - <60 mm)	Cobbles (>60mm - <200 mm)
55.1 %	**44.7 %**	**0.2 %**	**-**

PARTICLE SIZE DISTRIBUTION



Testing performed by: DLP **Results reviewed by:** DJG **Date reported:** 17-Sep-14

Certificate reference: 147612091_1402890_TR-140294_PSD_Rev0

Approved signatory:

NATA accreditation number: 1961 Melbourne
Accredited for compliance with ISO/IEC 17025

D.L.Pamment

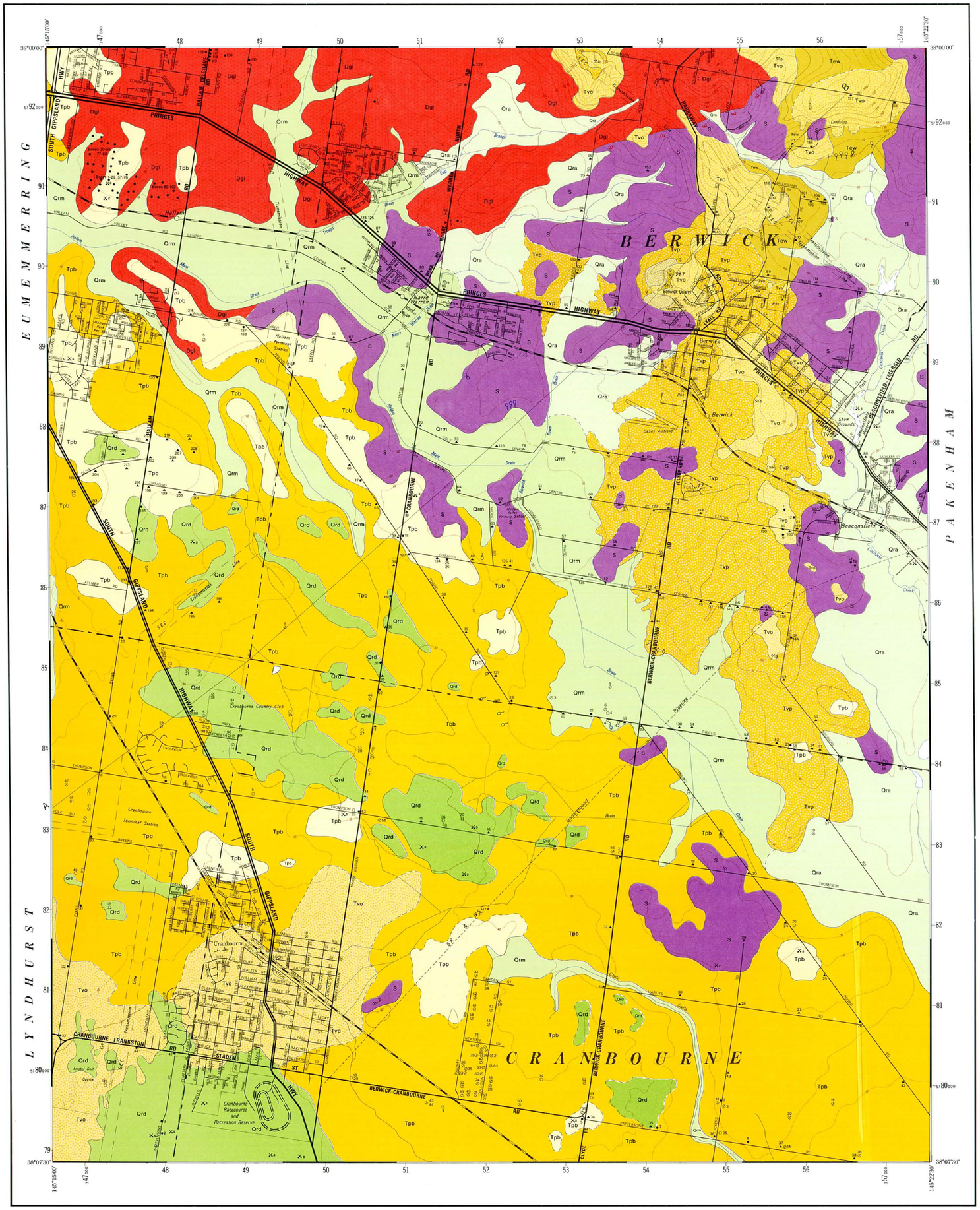
These tests were carried out in general accordance with the Australian standards identified in this certificate.

AUSTRALIA 1:25 000

BERWICK

GEOLOGICAL SURVEY OF VICTORIA

7921-I-NW



		SEDIMENTARY				IGNEOUS	
		Alluvial and Colluvial	Lacustrine-Paludal	Marine	Aeolian	Extrusive	Intrusive
QUATERNARY	RECENT	Qra	Qrm		Qrd		
	PLEISTOCENE						
TERTIARY	PLIOCENE	Tpb					
	MIOCENE	Tpb				Tvo	
	OLIGOCENE	Tvp					
		Tew					
		Unconformity					
DEVONIAN	UPPER						Dgl
		Major Unconformity					
SILURIAN				S			

Qra Sandy silty clay, sand

Qrm Clay, silt, sandy clay

Qrd Sand, silty sand, clayey sand

Baxter Formation

Tpb Sand, clayey sand, silt; minor gravel and clay-generally consolidated sediments

Tpb Sandy clay, minor sand-generally poorly consolidated sediments

Older Volcanics

Tvo Limburgite, olivine basalt, titanaugite basalt

Tvp Clay, silty clay, sandy silty clay, pyroclastics

Werribee Formation

Tew Fissile clay, poorly consolidated sand and clayey sand, brown coal (in places intercalated with basal part of Older Volcanics)

Lysterfield Granodiorite

Dgl Granodiorite, biotite granodiorite

S Massive micaceous quartz siltstone, interbedded micaceous quartz sandstone

Geological boundary

Geological boundary inferred

Dip and strike of bedding

Sand pit

Clay pit

Quarry (b basalt)

Government bore

Auger bore (Government)

Private bore prior to the Groundwater Act 1969

Private bore after the Groundwater Act 1969

Fill

Radiometric age in millions of years (K/Ar method) 21-7

Highway

Main connecting road

Other road

Railway, station Hallam

Parish boundary

Parish name LYND

Watercourse, intermittent water cover

Drain

Spring, seep

Metamorphosed Silurian sediments m m m

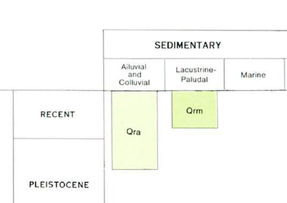
Contours (10 metre interval

Plant fossils (leaves, stems, silicified wood)

SURVEY DETAILS

A Based on engineering geological survey, 1974-1976

B Modified from Cranbourne 1:63360 geological sheet 1962



In the centre of the sheet Grid North is 1°03' west of True North and the magnetic declination from True North is approximately 10°30'

INDEX TO ADJOINING SHEETS

DANDENONG 7922-III-SE	LYSTERFIELD 7922-II-SW	CARDINIA CREEK 7922-II-SE
KEYSBOROUGH 7921-IV-NE	BERWICK 7921-I-NW	PAKENHAM 7921-I-NE
BAXTER 7921-IV-SE	DEVON MEADOWS 7921-I-SW	TOORADIN 7921-I-SE

Scale 1:25000

METRES 1000 500 0 1 2 3 KILOMETRES

CONTOUR INTERVAL 10 METRES

VERTICAL DATUM IS BASED ON LOW WATER, HOBSONS BAY

AUSTRALIAN MAP GRID - TRANSVERSE MERCATOR PROJECTION

HORIZONTAL DATUM - AUSTRALIAN GEODETIC DATUM 1966

NUMBERED TICKS INDICATE THE 1,000 METRE UNIVERSAL TRANSVERSE MERCATOR GRID, ZONE 55, AUSTRALIAN NATIONAL SPHEROID
THE LAST THREE DIGITS OF THE GRID NUMBERS ARE OMITTED

Geology resurveyed and compiled by AMCooney, BSc, based on earlier work by JJJenkin, MSc, PhD

JGDouglas, MSc, PhD, Supervising Geologist, Regional Geology
D Spencer-Jones, BSc, PhD, Director of Geological Survey

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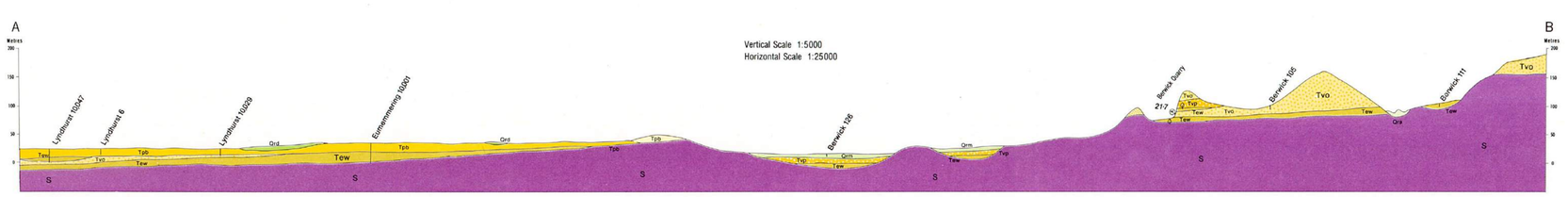
WJBennett MAIC, Chief Draughtsman, 1978

Base by courtesy of the Department of Crown Lands and Survey, Victoria

Issued by BWCourt, Secretary for Minerals and Energy, under the authority of the Hon JCMBallour, Minister for Minerals and Energy

FDAtkinson, Government Printer, 1979

FIRST EDITION 1978



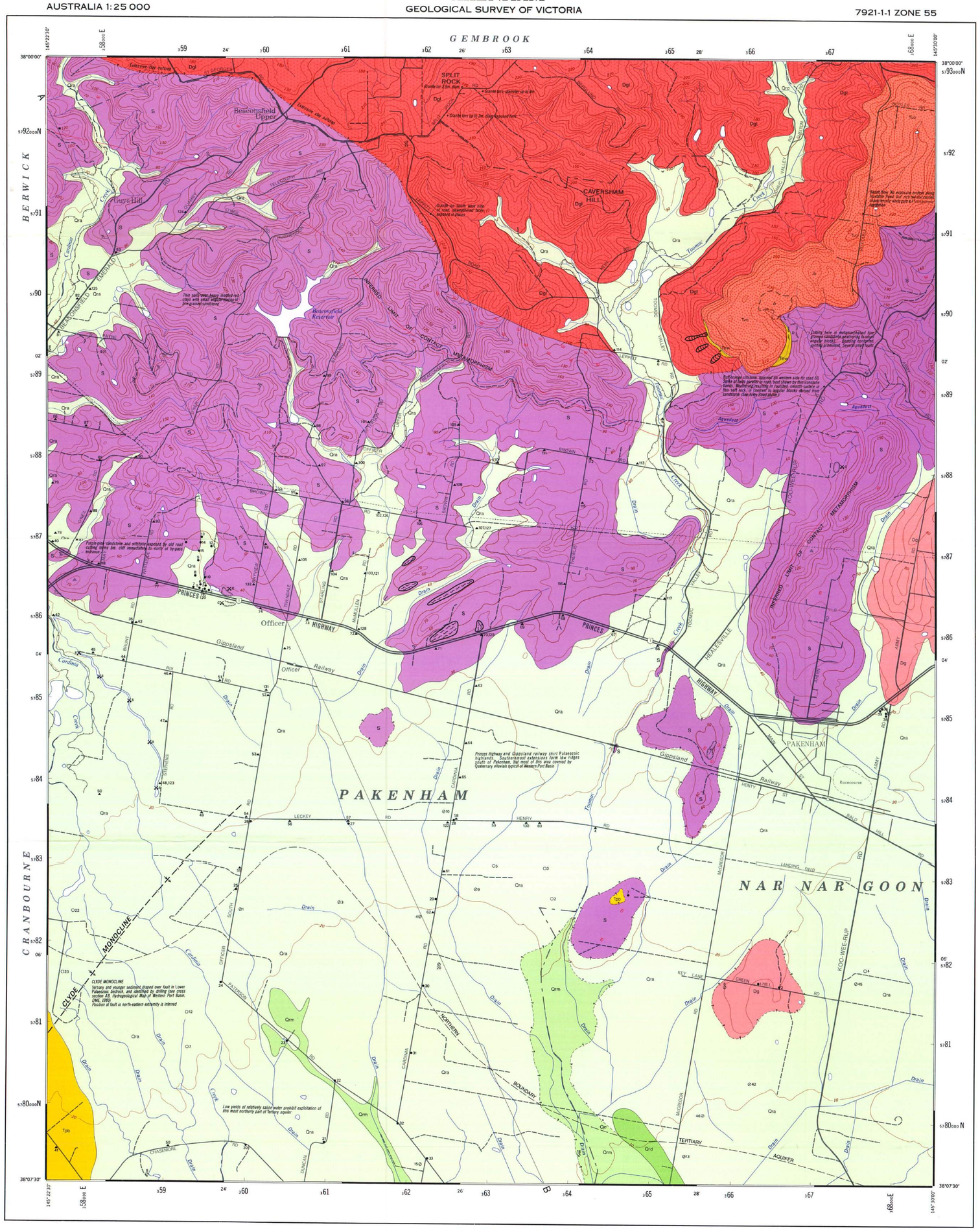
BERWICK
7921-I-NW

AUSTRALIA 1:25 000

PAKENHAM

GEOLOGICAL SURVEY OF VICTORIA

7921-1-1 ZONE 55



		SEDIMENTARY				IGNEOUS	
		Alluvial–Colluvial	Lacustrine–paludal	Marine	Aeolian	Extrusive	Intrusive
QUATERNARY	RECENT	Qra	Qrm		Qrd		
	PLEISTOCENE						
TERTIARY	PLIOCENE	Tpb					
	MIOCENE					Tvo	
	OLIGOCENE	Tew					
Major Unconformity							
DEVONIAN	UPPER						Dgl, Dg
Major Unconformity							
SILURIAN			S				

Qra Sandy silty clay, sand

Qrm Clay, silt, sandy clay

Qrd Sand, silty sand, silt (possibly old levee bank)

Baxter Formation Tpb Sandy clay, minor sand–generally poorly consolidated

Older Volcanics Tvo Basalt

Werribee Formation Tew Flesile clay, poorly consolidated sand & clayey sand, brown coal (in places intercalated with basal part of Older Volcanics

Lysterfield Granodiorite Dgl Granodiorite, biotite granodiorite

Dg Granite

S Massive micaceous quartz siltstone, very minor micaceous quartz sandstone

INDEX TO ADJOINING SHEETS

LYSTERFIELD 7922-2-3	CARDINIA CREEK 7922-2-2	GILWELL 8022-3-3
BERWICK 7921-1-4	**PAKENHAM 7921-1-1**	NAR NAR GOON 8021-4-4
DEVON MEADOWS 7921-1-3	TOORADIN 7921-1-2	BAYLES 8021-4-3

- Geological boundary
- Geological boundary, inferred
- Monocline, inferred
- Strike and dip of bedding
- Sand pit
- Clay pit
- Open cut quarry (b basalt)
- Old gold prospecting shaft
- Government bore
- Auger bore
- Private bore prior to the Groundwater Act 1969
- Private bore after the Groundwater Act 1969
- Landslide
- River terrace
- Aquifer
- Highway, with route marker
- Main connecting road
- Other roads
- Railway line and station
- Parish boundary
- Parish name (GEM)
- Watercourse
- Drain, aqueduct
- Dam
- Underground water pipeline
- Transmission line
- Trig. station
- Natural gas pipeline
- Metamorphosed Silurian sediments
- Contours (10 metre interval)

TN GN

GRID CONVERGENCE 0°51'

GRID MAGNETIC ANGLE 9°36'

THE RELATIONSHIP BETWEEN TRUE NORTH, GRID NORTH AND MAGNETIC NORTH IS SHOWN DIAGRAMMATICALLY FOR THE CENTRE OF THIS MAP. MAGNETIC VALUE IS CORRECT FOR 1980. ANNUAL CHANGE IS 6' EASTERLY

Scale 1:25 000

METRES 1000 500 0 1 2 3 KILOMETRES

CONTOUR INTERVAL 10 METRES
VERTICAL DATUM IS BASED ON LOW WATER, HOBSONS BAY

AUSTRALIAN MAP GRID – TRANSVERSE MERCATOR PROJECTION
HORIZONTAL DATUM – AUSTRALIAN GEODETIC DATUM 1966

NUMBERED TICKS INDICATE THE 1 000 METRE UNIVERSAL TRANSVERSE MERCATOR GRID, ZONE 55. AUSTRALIAN NATIONAL SPHEROID
THE LAST THREE DIGITS OF THE GRID NUMBERS ARE OMITTED

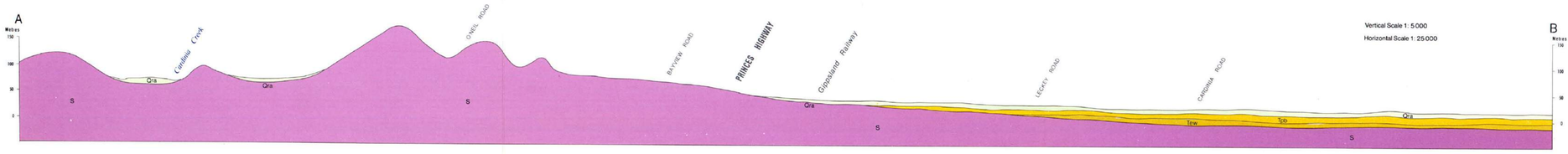
Geology resurveyed and compiled by A M Cooney BSc based on earlier work by J J Jenkins MSc PhD

Supervising Geologist, Regional Geology: J G Douglas MSc PhD
Director of Geological Survey: J Cramsie MSc

Cartography: K Dodd and R C Findlay 1985
Chief Draughting Officer: W J Bennett MAIC

Base detail courtesy of the Department of Crown Lands and Survey 1977

Printed by F D Atkinson Government Printer 1985

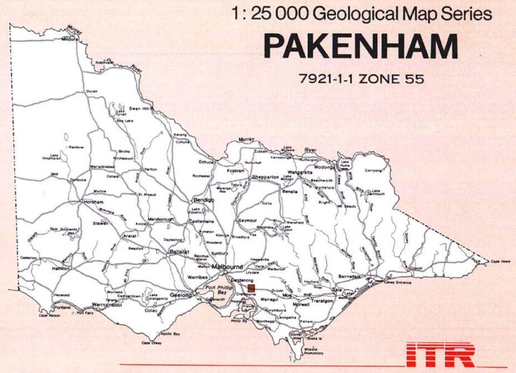


Vertical Scale 1:5 000
Horizontal Scale 1:25 000

1:25 000 Geological Map Series

PAKENHAM

7921-1-1 ZONE 55



ITR

Department of Industry, Technology and Resources

AUSTRALIA 1:63,360

CRANBOURNE

GEOLOGICAL SURVEY OF VICTORIA

NO. 859 ZONE 7

Scale 1 Mile to 1 Inch

CHAINS 80 40 0 1 2 3 4 MILES

METRES 1000 500 0 1 2 3 4 5 6 KILOMETRES

Contour interval 50 feet

Quaternary

Recent

- Q7 — Sand, clayey sand (mangrove swamp)
- Q6 — Mud, sand, peat (salt marsh)
- Q5 — Peaty clay, clay (mainly swamp deposits)
- Q4 — Siliceous and calcareous sand (dune and beach deposits)
- Q3 — Silt, sand, clay and occasional gravel (including Cardinia Sand shown stippled)

Pleistocene

- Q2 — Siliceous sand dunes and sheets (including Cranbourne Sand) Thin sand cover on older rocks shown stippled
- Q1 — Warneet Beds. Sand, silt, clay

Tertiary

Miocene

- Tb — Baxter Sandstone. Ferruginous sandstone, sand, sandy clay, occasional gravel
- Tm — Balcombe Clay. Silty clay, marl

Oligocene to Eocene

- Tob — Older Volcanics. Basalt, tuff

Lower Cretaceous

- Ks — Felspathic sandstone and mudstone (in shore platform)

Devonian

- Dgd — Granodiorite (Dgd), granite (Dg)
- Dg

Silurian

- S — Sandstone, siltstone, mudstone, shale

Ordovician

Upper

- Ou — Sandstone, slate, chert

Middle

- Om — Sandstone, slate, chert

INDEX TO ADJOINING SHEETS

MELBOURNE	RINGWOOD	GEMBROOK
PORTARLINGTON	CRANBOURNE	DROUIN
SORRENTO	WESTERN PORT	KORUMBURRA

In the centre of the sheet Grid North is 0°07'47" east of True North and the magnetic declination from True North is approximately 10°45'

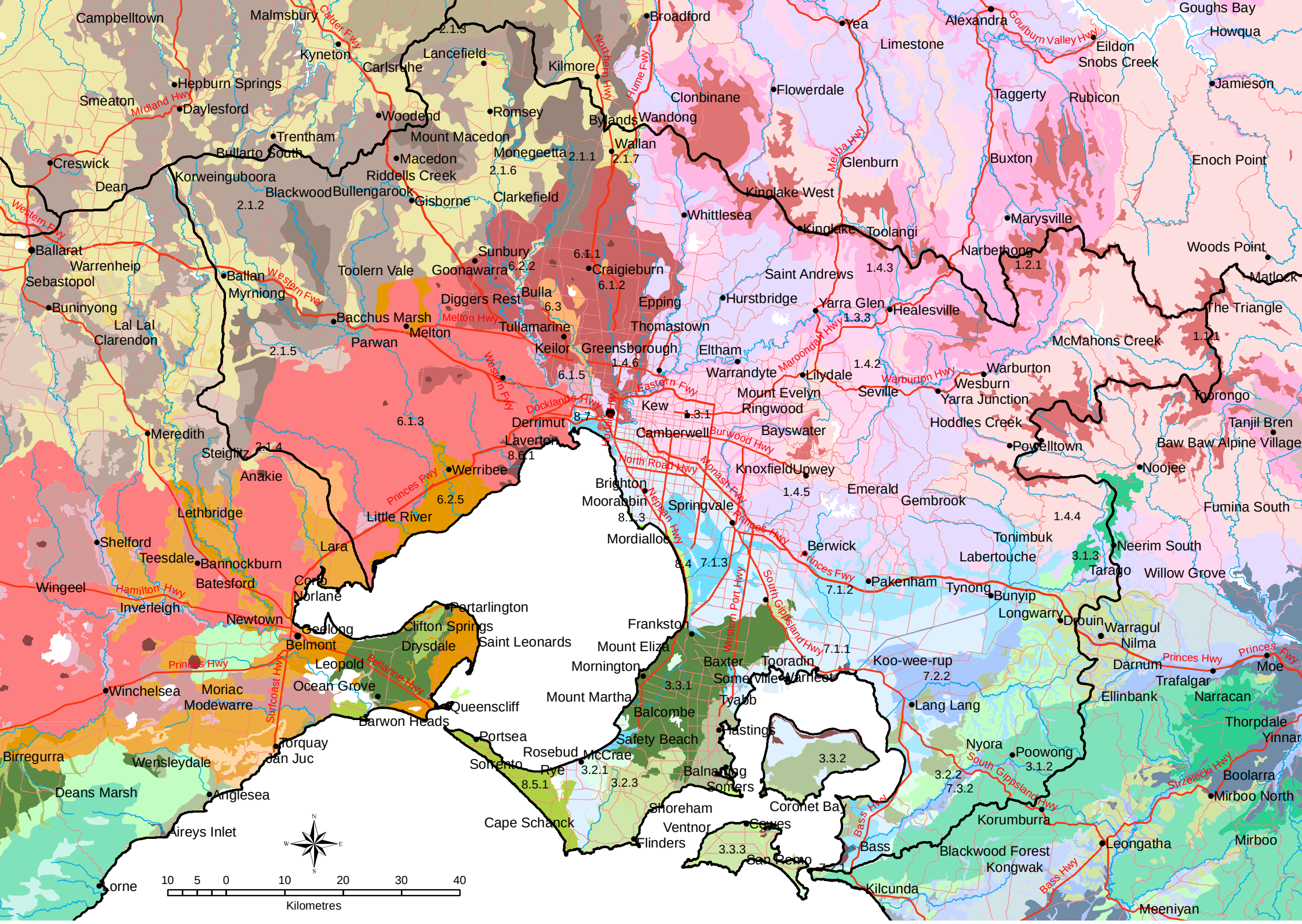
- Fault
- Strike with dip
- Quarry
- Sand pit
- Mines Department bore
- Shore platform
- Swamp or marsh
- Dam
- Drain
- Pipeline
- Trig. station
- Highway, main road
- Other roads
- Tracks
- Parish name — MORDI
- Parish boundary
- Railway line and station — BERWICK
- Bridge
- Pier, jetty or wharf
- Low water mark — L.W.M.
- Fathom line
- Contours

Geology by J. J. Jenkin, M.Sc., Ph.D., R. A. Keble, V. Gostin, M.Sc. D. E. Thomas, D.Sc., F.A.A., Director of Geological Survey.

Drawn for reproduction in the Department of Mines, Melbourne, Victoria, by L. M. Underwood and S. Wail, under the direction of D. W. McInnes, M.A.I.C., Chief Draughtsman, 1967.

Issued by E. J. Condon, LL.B., Secretary for Mines, under the authority of the Hon. J. C. M. Balfour, M.L.A., Minister of Mines.

A. C. Brooks, Government Printer.



Geomorphological Units

Eastern Uplands (EU)

- 1.1.1 High elevation summit plateaux
- 1.2.1 Moderate elevation plateaux and broad ridges
- 1.3.1 Low elevation low relief landscapes
- 1.3.3 Low elevation terraces, fans and floodplains
- 1.4.1 Prominent summits above 1200m
- 1.4.2 Prominent summits between 500 and 1200m
- 1.4.3 Escarpments and gorges
- 1.4.4 Deeply dissected ridge and valley landscapes
- 1.4.5 Moderately dissected ridge and valley landscapes
- 1.4.6 Outlying ridges and hills

Western Uplands (WU)

- 2.1.1 Dissected uplands: Ridges, escarpments, mountains on non-granitic Palaeozoic rocks
- 2.1.2 Dissected uplands: Hills, valley slopes and plains on non-granitic Palaeozoic rocks
- 2.1.3 Dissected uplands: Ridges, escarpments, mountains on granitic Palaeozoic rocks
- 2.1.4 Dissected uplands: Hills, valley slopes and plains on granitic Palaeozoic rocks
- 2.1.5 Dissected uplands: Plateaux and rises of residual Cainozoic landscapes
- 2.1.6 Dissected uplands: Eruption points and volcanic plains
- 2.1.7 Dissected uplands: Terraces and floodplains

Southern Uplands (SU)

- 3.1.2 Moderate elevation ranges
- 3.2.1 Low elevation plateau and broad ridges
- 3.2.2 Low elevation ranges
- 3.2.3 Low elevation basaltic residuals
- 3.3.1 Very low elevation plateaux
- 3.3.2 Very low elevation hills and low hills
- 3.3.3 Very low elevation basaltic residuals

Western Plains (WP)

- 6.1.1 Eruption points: maars, scoria cones and lava shields, including associated ash and scoria deposits
- 6.1.2 Volcanic derived stony rises
- 6.1.3 Volcanic derived plains with poorly developed drainage and shallow regolith
- 6.1.5 Volcanic derived terraces, floodplains and lakes, swamps and lunettes and their deposits
- 6.2.2 Sedimentary derived dissected plains
- 6.2.4 Sedimentary derived plains and plains with low rises
- 6.2.5 Sedimentary derived terraces and floodplains, and coastal plains
- 6.3 Hills and Low Hills

Eastern Plains (EP)

- 7.1.1 Sunkland coastal plains with ridges and dunefields
- 7.1.2 Sunkland alluvial plains
- 7.1.3 Sunkland former swamps and lagoonal deposits
- 7.2.1 Riverine flood plains and morasses
- 7.2.2 Riverine prior stream plains
- 7.3.1 Higher level plains without dunes
- 7.3.2 Higher level plains with dunes
- 7.3.3 Higher level dissected plains

Coast (C)

- 8.1.3 Active cliffs: Subaerial dominant processes; with shore platform
- 8.4 Coastal Barriers
- 8.5.1 Transgressive dunes: Cliff top; stranded
- 8.6.1 Low coasts: Tidal
- 8.7 Engineered Coast
- water/lake

Victorian Resources Online
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State Government Victoria

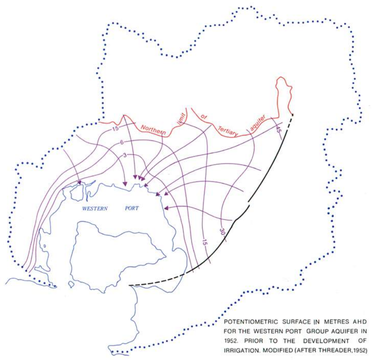
WESTERN PORT BASIN

HYDROGEOLOGICAL LEGEND

AGE	STRATIGRAPHY		LITHOLOGY AND DEPOSITIONAL ENVIRONMENT	AQUIFER TYPES AND FORM	USAGE AND AREA	SALINITY	BORE YIELD	HYDRAULIC CHARACTERISTICS (Determined from Aquifer Tests) Typical horizontal hydraulic conductivity (metres / day)	Maximum aquifer thickness (metres)	Maximum transmissivity (metres² / day)	Storage coefficient
QUATERNARY			*Sand, medium to coarse quartzose; aeolian deposition.*	*Unconfined sand aquifer, sheet-like form with limited distribution.*	*Stock and domestic; between Cranbourne and Tooradin.*	*<1000 mg/l T.D.S.*	*Up to 2.5 l/s*				
			Clay, minor feldpathic sand and gravel; fluvial deposition.	*Unconfined to semi-confined aquifer of sand and gravel, shoestring type form, interbedded in clay. Of very low hydraulic conductivity.*	*Stock and domestic; over the whole of the alluvial flats.*	*Highly variable, 500-5000 mg/l T.D.S., shallowest aquifers of low salinity.*	*Up to 10 l/s.*				
		Unconformity									
MIOCENE	Early / Late	GROUP — Baxter Formation	*Sand, medium to coarse, quartzose, gravel; often carbonaceous, numerous lignite and carbonaceous clay beds; fluvial and paludal deposition.*					*2.0-4.0*	*74*	*100*	*3.0 x 10⁻⁴ to 3.0 x 10⁻²*
	Middle	PORT — Tbt	*Sand, fine; transitional from littoral marine to fluvial deposition.*	*Unconfined to confined aquifer of unconsolidated sand and gravel, sheet-like form; beds of clay, lignite and cemented limestone impart marked anisotropy in hydraulic conductivity. In areas where the aquifer outcrops, clayey soil up to 5 m thick, partially confines the groundwater.*	*Irrigation of market gardens and fodder crops, stock and domestic; utilized over most of the area.*	*300-3000 mg/l T.D.S. (See main map).*	*Up to 25 l/s. (See main map).*	*1.0-2.6*	*58*	**50*	**2.0 x 10⁻⁴*
		WESTERN — Sherwood Formation — Tm	*Sand, fine to medium, calcareous, often silty, minor limestone; shallow marine deposition.*					*1.0-1.3*	*90*	*90*	*2.0 x 10⁻⁴*
	Early	Tmi	*Calcarenite with sand, silt and clay matrix; shallow marine deposition.*					*2.4-8.5*	*10*	*85*	*2.5 x 10⁻⁴*
OLIGOCENE		Yallock Formation — Ty	*Sand, medium to coarse quartzose, gravel, often carbonaceous; minor lignite; fluvial and paludal deposition.*					*3.0-4.8*	*72*	*191*	*3.0 x 10⁻⁴ to 0.35*
TERTIARY		Unconformity									
EOCENE	Older Volcanics		*Clay; highly weathered basalt.*	*Aquitard to aquiclude, discontinuous, where present restricts upward leakage from the underlying basalt and Childers Formation aquifers.*							
			Basalt	*Semi-confined to confined aquifer, sheet-like form. Hydraulic conductivity varies according to development of secondary porosity.*	*Irrigation of market gardens, in the Clyde-Cranbourne area; also stock supplies immediately north west of Cora Lynn.*	*300-3000 mg/l T.D.S. Similar distribution of salinities to the Baxter Formation.*	*Up to 15 l/s.*	*2.9-11.7*	*111*	*1500*	*5.0 x 10⁻⁴ to 5.0 x 10⁻³*
	Childers Formation		*Sand, coarse quartzose; gravel; often carbonaceous; numerous lignite and hard carbonaceous clay beds, fluvial and paludal deposition.*	*Semi-confined to confined aquifer of sand and gravel, sheet-like form; lignite and clay beds impart marked anistropy in hydraulic conductivity.*	*Lang Lang town supply, minor usage for irrigation in the Cranbourne area.*	*<1000 mg/l T.D.S.*	*2.5-25 l/s*	*3.0-3.7*	*69*	*149*	*2.5 x 10⁻⁴*
		Unconformity								**estimated*	
CRETACEOUS	Early	Strzelecki Group	*Sandstone, felspathic, siltstone, mudstone.*								
		Unconformity									
LOWER PALAEOZOIC			*Granite, granodiorite.*								
			Mudstone, siltstone, sandstone.	*Little known, but includes some minor fractured rock aquifers.*	*Stock, minor usage for irrigation; Pearcedale to Cranbourne to Pakenham.*	*Usually ~2000 mg/l T.D.S. except near Cranbourne where overlain by dunes.*	*Up to 2.5 l/s except near Cranbourne where up to 10 l/s*				

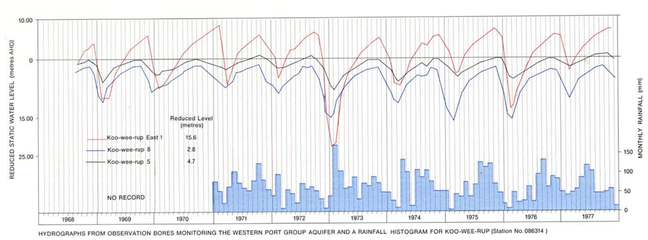
Potentiometric surface (metres AHD) Feb. 1978 — 3
Flow line
Recharge/discharge zone
Surface water divide
Groundwater Conservation Area boundary
Northern limit of Tertiary aquifer
Government observation bore
Irrigation bore
Stream gauging station — Annual discharge / Catchment area
Geological boundary
Geological boundary, position approximate
Monocline
Fault
Fault inferred
Salinity/yield zone boundary

Watercourse
Low water mark
High water mark
Bathymetric contour (metres below AHD)
Dredged channel
Drain
Water pipeline
Aqueduct
Highway
Main connecting road
Other road
Railway line
Parish boundary
Parish name — NAR
Topographic contour



POTENTIOMETRIC SURFACE IN METRES AHD FOR THE WESTERN PORT GROUP AQUIFER IN 1952. PRIOR TO THE DEVELOPMENT OF IRRIGATION. MODIFIED (AFTER THREADER,1952)

DEPTH TO MAIN WATER INTERSECTION IN METRES FOR THE WESTERN PORT GROUP AQUIFER



HYDROGRAPHS FROM OBSERVATION BORES MONITORING THE WESTERN PORT GROUP AQUIFER AND A RAINFALL HISTOGRAM FOR KOO-WEE-RUP (Station No. 086314)

YIELD AND SALINITY ZONES (main map)

The zones of yield and salinity refer to the Western Port Group aquifer except to the north west of Cora Lynn and from Cranbourne to Clyde where the basalt aquifer is represented because in these areas it is the major source of groundwater.

PROBABLE YIELD (l/sec)			
SALINITY (mg/l TDS)	<2.5 Low	2.5-10 Moderate	>10 High
<1000 Low			
1000-2000 Moderate			
>2000 High			

SCALE 1:100000

METRES 2000 1000 0 2 4 6 8 10 12 KILOMETRES

CONTOUR INTERVAL 40 METRES
VERTICAL DATUM IS BASED ON LOW WATER, HOBSONS BAY

AUSTRALIAN MAP GRID - TRANSVERSE MERCATOR PROJECTION
HORIZONTAL DATUM - AUSTRALIAN GEODETIC DATUM 1966

Hydrogeology by R Lakey and S J Tickell

Acknowledgement: J J Jenkin (1962), B R Thompson (1974), and J J Carillo-Rivera (1975)

Supervised by C R Lawrence and A C M Laing
J L Knight, Director of Geological Survey

Drawn for reproduction in the Department of Minerals and Energy, Melbourne, by C Diblook, under the direction of W J Bennett, Chief Draughtsman, 1980

Base prepared from information supplied by the Department of Crown Lands and Survey, Victoria

Issued by B W Court, Secretary for Minerals and Energy, under the authority of the Honourable J C M Balfour, MLA, Minister for Minerals and Energy

F D Atkinson, Government Printer, 1980

HYDROGEOLOGICAL MAP OF WESTERN PORT BASIN

APPENDIX C

Summary of Contamination Information

APPENDIX C1

McPherson PSP

Table C1 - Summary of Former and Current Site Uses

MPA

147612091

Property Number	Sub Precinct / Land Parcel	Owner	Approximate Area (ha)	Precent wide historical use and / or actives	Industry or Land Use	Building Structures and Services	Development Status (within the past 20 years)	Notable observations made during the drive-bys and satellite imagery	Known former and current uses and activities present in sub-precinct (refer to list at the base of this table for associated potential contaminants of interest)							
									Primarily Residential	Earth Disturbance	Stockpiles of Soil / Imported Fill	Solid Inert Waste Observed on Site	Primarily Agricultural 1	Primarily Agricultural 2	Potential Cropping/Market Garden	Other
North																
	N1	Mirvac			Agriculture	Yes - 1 homestead area		Agriculture					✓			
	N2	Sandnien			Agriculture	Yes - 1 homestead area		Agriculture					✓			
	N3	Oakwood Riding School			Agriculture	Yes - 1 homestead area, other buildings		The area is used for horse training						✓		
	N4	DEPI			Agriculture	No	Retarding basin	Agriculture					✓			
Central																
	C1				Agriculture	Yes - 1 homestead area		Agriculture					✓			
	C2				Agriculture	Yes - sheds and stockyard		Agriculture					✓			
	C3				Agriculture	Yes - 1 homestead area		Agriculture and landscaped area		✓			✓			
	C4				Agriculture	Yes - 1 homestead area, other buildings		Agriculture, the area is used for horse adjistment		✓				✓		
	C5				Agriculture	Yes - 1 homestead area, other buildings		Agriculture					✓			
	C6				Residential	Yes - 1 homestead area, other buildings	building of residential	Agriculture	✓				✓			
East																
	E				Agriculture	No	Potential Land Filling	Some evidence of filling and land disturbance			✓		✓			✓
South																
	S1				Agriculture	Yes - 1 homestead area		Evidence of cropping activities						✓	✓	
	S2				Agriculture	Yes - 1 homestead area, other buildings		Agriculture, the area is used for horse training						✓		
	S3				Agriculture	Yes - 1 homestead area, other buildings		Agriculture, the area is used for horse training						✓		
	S4				Agriculture	Yes - 1 homestead area, other buildings		Agriculture, the area is used for horse training						✓		
	S5				Agriculture	Yes - 1 homestead area, other buildings		Agriculture, the area is used for horse training						✓		
	S6				Agriculture	Yes - 1 homestead area, other buildings		Agriculture, the area is used for horse training						✓		
	S7				Agriculture	Yes - 1 homestead area, other buildings		Agriculture, the area is used for horse training						✓		
	S8				Agriculture	Yes - 1 homestead area, other buildings		Agriculture, the area is used for horse training						✓		
	S9				Agriculture	Yes - 1 homestead area, other buildings		Agriculture, the area is used for horse training						✓		

Data sourced from 'drive-by' assessment of the Study Area, review of publically available for completed Statutory Environmental Audits for sites within and in the vicinity of the Precincts, review of historic aerial photographs and maps. Melways and published books (refer to main report for a full list of references).

APPENDIX C2

REGULATORY REVIEW

A regulatory review was undertaken, comprising a search of (1) the EPA Priority Sites Register, (2) EPA list of properties for which a certificate or statement of environmental audit has been issued and (3) the National Pollution Inventory (NPI). The purpose of each search was to identify properties of which the respective regulatory authority has knowledge that might be, or have been a source of soil and / or groundwater contamination within and adjacent to the Study Area.

Priority Sites Register

Priority Sites are sites for which the Environment Protection Authority (EPA) Victoria has issued a Clean-up Notice pursuant to Section 62A or a Pollution Abatement Notice (relevant to land and/or groundwater) pursuant to Section 31A or 31B of the Victorian *Environment Protection Act 1970*. Typically, these are sites where pollution of land and/or groundwater may present an unacceptable risk to human health or to the environment.

EPA maintains the Priority Sites Register as a listing of all priority sites identified by the EPA as requiring clean up. The Register is available to the public. It is important to note that the Priority Sites Register is not a listing of all contaminated sites in Victoria, nor is it a list of all contaminated sites of which EPA has knowledge.

As at August 2014, no Priority Site was identified within the Study Area.

Environmental Audits

The Environmental Audit System was established in Victoria by the EPA as a means by which planning authorities, site owners, purchasers and others are provided with assurance regarding the condition of a property and its suitability for use, frequently in the context of site development.

Each audit completed under Section 53X of the Victorian Environment Protection Act 1970 (as amended) will be issued with either a certificate or statement and be made publicly available. It is important to note that the list is not a register of all contaminated or cleaned sites in Victoria, but rather that it is a list of sites where a statutory audit has been completed. Additional sites may currently be undergoing statutory environmental audit, however the EPA list only includes completed audits.

As at August 2014, no Registered Section 53X Environmental Audits have been completed within and within 1 km radius of the site.

National Pollution Inventory

The National Pollutant Inventory (NPI) is the most comprehensive database of national information on pollutant emissions. It is compiled in partnership with state and territory governments. The NPI presents annually updated information on emissions of 93 key pollutants to the air, water and land from industry facilities, as well as information on waste transfers from facilities. It also includes information on pollution prevention by facilities.

The NPI contains two types of data — emissions from individual facilities and diffuse emissions. If facilities trip one of the NPI reporting thresholds, facilities must calculate their emissions and provide this data annually for the NPI.

A search of the 1998/1999, 2004/2005 and 2011/2012 NPI database and found no sites located within the Study Area reported data within the NPI.

APPENDIX C3

Photo Period Details	Sub-Precinct	Observation of Study Area (S.A)	Observation of Surrounding Area
1963 to 1968	North	The site appears largely undeveloped with the exception of one homestead (multiple buildings) on land now owned by Mirvac and single buildings on the Sandinien land.	The surrounding area appears to be open farmland, with some small scattered buildings.
	East	The area appears undeveloped with paddocks, and outlined of vegetation in the east of sub-precinct indicates a possible alternative flow channel of the river.	
	Central	The area appears as undeveloped paddocks with the exception of the established homestead (buildings and shed) at the Voldens Baldi, Briant and Peart properties. A large drainage channel is present in the east of the sub-precinct.	
	South	The area appears predominantly as undeveloped paddocks. The land currently owned by *Follett* appears with the multiple objects likely to be surface water dams. The land currently owned by *Bailleu* appears as open paddocks with one area of development. The areas currently developed as horse stables and horse training track (owned by Baldi and McTaggart) appear undeveloped with paddocks.	
1970 to 1978	North	No change, some of the paddocks appear to be cultivated, with rows distinguished. This indicates either fodder or export production crops.	No change.
	East	No change	
	Central	The area owned by Miller and Bohmer appears with some development. The buildings visible in 2014 are not visible in the aerial and areas to the north east of the section appear to be discoloured, potentially indicating excavation.	
	South	.	
1987 to 1991	North	The land in the north of the sub-precinct, bordering the river appears to be developed. This area coincides with the area of the retarding basin and could potentially indicate the building of the creek/river banks. Power lines are present in the centre of the sub-precinct. Additional buildings are apparent on the land now used for the Oakwood Riding School.	Development to the north of indicates the presence of the retarding basin.
	East	No change	
	Central	No change	
	South	The land currently owned by *Baldi* appears with two buildings in the centre. The	

Photo Period Details	Sub-Precinct	Observation of Study Area (S.A)	Observation of Surrounding Area
		ground appears discoloured in one of the *Bell* paddocks, potentially indicating either the cutting of drainage or cultivation.	
2004	North	No change	Increasing development in area.
	East	The land close to the river appears to be subject to development. Small uniform circular objects potentially indicate the presence and importation of fill.	
	Central	No change	
	South	The land on the intersection (currently owned by *McTaggart*) appears to be developed, with some small sheds – likely used for horse shelter. A large dam appears on the south west of the sub-precinct (on land currently owned by *Baillieu*).	
2014	North – N1	The area appears as undeveloped grazing paddocks with the exception the homestead area, some areas of water troughs and small areas of trees scattered throughout the area. The homestead area is noted to contain: ■ One large building – with associated water tanks, pool. ■ Two medium sized buildings – with associated water tanks, one with attached garden beds – likely vegetable. ■ One large shed with attached stockyard – the size of the building a stock yard is indicative of a dairy operation.	Slight increase in development.
	North – N2	Similar to parcel N1, the area appears to be undeveloped paddocks with the exception of the homestead area. The homestead area is noted to contain: ■ One large building – with associated water tanks, pool ■ Two sheds – with associated water tanks, one with attached feature (likely swimming pool). One large shed with attached stockyard – the size of the building a stock yard is indicative of a dairy operation.	
	North – N3	The area comprises undeveloped grassland in the east, and dense paddocks with	

Photo Period Details	Sub-Precinct	Observation of Study Area (S.A)	Observation of Surrounding Area
		small developed area in the west of the site (likely associated with horse training). The west of the site comprises many small paddocks containing small structures – likely used for horse shelter. A number of large structures exist in the west of the site, as follows: ■ One very large building likely used for horse training. ■ One medium sized building (shed). ■ Two large training 'pads'. ■ One medium sized buildings, approximately the size corresponding to residential accommodation.	
	North – N4	The area comprises open grassland and area of dense vegetation (trees).	
	East – E1	The area appears as undeveloped grassland. The colour of the vegetation changes considerably across the area. This could indicate the effects of the drainage and changing soil moisture conditions. The surface distance observed in the 2004 aerial does not appear in the 2014 aerial.	
	Central – C1	The area comprises undeveloped grazing paddocks with the exception the homestead area. The homestead area comprises: ■ One large building (likely residential with surrounding hardens, including regularly spaced trees. ■ Small adjoining shed.	
	Central – C2	The area comprises undeveloped grazing paddocks with the exception the southern area which comprises: ■ One large building (likely shed) with attached circular object (likely water tank); and ■ Stock yards.	

Photo Period Details	Sub-Precinct	Observation of Study Area (S.A)	Observation of Surrounding Area
	Central – C3	The area comprises undeveloped grazing paddocks and the developed homestead area (known as St Germains Homestead). The homestead area comprises: ■ One large building (residential) with attached adjacent tennis court, swimming pool and landscaped areas. ■ Four large buildings (likely shed) with attached circular objects (likely water tank); and stock yards. Multiple pieces of machinery (tractors and trucks) were observed around the shed areas. Additionally, some of the area at the back of the building and stock yards appears to be used for the storage of miscellaneous items. Three dams are present to the north of the homestead area.	
	Central – C4	The area comprises divided small paddocks within individual small structure, one large building in the south of the area. The area appears to be used for the adjustment/training of horses. The buildings appear with large attached objects (likely water tanks). The presence of the large cylindrical object to the east of the larger building indicates the presence of fuel storage (confirmed through the drive by)	
	Central – C5	The area comprises undeveloped grazing paddocks with the exception the northern area which comprises: ■ One large building (likely residential) with adjacent landscaped areas attached circular object (likely water tank); ■ Multiple large buildings (likely sheds) with connected circular objects (likely water tanks) ■ One large rectangular building with attached stock yards (likely to be a former milking shed).	
	Central – C6	The area is comprises	

Photo Period Details	Sub-Precinct	Observation of Study Area (S.A)	Observation of Surrounding Area
		■ One large building (likely residential) ■ One smaller building (likely a shed) ■ Open grassland comprising, small paddocks, circular area and one small building (likely used for horse shelter/shed)	
	South – S1	The area appears as undeveloped paddocks with the exception of a large building in the north of the area. The paddocks appear small in size with crop rows and/or drainage lines orientated consistently across the paddocks. This indicates a more intense agricultural practice of crop production.	
	South – S2	The area comprises undeveloped paddocks, with the exception of the southern area. The southern area comprises a one large shed with connected stock yards (likely dairy), large rectangular objects (likely shipping containers) and stock yards.	
	South – S3	The area comprises multiple buildings, pool and tennis court. The area is considered likely to be used for residential purposes.	
	South – S4	The area comprises undeveloped paddocks with the exception of a building in the north east of the area (likely residential) and a 'U' shaped feature in the centre of the site. The U shaped feature could represent shipping containers.	
	South – S5	The area appears to be used for horse adjustment. The site comprises small distinct paddocks with small structures (likely horse shelters). Three large buildings are present in the centre of the site. These are likely to be a combination of residential houses and agricultural sheds.	
	South – S6	The area appears to be used for horse adjustment and horse training. The site comprises small distinct paddocks with small structures (likely horse shelters). A large track is present on the site, presumably used for horse training. Large buildings are present in the south of the area. The eastern buildings include a tennis court and pool and are likely to be used for residential purposes. The western buildings are very large and inferred to be used in connection with agricultural/horse training activities.	
	South – S7	The area comprises undeveloped paddocks with the exception of stock yards in the north west of the area.	

Photo Period Details	Sub-Precinct	Observation of Study Area (S.A)	Observation of Surrounding Area
	South – S8	The site comprises undeveloped paddocks over the majority of the area. A large surface water body is present in the east of the area. Multiple buildings are present in the south of the site. The buildings comprise one rectangular building with tiled roof (likely residential) and other large buildings (likely sheds). The building in the north of the area has an attached concrete apron. This could indicate the presence of a dairy milking operation.	
	South – S9	.	

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APPENDIX C4

ACID SULFATE SOIL

Potential Acid Sulfate Soil

Acid sulfate soils (ASS) in Australia are commonly found in Holocene age sediments where the natural surface elevation is less than 5 mAHD and may be deeply deposited and covered by other sediments. Potential acid sulfate soils (PASS) contain iron pyrite which is stable in an un-oxidised state although can present a potential acid leachate risk if exposed to air, resulting in production of sulphuric acid by oxidation. These oxidising soils are commonly referred to as actual acid sulfate soils (AASS).

In general, the potential for soils to generate acid is a function of the geological history of the soils, and geomorphologic landscape within a given region (White, 1995). Furthermore the Victorian Department of Primary Industries (DPI) has produced a series of maps illustrating the extent of estimated Coastal Acid Sulphate Soils along Victorian coastal regions.

Management of Acid Sulfate Soils (ASS) and Rock (ASR)

EPA Government Gazette, "*Industrial Waste Management Policy on Waste Acid Sulphate Soils",* dated 1999 and EPA Information Bulletin Publication 655.1 "*Acid Sulfate Soil and Rock*" dated July 2009 provide specific guidance on the identification, assessment and management of Acid Sulfate Soils (ASS). The policy requires that a person must not cause or permit the disposal or re-use of waste ASS at any premises, except where the occupier of the premises:

1) Is licensed under the Environment Protection Act 1970 to dispose of that type of waste; or
2) Has an environment management plan prepared in accordance with the IWMP "Waste Acid Sulfate Soils" and approved by the Authority.

In situations where acid sulfate soils may be disturbed during development (such as excavation, exposure, dewatering or placement of fill), the Victorian EPA guidelines (EPA Information Bulletin 665.1) require that the site be managed to avoid and control adverse environmental impacts. The hierarchy for management is:

1) Avoid disturbance
2) Minimise disturbance
3) Prevent oxidation
4) Treat to reduce or neutralise acidity
5) Offsite reuse or disposal

Presence of Probable Acid Sulfate Soils

To assign for the presence of probable acid sulfate soils we reviewed the following information:

- Available published information on the site geology and geomorphology; and
- Available information relating to the presence of ASS, the regional topography and likely depth of groundwater.

The following map presenting ASS data from CSIRO Land and Water is presented below as Plate 1

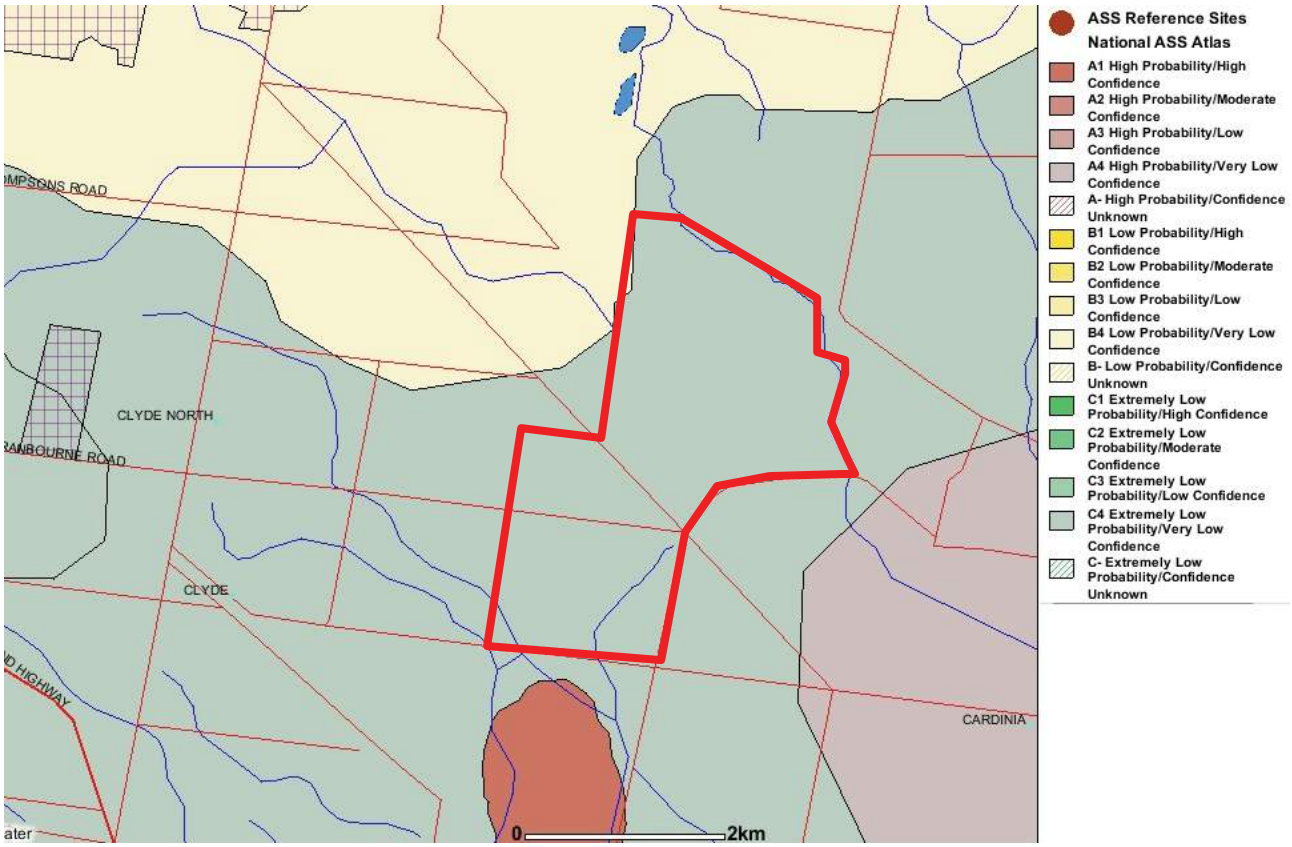

Plate 1: ASS - CSIRO Land and Water

Plate 1 indicates that the ASS has a low probability of occurring within the Study Area. However, this is low confidence. It is noted that the map indicated area with high probability and high confidence ASS approximately 100 m south of the Study Area.

These sediments may be probably acid sulfate soils particular along drainage areas given their depositional conditions and geomorphology. EPA Information Bulletin 655.1 “Acid Sulfate Soil and Rock” (July 2009).

APPENDIX C5

Planning Map

McPherson PSP 1055 - Aboriginal Heritage

Department of Transport, Planning and Local Infrastructure

Legend

WARRNAMBOOL Major Town
Major Road, Road
BOURKE STREET Road name
Railway, Tramway
Property/Parcel, Selected
25 2 1C Address, Lot, Crown allotment
River, Stream, Coastline
Waterbody
Locality
SEDDON Locality Name
Local Government Area
BRIMBANK Local Government Name
Urban Growth Boundary (UGB)
Area outside the UGB
Investigation Area
Land added to UGB since 2005
Boundary of Searched Suburb

ZONES

- ACZ - Activity Centre
- B1Z - Commercial 1
- B2Z - Commercial 1
- B3Z - Commercial 2
- B4Z - Commercial 2
- B5Z - Commercial 1
- C1Z - Commercial 1
- C2Z - Commercial 2
- CA - Commonwealth Land
- CCZ - Capital City
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OVERLAYS

- AEO - Airport Environs
- BMO - Bushfire Management (also WMO)
- CLPO - City Link Project
- DCPO - Development Contributions Plan
- DDO - Design & Development
- DDOPT - Design & Development Part
- DPO - Development Plan
- EAO - Environmental Audit
- EMO - Erosion Management
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- FO - Floodway
- HO - Heritage
- IPO - Incorporated Plan
- LSIO - Land Subject to Inundation
- MAEO1 - Melbourne Airport Environs 1
- MAEO2 - Melbourne Airport Environs 2
- NCO - Neighbourhood Character
- PO - Parking
- PAO - Public Acquisition
- RO - Restructure
- RCO - Road Closure
- SBO - Special Building
- SLO - Significant Landscape
- SMO - Salinity Management
- SRO - State Resource
- VPO - Vegetation Protection

Map Centre - VicRoads 95 H3
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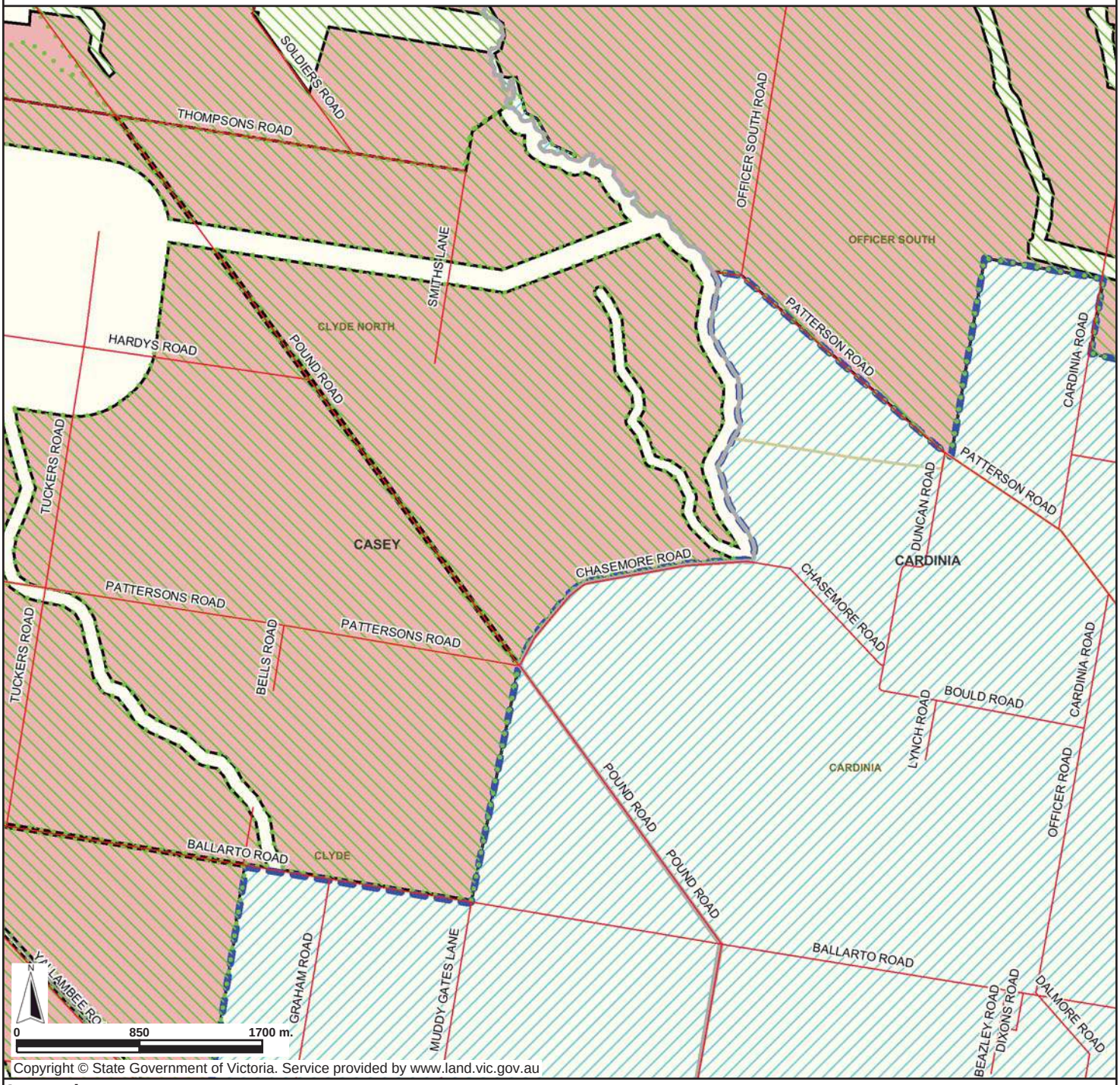
State Government Victoria

Planning Map

McPherson PSP 1055 - Growth Zones

Department of Transport, Planning and Local Infrastructure



Legend

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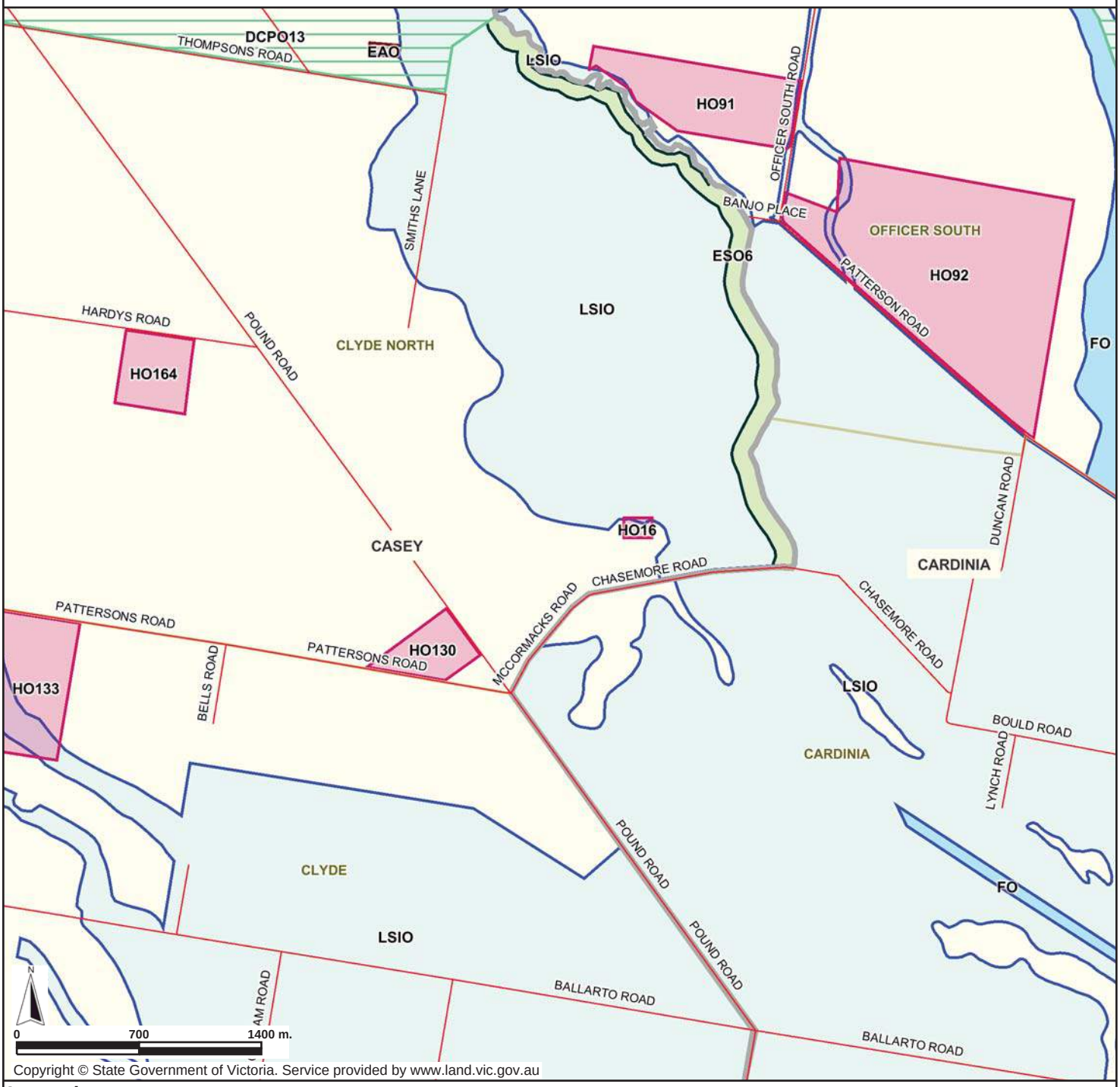
State Government Victoria

Planning Map

McPherson PSP 1055 - Current Planning Overlay

Department of Transport, Planning and Local Infrastructure



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Map Centre - VicRoads 95 H3
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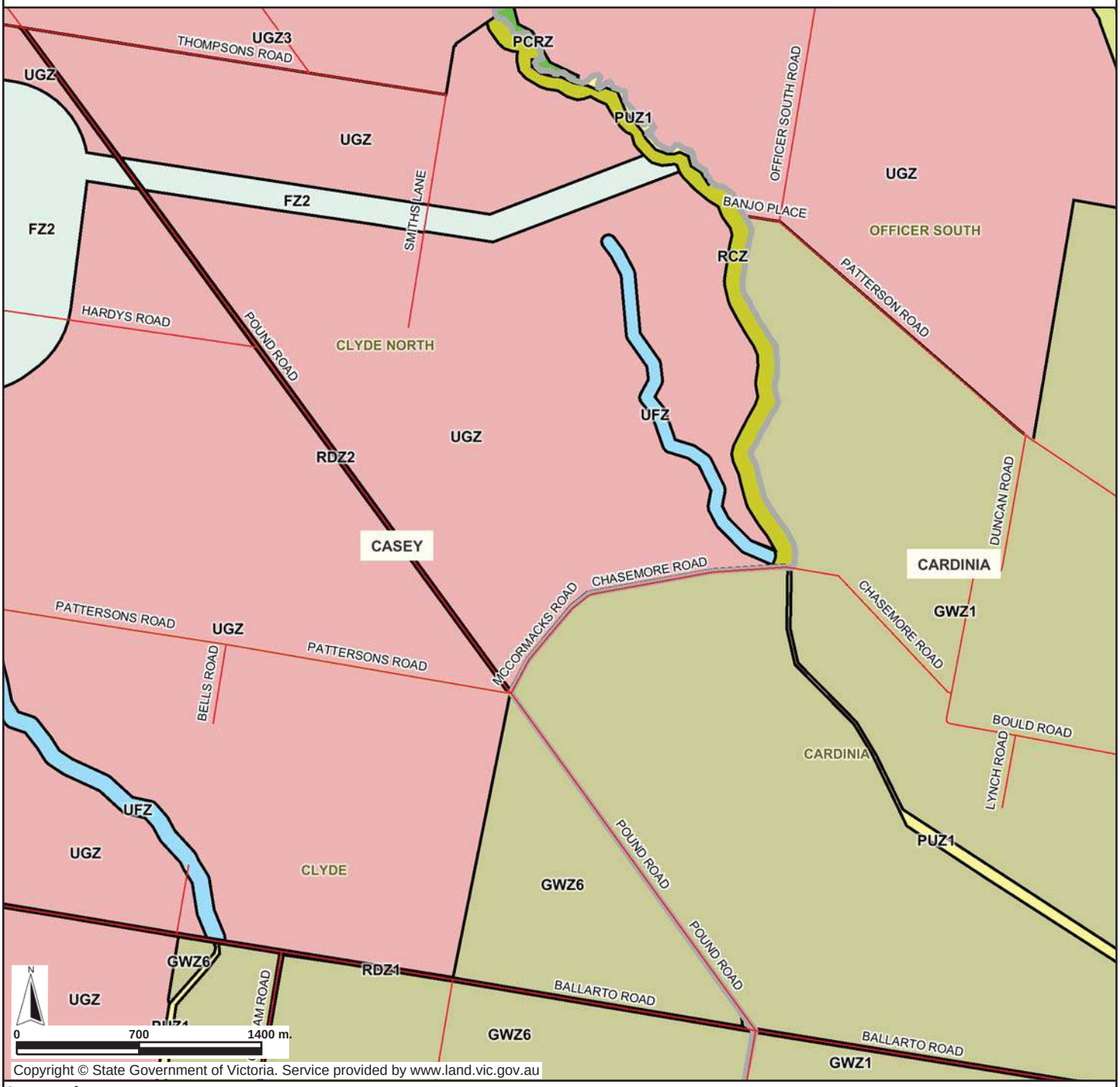
State Government Victoria

Planning Map

McPherson PSP 1055 - Planning Zone

Department of Transport, Planning and Local Infrastructure



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Map Centre - VicRoads 95 H3
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State Government Victoria

APPENDIX D

DSE Practice Note on Potentially Contaminated Land

Department of Sustainability and Environment

Potentially Contaminated Land

General Practice Note **June 2005**

This General Practice Note is designed to provide guidance for planners and applicants about:

- how to identify if land is potentially contaminated
- the appropriate level of assessment of contamination for a planning scheme amendment or planning permit application
- appropriate conditions on planning permits
- circumstances where the Environmental Audit Overlay should be applied or removed.

What is potentially contaminated land?

Potentially contaminated land is defined in *Ministerial Direction No. 1 – Potentially Contaminated Land*, as land used or known to have been used for industry, mining or the storage of chemicals, gas, wastes or liquid fuel (if not ancillary to another use of land). This practice note also deals with land that may have been contaminated by other means such as by ancillary activities, contamination from surrounding land, fill using contaminated soil or agricultural uses.

How is potentially contaminated land considered in the planning system?

The planning system is the primary means for regulating land use and approving development and is an important mechanism for triggering the consideration of potentially contaminated land.

The *Planning and Environment Act 1987* requires a **planning authority** when preparing a planning scheme or planning scheme amendment to *'take into account any significant effects which it considers the scheme or amendment might have on the environment or which it considers the environment might have on any use or development envisaged in the scheme or amendment'* (Section 12).

Ministerial Direction No. 1 – Potentially Contaminated Land (*Direction No. 1*) requires **planning authorities** when preparing planning scheme amendments, to satisfy themselves that the environmental conditions of land proposed to be used for a sensitive use (defined as residential, child-care centre, pre-school centre or primary school), agriculture or public open space are, or will be, suitable for that use.

EPA VICTORIA

Victoria The Place To Be

If the land is potentially contaminated and a sensitive use is proposed, *Direction No. 1* provides that a planning authority must satisfy itself that the land is suitable through an environmental audit.

Clause 15.06 of the *State Planning Policy Framework* contains State Planning Policy for soil contamination. Clause 15.06-2 refers to *Direction No. 1* and also states that in considering applications for use of land used or known to have been used for industry, mining or the storage of chemicals, gas, wastes or liquid fuel, responsible authorities should require applicants to provide adequate information on the potential for contamination to have adverse effects on the future land use.

The Environmental Audit Overlay (EAO) is a mechanism provided in the *Victoria Planning Provisions* and planning schemes to ensure the requirement for an environmental audit under *Direction No.1* is met before the commencement of the sensitive use or any buildings and works associated with that use. The application of the overlay, in appropriate circumstances, ensures the requirement will be met in the future but does not prevent the assessment and approval of a planning scheme amendment.

The Act also requires a **responsible authority**, before deciding on a planning permit application, to consider *'any significant effects which the responsible authority considers the use or development may have on the environment or which the responsible authority considers the environment may have on the use or development'* (Section 60).

What is an environmental audit?

The environmental audit system was introduced under the *Environment Protection Act 1970.* It aims to identify the environmental quality of a segment of the environment and any detriment to the beneficial uses of that segment. In the case of land, the beneficial uses are linked to land use.

A statutory environmental audit provides for an environmental auditor appointed under the *Environment Protection Act* 1970, to undertake an independent assessment of the condition of a site and form an opinion about its suitability for the proposed use. To form such an opinion, the auditor must gather and review sufficient information including site history information and the results of sampling and analysis of soil and possibly groundwater, surface water and air.

An audit of the condition of a site may result in the issue of either:

- a **Certificate** of Environmental Audit that indicates the auditor is of the opinion that the site is suitable for any beneficial use and that there is no restriction on use of the site due to its environmental condition; or
- a **Statement** of Environmental Audit that indicates that the auditor is of the opinion that there is, or may be, some restriction on use of the site due to its environmental condition. A Statement may include conditions that require remediation works to be undertaken or places ongoing requirements on the site. A Statement might also indicate that a site is not suitable for any use, in which case the EPA will usually issue a Notice to require clean up or management of that site.

An auditor must first consider whether a Certificate can be issued for the site. This is the desired outcome for all sites. However, if a Certificate cannot be issued then a Statement of Environmental Audit must be issued.

An environmental audit reflects the condition of the site at the date of issue of the Certificate or Statement. If the site condition changes, an additional assessment may be required.

Section 53 ZE of the *Environment Protection Act 1970* requires that an occupier provide to any person who proposes to become an occupier a copy of any Statement of Environmental Audit that has been issued for the site (unless a Certificate of Environmental Audit has been subsequently issued).

What does the SEPP (Prevention and Management of Contamination of Land) 2002 do?

The *State Environment Protection Policy (Prevention and Management of Contamination of Land) (SEPP)* was released in 2002 to bring together all matters relating to contamination of land, including responsibilities for prevention and management of contamination.

The SEPP confirms the requirements of *Direction No. 1.* It also outlines useful actions a responsible authority should take in the assessment of planning permit applications. The SEPP provides guidance to responsible authorities in Clauses 13 & 14 of the SEPP. The suggested actions are elaborated on in later sections of this practice note.

How is potentially contaminated land identified?

Contamination of land is often a result of current or historical activities that have taken place at a site, or adjacent to it.

To identify the potential for contamination, the following steps may assist:

- Inspect the site. Observations should be made regarding evidence of contamination or historical activities that may give rise to contamination (for example, fuel tanks).
- Identify whether an Environmental Audit Overlay (EAO) exists over the site.
- Review any Site Analysis presented in accordance with Clauses 54.01-1 (single dwellings) & 55.01-1 (two or more dwellings) of planning schemes (these clauses require issues of site contamination to be identified).
- Consider any available information about the site:
  - The current and previous zoning, ownership or activities carried out on the site (for example council, rail, other utility or defence). Council rate records are a useful record of this information.
  - Any previous investigations or site assessments conducted.
  - Any potential contamination from surrounding land uses (for example, an adjacent service station known to be causing off-site contamination).
- Review lists of Certificates and Statements of Environmental Audit held by council and EPA. Environmental auditors are required to provide a copy of any Certificate or Statement issued to both the relevant council and the EPA.
- Review the EPA Priority Sites Register for information about sites with a current EPA Notice (for example, clean-up notice or pollution abatement notice) via Landata (www.land.vic.gov.au , Tel: 8636 2456) or Anstat (www.anstat.com.au, Tel. 9278 1172).

What information is needed?

In most cases the relevant information should be available from council or EPA records.

Particular types of current or past land uses or activities on a site (see section below) can act as a 'trigger' for the collection of more information about the previous uses or activities. Zoning may indicate past land uses, but is not a substitute for a detailed review of the site history.

If this information is not available to council officers, the SEPP suggests that further information should be requested from the proponent or applicant.

A suitably qualified environmental professional may provide an opinion on whether land intended for a sensitive use, is potentially contaminated. To contact a suitably qualified contaminated land professional, go to either the EPA environmental auditors appointed in the category of contaminated land (www.epa.vic.gov.au/Industry/environmental_auditors.asp) or the Australian Contaminated Land Consultants Association (ACLCA) Victorian Branch, at www.aclca.asn.au or Ph: 9509 5949.

Where the applicant submits an environmental assessment of the land, the planning or responsible authority may require the applicant to contribute financially to an independent review of the information by a suitably qualified environmental professional.

What land uses or activities might indicate potential contamination?

An assessment of the current *or previous* land uses of a site is an important step in the identification of potentially contaminated land. Table 1 lists the types of land uses that may have potential for contaminating land.

Table 1 - Potential for contamination

High potential for contamination includes land used for:

- Abattoir
- Abrasive blasting
- Airport
- Asbestos production/disposal
- Asphalt manufacturing
- Automotive repair/engine works
- Battery manufacturing/recycling
- Bitumen manufacturing
- Boat building/maintenance
- Breweries/distilleries
- Brickworks
- Chemical manufacturing/storage/blending
- Cement manufacture
- Ceramic works
- Coke works
- Compost manufacturing
- Concrete batching
- Council works depot
- Defence works
- Drum re-conditioning facility
- Dry cleaning
- Electrical/electrical components manufacture
- Electricity generation/power station
- Electroplating
- Explosives industry
- Fibreglass reinforced plastic manufacture
- Foundry
- Fuel storage depot
- Gasworks
- Glass manufacture
- Iron and steel works
- Landfill sites/waste depots
- Lime works

- Metal coating
- Metal finishing and treatments
- Metal smelting/refining/finishing
- Mining and extractive industries
- Oil or gas production/refining
- Pest control depots
- Printing shops
- Pulp or paper works
- Railway yards
- Shooting or gun clubs
- Scrap metal recovery
- Service stations/fuel storage
- Sewage treatment plant
- Ship building/breaking yards
- Shipping facilities – bulk (rate <100 t/day)
- Stock dipping sites
- Spray painting
- Tannery (and associated trades)
- Textile operations
- Timber preserving/treatment
- Tyre manufacturing
- Underground storage tanks
- Utility depots
- Waste treatment/incineration/disposal
- Woolscouring

Medium potential for contamination can be identified by certain types of activities carried out on the land, which may be incidental to the main site activity. The nature of the products used or stored, the quantity stored, and the location of use or storage should be considered. Such activities might include:

- Chemical storage
- Fuel storage
- Underground storage tank (if recently installed and no evidence of leaks)
- Market gardens
- Waste disposal
- Filling (imported soil)
- Other industrial activities (such as warehousing of chemicals that may be spilt during loading or unloading)

Low potential for contamination is likely to exist if none of the identified uses or activities in the high and medium potential categories are known to have been carried out on the land.

What level of assessment is required?

The level of environmental assessment necessary for a planning scheme amendment or planning permit application will depend on the statutory requirements for the proposed land use and the potential for contamination.

Where land has been identified as being potentially contaminated, an assessment of the level of contamination is necessary before a decision is made about the future use or development of that land. Councils should consider whether further information or advice from an expert should be sought to assist in determining what level of assessment is required. This enables planning decisions to be made with the knowledge of the condition of the site and the most satisfactory site management strategies.

There are two forms of assessment that can be applied. These are:

Require an environmental audit: a statutory audit undertaken by an environmental auditor under the *Environment Protection Act 1970*. The outcome is either a Certificate of Environmental Audit or a Statement of Environmental Audit.

Require a site assessment: a preliminary review of the site history (including current and previous uses and activities) by a suitably qualified environmental professional.

The matrix in Table 2 indicates the appropriate assessment level, based on proposed land use and current or historic land uses or activities carried out on the land.

Table 2 – Assessment matrix

PROPOSED LAND-USE	POTENTIAL FOR CONTAMINATION (as indicated in Table 1)		
	High	*Medium*	*Low*
Sensitive Uses			
Child care centre, pre-school or primary school	*A*	*B*	*C*
Dwellings, residential buildings etc.	*A*	*B*	*C*
Other Uses			
Open space	*B*	*C*	*C*
Agriculture	*B*	*C*	*C*
Retail or office	*B*	*C*	*C*
Industry or warehouse	*B*	*C*	*C*

A: *Require an environmental audit as required by Ministerial Direction No. 1 or the Environmental Audit Overlay when a planning scheme amendment or planning permit application would allow a sensitive use to establish on potentially contaminated land.*

An environmental audit is also strongly recommended by the SEPP where a planning permit application would allow a sensitive use to be established on land with 'high potential' for contamination.

B: *Require a site assessment from a suitably qualified environmental professional if insufficient information is available to determine if an audit is appropriate. If advised that an audit is not required, default to C.*

C: *General duty under Section 12(2)(b) and Section 60(1)(a)(iii) of the Planning and Environment Act 1987.*

When is an environmental audit necessary for a planning scheme amendment?

For land that has been identified as potentially contaminated land and where a planning scheme amendment would have the effect of allowing that land to be used for a sensitive use, *Direction No. 1* requires a planning authority to satisfy itself that the land is suitable for the use by:

(a) A Certificate of Environmental Audit issued for the site; or

(b) A Statement of Environmental Audit issued by an environmental auditor stating that the environmental conditions of the site are suitable for the sensitive use (with or without conditions on the use of the site).

Direction No. 1 requires that this be done before notice of a planning scheme amendment is given. However, it may be appropriate to delay this requirement if testing of the land before a notice of the amendment is given is difficult or inappropriate. For instance, if the rezoning relates to a large strategic exercise or involves multiple sites in separate ownership. *Direction No. 1* provides for the requirement for an environmental audit to be included in the amendment. This can be done by applying the EAO. See the section 'When should an Environmental Audit Overlay be applied'.

For a proposal to redevelop potentially contaminated land for a use other than a sensitive use (for example, a retail premises or office use), a planning authority can require an environmental audit if it considers it appropriate.

Direction No. 1 provides for an exemption from the need to comply with the Direction. Such an exemption may be appropriate where:

- Potentially contaminated land is already used for a sensitive use, agriculture or open space.
- Prior industry use of the land was benign and unlikely to result in any contamination.
- If there is a regional strategy to manage contamination (for example former gold mining activities).

A planning authority may request an exemption from the Minister for Planning or the Deputy Secretary, Built Environment, Department of Sustainability and Environment. The Minister or Deputy Secretary must consult with the EPA before making a decision. The planning authority should consult with the EPA before requesting an exemption.

When is an environmental audit necessary for a planning permit application?

For land that has been identified as potentially contaminated land and where a planning permit application may allow potentially contaminated land to be used for a sensitive use, the SEPP requires that the responsible authority seek a Certificate of Environmental Audit or a Statement of Environmental Audit indicating that the site is suitable for the proposed use.

An environmental audit should be required unless the proponent can demonstrate to the satisfaction of the responsible authority that the site has never been used for a potentially contaminating activity, or that other strategies or programs are in place to effectively manage any contamination.

Uses such as open space, agriculture and outdoor playgrounds associated with other uses are not sensitive uses but include an element of risk to the public. Careful consideration should be given to the likelihood of contamination and the need for an environmental audit.

If an environmental audit is required because an EAO is applied over the land, a Certificate or Statement of Environmental Audit must be issued before the sensitive use or buildings and works associated with the sensitive use can commence. If an EAO has been applied, the planning authority has already made an assessment that the land is potentially contaminated and that it is unlikely to be suitable for a sensitive use without further assessment and remediation works or management.

There may be other circumstances where the land is known to be contaminated and it would be appropriate for the level of contamination to be fully assessed as part of the application process.

Generally an environmental audit should be provided as early as possible in the planning process. This may not always be possible or reasonable and requiring an environmental audit as a condition of permit may be acceptable if the responsible authority is satisfied that the level of contamination will not prevent the use of the site.

Environmental audit works

The EAO is not a permit trigger and does not prevent works or activities being undertaken that are associated with an environmental audit (such as soil sampling).

Remediation works

Works that are associated with a development and that might also be remediation works (such as excavation or basement construction) should not commence before the completion of an environmental audit if a planning permit has not been issued for the development.

Where a permit has been issued for a development and a requirement for an environmental audit is a condition of permit, the responsible authority should consider carefully wording the permit conditions to allow early building works that facilitate remediation of the site.

When should a site assessment be sought?

A planning or responsible authority should seek (or require a proponent to seek) a site assessment by a suitably qualified environmental professional for proposals in category B, as shown in Table 2.

A site assessment should include:

- The nature of the previous land use or activities on the site
- How long did the activity take place?
- What is known about contamination?
- How much is present?
- How is it distributed?

An environmental professional may also assist in assessing information contained in any site assessment and advising further on the need for an audit on all or part of the site. The planning or responsible authority may require the applicant to include an independent assessment of the information, as part of the assessment of the permit application.

What if there are ongoing conditions of management?

Statement of Environmental Audit available at time of decision

A Statement of Environmental Audit usually contains one or more conditions that must be implemented for the site to be suitable for the proposed use.

The planning or responsible authority must consider any conditions in a Statement and:

- include provisions in a planning scheme amendment or conditions in a planning permit that reflect the requirements of the conditions of the Statement
- require the applicant to demonstrate that the conditions included in the Statement have been or will be met before the use commences
- liaise with other agencies of appropriate jurisdiction where the nature of the conditions means that they are more properly considered by that agency (for example, liaise with the EPA about conditions requiring ongoing management of groundwater).

It is appropriate for a Section 173 agreement under the *Planning and Environment Act 1987* to be required where:

- the conditions on a Statement of Environmental Audit will be ongoing in nature and require maintenance or monitoring such as regular groundwater or waterway testing
- other parties, such as the EPA or a water authority are involved with conditions of an ongoing nature.

The agreement should also provide for periodic reporting.

Other conditions, such as maintenance of a clay barrier are suitable to include as a planning permit condition.

If the conditions of a Statement of Environmental Audit are impractical or inappropriate to include as planning permit conditions, the environmental auditor should be asked to either re-issue the Statement or to confirm that the intent of the Statement conditions are adequately captured in the proposed planning permit conditions.

Where conditions on a Statement of Environmental Audit can be most effectively implemented by another agency, the planning or responsible authority should liaise with that agency and reach agreement about responsibilities and actions. Most commonly this would involve EPA, but on occasions may involve other agencies such as water authorities (for example where conditions requiring ongoing monitoring and management of polluted groundwater are to be imposed).

Requirements where an environmental audit is a condition of permit

Where an environmental audit is to be completed in response to a condition of a planning permit, it is necessary to carefully word planning permit conditions to not only require a Certificate or Statement of Environmental Audit but to also address the implementation of Statement conditions.

An example of conditions that might be placed on a planning permit is provided below:

1. Prior to the commencement of the use or buildings and works associated with the use (or the certification or issue of a statement of compliance under the *Subdivision Act 1988*) the applicant must provide:
   (a) A Certificate of Environmental Audit in accordance with Section 53Y of the *Environment Protection Act 1970*; or
   (b) A Statement of Environmental Audit under Section 53Z of the *Environment Protection Act 1970*. A Statement must state that the site is suitable for the use and development allowed by this permit.
2. All the conditions of the Statement of Environmental Audit must be complied with to the satisfaction of the responsible authority, prior to commencement of use of the site. Written confirmation of compliance must be provided by a suitably qualified environmental professional or other suitable person acceptable to the responsible authority. In addition, sign off must be in accordance with any requirements in the Statement conditions regarding verification of works.

Where there are conditions on a Statement of Environmental Audit that require significant ongoing maintenance and/or monitoring, the following condition might also be used:

3. The applicant must enter into a Section 173 Agreement under the *Planning and Environment Act* 1987. The Agreement must be executed on title prior to the commencement of the use and prior to the issue of a Statement of Compliance under the Subdivision Act 1987. The applicant must meet all costs associated with drafting and execution of the Agreement, including those incurred by the responsible authority.

How are environmental audit conditions enforced?

Where a responsible authority becomes aware that an occupier is failing to comply with requirements set out in the planning scheme or planning permit, enforcement procedures under the *Planning and Environment Act* 1987 are available. These may include planning infringement notices, enforcement orders or prosecution through the Magistrates Court.

Where the failure to comply with Statement conditions results in a site not being suitable for its current use, EPA may issue a Clean-up Notice under the *Environment Protection Act 1970*. This also applies where the non-compliance results in pollution or a likelihood of pollution of another segment of the environment.

Depending on the nature of the conditions, other agencies may also have a role in enforcement.

When should an Environmental Audit Overlay be applied?

The Environmental Audit Overlay (EAO) is a mechanism provided in *the Victoria Planning Provisions* and planning schemes to defer the requirements of *Direction No. 1* for an environmental audit until the site is to be developed for a sensitive use.

By applying the overlay, the planning authority has made an assessment that the land is potentially contaminated land, and is unlikely to be suitable for a sensitive use without more detailed assessment and remediation works or management. The steps set out in *'How* is potentially contaminated land identified?*'* should be used to make this assessment.

The planning authority is also determining that the requirements of *Direction No. 1* may be deferred. The EAO is a statutory mechanism to provide for that deferment. The EAO is not simply a means of identifying land that is or might be contaminated and should not be used for that purpose. Previous zoning is not sufficient reason in itself to justify application of an EAO.

The Explanatory Statement to *Direction No. 1* suggests that it may only be appropriate to defer the audit requirement if testing of the land before a notice of amendment is given is difficult or inappropriate. An example might be where the rezoning relates to a large strategic exercise or involves multiple sites in separate ownership.

Planning authorities should be careful in applying the overlay. All buildings and works associated with a sensitive use (irrespective of how minor) will trigger the need to undertake an environmental audit.

Where sensitive uses already exist on a site the planning authority, before applying an EAO, should satisfy itself that these sites are potentially contaminated (through site history records). If there is no evidence of potentially contaminated land it may not be appropriate to apply the EAO to these sites.

When should an Environmental Audit Overlay be removed?

The planning authority should remove the EAO if:

- it determines that the land is not potentially contaminated land. The steps set out in 'How is potentially contaminated land identified?' will assist this decision; or
- the site is given a Certificate of Environmental Audit.

In some circumstances where a Statement of Environmental Audit is issued, it may also be possible to remove the EAO (for example, where there are minimum restrictions or conditions on the use of the site, or the conditions have been complied with). The timely removal of an EAO will avoid costly and time-consuming requirements for all parties.

References

- *Ministerial Direction No. 1 – Potentially Contaminated Land* 1989.
- *Victoria Planning Provisions*, particularly Clauses 15.06, 45.03, 54.01, 55.01 and 65.
- *State Environment Protection Policy (Prevention and Management of Contamination of Land)* June 2002.
- *Environmental Auditing of Contaminated Land* (EPA Publication 860, July 2002)).
- *Environmental Auditor (Contaminated Land) Guidelines for Issue of Certificates and Statements of Environmental Audit* (EPA Publication 759b, October 2002.

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APPENDIX E

Summary of Stage 2 Results

1.0 ENVIRONMENTAL ASSESSMENT

1.1 Assessment Framework

The framework for environmental site assessment outlined in the following sections is in general accordance with the National Environmental Protection (Assessment of Site Contamination) Measure 1999 (updated 2013) and is pursuant to the Victorian legislative framework

Indicators and objectives for protection of beneficial uses of land are set out in the *State Environment Protection Policy (Prevention and Management of Contamination of Land)* (Land SEPP). The site will likely be used for a range of activities/uses. The relevant beneficial uses of different types of land uses are outlined below:

Table 1: Summary of Protected Beneficial Uses of Land

Beneficial Use	Sensitive Use (Residential – Other)	Sensitive Use (Residential - High Density)	Commercial / Industrial Use	Open Space
Maintenance of ecosystems **a) Natural** **b) Modified** **c) Highly Modified**	 No Yes Yes	 No No Yes	 No No Yes	 No Yes Yes
Human Health	Yes	Yes	Yes	Yes
Buildings and Structures	Yes	Yes	Yes	No
Aesthetics	Yes	Yes	No	Yes
Production of Food Flora and Fibre	Yes	No	No	No

Given a large majority of the land is likely to be used for low density residential. Indicators and guidelines protective of this most sensitive land use have been adopted as screening criteria. The adopted guidelines and screening criteria for a sensitive use are presented in Table 2.

Table 2: Indicators and Screening Criteria for Assessment of Sensitive Uses of Land

Beneficial Use	Soil and Groundwater Quality Indicator
Maintenance of Ecosystems	Chemical substances identified through the application of the Amended (2013) National Environment Protection (Assessment of Site Contamination) Measure (NEPM) above the following screening criteria: ■ NEPM 2013 Ecological Investigation Levels (EILs). ■ NEPM 2013 Ecological Screening Levels (ESLs)
Human Health	Chemical substances identified through the application of the NEPM above the following screening criteria: ■ NEPM 2013 Health Investigation Levels (HIL) "D" for screening of health risk within a commercial / industrial land use setting. ■ NEPM 2013 Health Screening Levels (HSL) "D" for screening of vapour inhalation risk for total recoverable hydrocarbons (TRH), monocyclic aromatic hydrocarbons (MAH) and naphthalene. ■ NEPM 2013 management limits for petroleum hydrocarbons.
Building and Structures	■ Threshold values outlined in the Australian Standard 2159 Piling – Design and Installation for parameters including pH, sulfate, redox potential, salinity or any chemical substance or waste that may have a detrimental impact on the structural

Beneficial Use	Soil and Groundwater Quality Indicator
	integrity of buildings or other structures.
Aesthetics	The Land SEPP states that contamination must not cause the land to be offensive to the senses of humans. Generally, aesthetic issues relate to the presence of non-hazardous inert foreign material (refuse) in soil or fill resulting from human activity. Further, the land is considered to be aesthetically acceptable if the soils are free of chemical substances, wastes, staining and odours. For the consideration of an assessment includes both a consideration of observations during fieldwork for the potential presence of visual or olfactory evidence of contamination and concentrations of volatile contaminants.

The specific guideline values adopted for assessment are based on the identified presence of a fine grained (silt) soil existing immediately below the surface of site.

2.0 RESULTS

2.1 Summary of Sub-surface conditions

The sub-surface conditions encountered varied between test pit locations. The description of subsurface conditions encountered is described in the main document.

Field observations

An assessment of each soil sample from the 10 test pits was made in the field and involved ranking based on both odorous and visible evidence of contamination. Each soil sample recovered was given a ranking according to Table 3.

Table 3: Environmental Ranking System for Soil Samples

Visible Contamination		Odourous Soil	
Rank	**Description**	**Rank**	**Description**
0	No visible evidence of contamination	A	No odour
1	Slight evidence of visual contamination	B	Slightly offensive odour
2	Visible contamination	C	Moderately offensive odour
3	Obviously contaminated	D	Strongly offensive odour

Minor amounts of visible contamination were observed at the one test pit location (TP07). Rankings assigned in the field ranged from 0A to 2A (presented in the borelogs provided). The observed visible contamination was generally limited to whole bricks, fragmented bricks, crushed bitumen, concrete rubble, minor staining, fragments of metal, glass, rubber, plastic, terracotta.

A photoionisation detector (PID) was used to screen for volatile organic compounds during the field works. The PID readings are summarised on the bore logs in Appendix A. The readings ranged from 0.0 ppm to 0.5 ppm; these readings indicate that the PID did not detect significant levels of volatile organic compounds.

2.2 Soil Analytical Results

The soil analytical results from the soil investigation are presented in Table E1. Laboratory analytical certificates are provided attached to the Appendix.

All concentrations of analytes were reported below the adopted assessment criteria.

2.3 Data Quality

Data Quality Measures and Objectives

The data quality measures for the assessment are as follows:

1)*Accuracy:* A measure of the closeness of the reported results to the actual results, assessed in two ways. Firstly results produced by the primary and secondary laboratories for the same sample are compared. Secondly, the extent to which an analytical result reflects the known concentration as measured by the recovery obtained from internal laboratory spikes is measured.

2) *Precision*: A measure of the repeatability of results by the laboratory. This is assessed through the analysis of duplicates both internally and externally by the primary laboratory.

3) *Completeness:* The percentage of the total number of samples analysed which produce acceptable data.

The following data quality objectives targets have been set for this project based on guidelines provided in the Australian Standard AS4482.1-2005 (AS, 2005).

- Field duplicates recording a Relative Percentage Differences (RPDs) between 30% to 50%;
- Primary laboratory internal duplicates recording RPDs between 30% to 50%;
- Rinsate/Field blanks below laboratory reporting limits;
- Primary laboratory spikes for organics and inorganics falling in the range of 70% to 130%;
- Primary laboratory internal blanks below reporting limits; and
- Overall completeness should be a minimum of 95%.

In order to assess these objectives, a quality assurance plan for the investigation program was implemented by Golder for both the field sampling and laboratory components of the sample collection and analysis. The below assessment of data quality requirements provides the basis for the review of the quality assurance aspects of the soil investigation.

Data Quality Assessment

A soil quality assurance (QA) program was implemented as part of the soil investigation. One primary and secondary duplicate samples were collected as part of the quality assurance program at a duplicate sampling rate of 1 per 20 sampling locations, which is in accordance with the recommended duplicate sampling of 1 per 20 of the total samples collected in Australian Standard 4482.1 *Guide to investigation and sampling of sited with potentially contaminated soil*.

The main aspects of the data quality assurance relate to the field work procedures, collection of quality control samples and generation of internal laboratory quality control data to support the reported results and the assessment of laboratory results.

Samples were collected with the following measures to prevent cross contamination and to preserve the quality of the samples:

- A clean pair of nitrile gloves was worn when collecting each sample.
- The samples were stored in new clean containers supplied by the NATA certified laboratories.

- The collection of duplicates in the field was conducted at the same time as the collection of the primary samples, and sample containers were labelled using a predetermined unique numbering system to enable later identification.
- Samples were stored in an Esky to protect the samples from sunlight and contained ice to keep the samples cool. The samples were received by the laboratory at a temperature range of 1.2 to 3.9 ^{o}C.

Field chain of Custody (CoC) records outlining the required analysis accompanied samples delivered to the laboratories. The CoC records were signed by the relinquishing and receiving parties are presented in Appendix E).

Table 4: QA/QC Completeness

QC Sample Type	Results Not Meeting Data Quality Objectives	Total Number of Results (individual analytes)	Percentage meeting Data Quality Objectives (%)
Primary Duplicates	0	57	100%
Secondary Duplicates	0	39	100%
Internal Duplicates	0	174	100%
Internal Spike Recoveries	0	54	100%
Internal Method Blanks	0	106	100%
Overall Completeness	**0**	**430**	**100%**

The overall assessment of the Golder QA program for the soil investigation has been made in terms of completeness. The completeness is equal to the percentage of valid quality control results. The quality control results meet the acceptance criteria and are therefore considered to be acceptable for the purposes of this assessment.

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				pH				ample Quality Paramete			Heavy Metals								Organochlorine Pesticides																				
				pH (F)	PH_CACL2	pH (Field ox)	Reaction Rate	Sulphate (as SO4)	Total Phosphorus (as P)	Moisture	Arsenic	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Zinc	a-BHC	Aldrin	Aldrin & Dieldrin (Sum of total) (Lab Reported)	Aldrin & Dieldrin (Sum of total) (Calculated)	b-BHC	Chlordane (Sum of total)	cis-Chlordane	trans-Chlordane	d-BHC	DDD	DDE	DDT	DDT+DDE+DDD (Sum of total) (Lab Reported)	DDT+DDE+DDD (Sum of total) (Calculated)	Dieldrin	Endosulfan	Endosulfan I	Endosulfan II	Endosulfan sulphate	Endrin	Endrin aldehyde	Endrin ketone
				pH Unit	pH Unit	pH_Units	-	mg/kg	mg/kg	%	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
LOR				0.1	0.1	0.1	1	10	2	1	5	1	2	5	5	0.1	2	5	0.05	0.05	0.05		0.05	0.05	0.05	0.05	0.05	0.05	0.2	0.05		0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
NEPM 2013 EILS-Areas of ecological significance											40																			3	3								
NEPM 2013 EILS-Commercial and industrial											160																			640	640								
NEPM 2013 EILs-Urban Residential and public open space											100																			180	180								
NEPM 2013 HIL- Residential A Soil											100	20		6000	300	40	400	7400			6	6		50						240	240		270				10		
Location_Code	**Field_ID**	**Depth**	**Sampled_Date_Time**																																				
TP01	TP01/1001	0.1-0.2	5/09/2014	-	4.5	-	-	<10	77	13.2	<5	<1	4	<5	6	<0.1	<2	<5	<0.05	<0.05	<0.05	<0.1[#1]	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.3[#1]	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
TP01	TP01/1002	0.25-0.35	5/09/2014	6.2	-	2.7	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP02	TP02/1001	0.1-0.15	5/09/2014	5.9	4.5	3	3	<10	880	18.3	<5	<1	8	<5	5	<0.1	2	6	<0.05	<0.05	<0.05	<0.1[#1]	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.3[#1]	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
TP03	TP03/1001	0.1-0.2	5/09/2014	-	5.1	-	-	<10	136	18.1	<5	<1	4	<5	13	<0.1	<2	<5	<0.05	<0.05	<0.05	<0.1[#1]	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.3[#1]	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
TP03	TP03/1002	0.3-0.4	5/09/2014	6.2	-	3.2	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP04	TP04/1001	0.1-0.2	5/09/2014	6.3	4.9	2.6	3	10	88	16.6	<5	<1	4	<5	6	<0.1	<2	<5	<0.05	<0.05	<0.05	<0.1[#1]	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.3[#1]	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
TP05	TP05/1001	0.1-0.3	5/09/2014	6.1	5	2.4	3	40	158	17.5	<5	<1	9	<5	11	<0.1	2	<5	<0.05	<0.05	<0.05	<0.1[#1]	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.3[#1]	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
TP06	TP06/1001	0.1-0.2	5/09/2014	-	4.3	-	-	<10	98	25.3	<5	<1	<2	<5	<5	<0.1	<2	<5	<0.05	<0.05	<0.05	<0.1[#1]	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.3[#1]	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
TP06	TP06/1002	0.3-0.35	5/09/2014	6.1	-	2.6	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP07	TP07/1001	0.05-0.1	4/09/2014	-	4.8	-	-	<10	227	17.8	<5	<1	4	<5	8	<0.1	<2	<5	<0.05	<0.05	<0.05	<0.1[#1]	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.3[#1]	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
TP07	TP07/1002	0.3-0.35	4/09/2014	6.7	-	3.2	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP08	TP08/1001	0.1-0.2	4/09/2014	6.7	5.2	3.1	3	10	152	11.3	<5	<1	19	9	12	<0.1	10	12	<0.05	<0.05	<0.05	<0.1[#1]	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.3[#1]	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
TP09	TP09/1001		4/09/2014	-	4.4	-	-	20	580	21.6	<5	<1	13	7	16	<0.1	4	<5	<0.05	<0.05	<0.05	<0.1[#1]	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.3[#1]	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
TP09	TP09/1002		4/09/2014	5.6	-	2.4	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP10	TP10/1001	0.05-0.1	4/09/2014	-	4.4	-	-	20	496	23.7	<5	<1	12	10	12	<0.1	5	6	<0.05	<0.05	<0.05	<0.1[#1]	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.3[#1]	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
TP10	TP10/1002	0.3-0.35	4/09/2014	5.9	-	2.3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Statistical Summary																																						
Number of Results				10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Number of Detects				10	10	10	10	5	10	10	0	0	9	3	9	0	5	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Minimum Concentration				5.6	4.3	2.3	2	<10	77	11.3	<5	<1	<2	<5	<5	<0.1	<2	<5	<0.05	<0.05	<0.05	<0.1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.3	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Minimum Detect				5.6	4.3	2.3	2	10	77	11.3	ND	ND	4	7	5	ND	2	6	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Maximum Concentration				6.7	5.2	3.2	3	40	880	25.3	<5	<1	19	10	16	<0.1	10	12	<0.05	<0.05	<0.05	<0.1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.05	<0.3	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Maximum Detect				6.7	5.2	3.2	3	40	880	25.3	ND	ND	19	10	16	ND	10	12	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Average Concentration				6.2	4.7	2.8	2.9	13	289	18	2.5	0.5	7.8	4.4	9.2	0.05	2.8	4.2	0.025	0.025	0.025	0.05	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.1	0.025	0.15	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025
Median Concentration				6.15	4.65	2.65	3	7.5	155	17.95	2.5	0.5	6	2.5	9.5	0.05	1.5	2.5	0.025	0.025	0.025	0.05	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.1	0.025	0.15	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025
Standard Deviation				0.34	0.33	0.35	0.32	11	271	4.3	0	0	5.5	3.1	4.3	0	2.9	3.1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Number of Guideline Exceedances				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Number of Guideline Exceedances(Detects Only)				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Comments

#1 ESDAT Combined.

Golder Associates

147612091-002-R-Rev0

					Organophosphorous Pesticides																				Pesticides-Others	Halogenated Benzenes	Polychlorinated Biphenyls
					g-BHC	Heptachlor	Heptachlor epoxide	Methoxychlor	Azinphos-methyl	Bromophos-ethyl	Carbophenothion	Chlorfenvinphos	Chlorpyriphos	Chlorpyriphos-methyl	Diazinon	Dichlorvos	Dimethoate	Ethion	Fenamiphos	Fenthion	Malathion	Parathion-methyl	Monocrotophos	Parathion	Pirimphos-ethyl	Prothiofos	Demeton-s-methyl	Hexachlorobenzene	PCB (Sum of Total-Lab Reported)
					mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
LOR					0.05	0.05	0.05	0.2	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.2	0.2	0.2	0.05	0.05	0.05	0.05	0.1
NEPM 2013 EILS-Areas of ecological significance																													
NEPM 2013 EILS-Commercial and industrial																													
NEPM 2013 EILs-Urban Residential and public open space																													
NEPM 2013 HIL- Residential A Soil						6		300					160														10	1
Location_Code	Field_ID	Depth	Sampled_Date_Time																										
TP01	TP01/1001	0.1-0.2	5/09/2014		<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.2	<0.2	<0.05	<0.05	<0.05	<0.05	<0.1
TP01	TP01/1002	0.25-0.35	5/09/2014		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP02	TP02/1001	0.1-0.15	5/09/2014		<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.2	<0.2	<0.05	<0.05	<0.05	<0.05	<0.1
TP03	TP03/1001	0.1-0.2	5/09/2014		<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.2	<0.2	<0.05	<0.05	<0.05	<0.05	<0.1
TP03	TP03/1002	0.3-0.4	5/09/2014		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP04	TP04/1001	0.1-0.2	5/09/2014		<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.2	<0.2	<0.05	<0.05	<0.05	<0.05	<0.1
TP05	TP05/1001	0.1-0.3	5/09/2014		<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.2	<0.2	<0.05	<0.05	<0.05	<0.05	<0.1
TP06	TP06/1001	0.1-0.2	5/09/2014		<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.2	<0.2	<0.05	<0.05	<0.05	<0.05	<0.1
TP06	TP06/1002	0.3-0.35	5/09/2014		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP07	TP07/1001	0.05-0.1	4/09/2014		<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.2	<0.2	<0.05	<0.05	<0.05	<0.05	<0.1
TP07	TP07/1002	0.3-0.35	4/09/2014		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP08	TP08/1001	0.1-0.2	4/09/2014		<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.2	<0.2	<0.05	<0.05	<0.05	<0.05	<0.1
TP09	TP09/1001		4/09/2014		<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.2	<0.2	<0.05	<0.05	<0.05	<0.05	<0.1
TP09	TP09/1002		4/09/2014		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TP10	TP10/1001	0.05-0.1	4/09/2014		<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.2	<0.2	<0.05	<0.05	<0.05	<0.05	<0.1
TP10	TP10/1002	0.3-0.35	4/09/2014		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Statistical Summary																													
Number of Results					10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Number of Detects					0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Minimum Concentration					<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.2	<0.2	<0.05	<0.05	<0.05	<0.05	<0.1
Minimum Detect					ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Maximum Concentration					<0.05	<0.05	<0.05	<0.2	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.2	<0.2	<0.2	<0.05	<0.05	<0.05	<0.05	<0.1
Maximum Detect					ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Average Concentration					0.025	0.025	0.025	0.1	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.1	0.1	0.1	0.025	0.025	0.025	0.025	0.05
Median Concentration					0.025	0.025	0.025	0.1	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.1	0.1	0.1	0.025	0.025	0.025	0.025	0.05
Standard Deviation					0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Number of Guideline Exceedances					0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Number of Guideline Exceedances(Detects Only)					0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Comments

#1 ESDAT Combined.

(1) 9161

CHAIN OF CUSTODY

NO. _____

GOLDER ASSOCIATES PTY LTD
BUILDING 7, BOTANICCA CORPORATE PARK
570 - 588 SWAN STREET,
RICHMOND, VICTORIA 3121.
Tel: (03) 8862 3500
Fax: (03) 8862 3501

Page ____ of ____

Golder Job Number: 147612091
Job Location: McPherson PSP
Laboratory Issued To: Eurofins
Order No.:
Sampled By (Golder): Chris Lenthal, Michael
Golder Job Contact: Jock Martin / Alessandro Sica
Golder Contact Email: jomartin@golder.com.au ngcooper@golder.com.

# OBSERV-ATIONS	SAMPLE DATE	SAMPLE NUMBER TAAXXX/MQNN	SAMPLE TYPE	SAMPLE DEPTH (m)	No. OF CONTAIN-ERS	pH	pH(F) and pH (FOX) - EA003	Phosphorous - Total	Sulphate - Water Soluable S as SO4	OCP, OPP and PCB - S13	metals (8)	Hold
	5/09/2014	TP01/1001	soil	0.1-0.2	1	X		X	X	X	X	
	5/09/2014	TP01/1002	soil	0.25-0.35	1		X					
	5/09/2014	TP02/1001	soil	0.1-0.15	1	X	X	X	X	X	X	
	5/09/2014	TP02/1002	soil	0.3-0.4	1							X
	5/09/2014	TP03/1001	soil	0.1-0.2	1	X		X	X	X	X	
	5/09/2014	TP03/1002	soil	0.3-0.4	1		X					
	5/09/2014	TP04/1001	soil	0.1-0.2	1	X	X	X	X	X	X	
	5/09/2014	TP04/1002	soil	0.6-0.7	1							
	5/09/2014	TP05/1001	soil	0.1-0.3	1	X	X	X	X	X	X	
	5/09/2014	TP05/1002	soil	0.3-0.4	1							X
	5/09/2014	TP06/1001	soil	0.1-0.2	1	X		X	X	X	X	
	5/09/2014	TP06/1002	soil	0.3-0.35	1		X					
	5/09/2014	TP06/1003	soil	0.5-0.7	1							
	4/09/2014	TP07/1001	soil	0.05-0.1	1	X		X	X	X	X	
	4/09/2014	TP07/1002	soil	0.3-0.35	1		X					X
	4/09/2014	TP08/1001	soil	0.1-0.2	1	X	X	X	X	X	X	
	4/09/2014	TP08/1002	soil	0.3-0.4	1							X
	4/09/2014	TP08/1003	soil	0.8-0.9	1							X
	4/09/2014	TP09/1001	soil		1	X	X	X	X	X	X	
	4/09/2014	TP09/1901	soil		1	X	X	X	X	X	X	
	4/09/2014	TP09/1002	soil		2							X
	4/09/2014	TP10/1001	soil	0.05-0.1	1	X	X	X	X	X	X	
	4/09/2014	TP10/1901	soil		1	X	X	X	X	X	X	
	4/09/2014	TP10/1002	soil	0.2-0.25	2							

COURIER

Relinquished by: Bharathi (ALS) 9/9/14 14:10

FORWARD TO EUROFINS

Special Instructions: Frozen samples included for pH(f) and pH(fox) testing
Forward sample TP10/1901 to Eurofins for testing

TURN AROUND TIME REQUIRED

☐ 1 Working Day ☐ 2 Working Days ☐ 3 Working Days ☐ 4 Working Days ☒ 5 Working Days (standard) ☐ Other _____

SAMPLE RECEIPT

Relinquished by: Jock Martin Date: 8/09/2014 Time: 1100
Organisation: Golder Associates
Received by: Tony W Date: 9/9 Time: 3:00pm
Organisation: Eurofins|mgt

ANALYTICAL SCHEDULE

Relinquished by: Jock Martin Date: 8/09/2014 Time: 1100
Organisation: Golder Associates
Received by: Amitha Date: 8/9 Time: 13:50
Organisation: ALS

DELIVERED BY: ☐ COURIER/LAB ☐ GOLDER
RECEIVED BY: ☐ FAX ☐ HAND

SAMPLE STATUS: ☐ Security Sealed ☐ Chilled ☐ Frozen ☐ Ambient

RECEIVING LABORATORY TO CONFIRM RECEIPT OF ANALYTICAL SCHEDULE BY RETURN FAX TO : (03) 8862 3501

 # Observations to Assist Analysis and OH&S
C - Expected to be Highly Contaminated
N - NAPL Sample
HS - Expected High Salinity
HOC - Expected High Total Organic Carbon
S - Sheen
O - Odourous

Original (white) - Laboratory
Duplicate (yellow) - Project File
Triplicate (pink) - COC Book

Checked By: _____ Date: _____

Report: 431447.

eurofins | mgt

Certificate of Analysis

Golder Associates Pty Ltd (Richmond)
570-588 Swan Street
Richmond
VIC 3121

NATA Accredited
Accreditation Number 1261
Site Number 1254

Accredited for compliance with ISO/IEC 17025.
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

Attention: **- Natalie Cooper - ALL COCs/SRAs/REPORTS**

Report **431447-S**
Client Reference MCPHERSON PSP 147612091
Received Date Sep 09, 2014

Client Sample ID			**TP10/1901**
Sample Matrix			**Soil**
Eurofins | mgt Sample No.			**M14-Se07234**
Date Sampled			**Sep 04, 2014**
Test/Reference	LOR	Unit	
Organochlorine Pesticides			
Chlordanes - Total	0.1	mg/kg	< 0.1
4.4'-DDD	0.05	mg/kg	< 0.05
4.4'-DDE	0.05	mg/kg	< 0.05
4.4'-DDT	0.05	mg/kg	< 0.05
a-BHC	0.05	mg/kg	< 0.05
Aldrin	0.05	mg/kg	< 0.05
b-BHC	0.05	mg/kg	< 0.05
d-BHC	0.05	mg/kg	< 0.05
Dieldrin	0.05	mg/kg	< 0.05
Endosulfan I	0.05	mg/kg	< 0.05
Endosulfan II	0.05	mg/kg	< 0.05
Endosulfan sulphate	0.05	mg/kg	< 0.05
Endrin	0.05	mg/kg	< 0.05
Endrin aldehyde	0.05	mg/kg	< 0.05
Endrin ketone	0.05	mg/kg	< 0.05
g-BHC (Lindane)	0.05	mg/kg	< 0.05
Heptachlor	0.05	mg/kg	< 0.05
Heptachlor epoxide	0.05	mg/kg	< 0.05
Hexachlorobenzene	0.05	mg/kg	< 0.05
Methoxychlor	0.05	mg/kg	< 0.05
Toxaphene	1	mg/kg	< 1
Dibutylchlorendate (surr.)	1	%	119
Tetrachloro-m-xylene (surr.)	1	%	110
Organophosphorous Pesticides			
Bolstar	0.2	mg/kg	< 0.2
Chlorpyrifos	0.2	mg/kg	< 0.2
Demeton-O	0.2	mg/kg	< 0.2
Diazinon	0.2	mg/kg	< 0.2
Dichlorvos	0.2	mg/kg	< 0.2
Disulfoton	0.2	mg/kg	< 0.2
Ethion	0.2	mg/kg	< 0.2
Ethoprop	0.2	mg/kg	< 0.2
Fenitrothion	0.2	mg/kg	< 0.2
Fensulfothion	0.2	mg/kg	< 0.2
Fenthion	0.2	mg/kg	< 0.2
Merphos	0.2	mg/kg	< 0.2

Client Sample ID			TP10/1901
Sample Matrix			**Soil**
Eurofins | mgt Sample No.			**M14-Se07234**
Date Sampled			**Sep 04, 2014**
Test/Reference	LOR	Unit	
Organophosphorous Pesticides			
Methyl azinphos	0.2	mg/kg	< 0.2
Methyl parathion	0.2	mg/kg	< 0.2
Mevinphos	0.2	mg/kg	< 0.2
Naled	0.5	mg/kg	< 0.5
Phorate	0.2	mg/kg	< 0.2
Ronnel	0.2	mg/kg	< 0.2
Tokuthion	0.2	mg/kg	< 0.2
Trichloronate	0.2	mg/kg	< 0.2
Triphenylphosphate (surr.)	1	%	101
Polychlorinated Biphenyls			
Aroclor-1016	0.1	mg/kg	< 0.1
Aroclor-1221	0.1	mg/kg	< 0.1
Aroclor-1232	0.1	mg/kg	< 0.1
Aroclor-1242	0.1	mg/kg	< 0.1
Aroclor-1248	0.1	mg/kg	< 0.1
Aroclor-1254	0.1	mg/kg	< 0.1
Aroclor-1260	0.1	mg/kg	< 0.1
Total PCB	0.1	mg/kg	< 0.1
Dibutylchlorendate (surr.)	1	%	119
Tetrachloro-m-xylene (surr.)	1	%	110
pH (1:5 Aqueous extract)	0.1	pH Units	5.4
Sulphate (as S) (soluble)	10	mg/kg	54
Phosphorus	5	mg/kg	400
% Moisture	0.1	%	20
Heavy Metals			
Arsenic	2	mg/kg	3.8
Cadmium	0.4	mg/kg	< 0.4
Chromium	5	mg/kg	12
Copper	5	mg/kg	9.2
Lead	5	mg/kg	10
Mercury	0.1	mg/kg	< 0.1
Nickel	5	mg/kg	< 5
Zinc	5	mg/kg	5.5
Acid Sulphate Soils Field pH Test			
pH-F (Field pH test)	0.1	pH Units	5.0
pH-FOX (Field pH Peroxide test)	0.1	pH Units	2.9
Reaction Ratings		comment	High

Sample History

Where samples are submitted/analysed over several days, the last date of extraction and analysis is reported.
A recent review of our LIMS has resulted in the correction or clarification of some method identifications. Due to this, some of the method reference information on reports has changed. However, no substantive change has been made to our laboratory methods, and as such there is no change in the validity of current or previous results (regarding both quality and NATA accreditation).

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Organochlorine Pesticides	Melbourne	Sep 10, 2014	14 Day
- Method: USEPA 8081 Organochlorine Pesticides			
Organophosphorous Pesticides	Melbourne	Sep 10, 2014	14 Day
- Method: USEPA 8270 Organophoshorus Pesticides			
Polychlorinated Biphenyls	Melbourne	Sep 10, 2014	28 Day
- Method: USEPA 8082 Polychlorinated Biphenyls			
pH (1:5 Aqueous extract)	Melbourne	Sep 11, 2014	7 Day
- Method: LM-LTM-INO-4000			
Sulphate (as S) (soluble)	Melbourne	Sep 10, 2014	28 Day
- Method: APHA 4500-SO4 Sulfate by FIA			
Phosphorus	Melbourne	Sep 10, 2014	180 Day
- Method: USEPA 6010			
% Moisture	Melbourne	Sep 09, 2014	14 Day
- Method: Method 102 - ANZECC - % Moisture			
Metals M8	Melbourne	Sep 10, 2014	28 Day
- Method: USEPA 6010/6020 Heavy Metals & USEPA 7470/71 Mercury			
Acid Sulphate Soils Field pH Test	Brisbane	Sep 11, 2014	7 Day
- Method: Acid Sulphate Soils Guideline Series			

Company Name: Golder Associates Pty Ltd (Richmond)
Address: 570-588 Swan Street
Richmond
VIC 3121

Client Job No.: MCPHERSON PSP 147612091

Order No.:
Report #: 431447
Phone: (03) 8862 3500
Fax: (03) 8862 3501

Received: Sep 9, 2014 3:00 PM
Due: Sep 16, 2014
Priority: 5 Day
Contact Name: - Natalie Cooper - ALL

Eurofins | mgt Client Manager: Onur Mehmet

Sample Detail					% Moisture	pH (1:5 Aqueous extract)	Phosphorus	Sulphate (as S) (soluble)	Organochlorine Pesticides	Organophosphorous Pesticides	Polychlorinated Biphenyls	Acid Sulphate Soils Field pH Test	Metals M8
Laboratory where analysis is conducted													
Melbourne Laboratory - NATA Site # 1254 & 14271					X	X	X	X	X	X	X		X
Sydney Laboratory - NATA Site # 18217													
Brisbane Laboratory - NATA Site # 20794												X	
External Laboratory													
Sample ID	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**									
TP10/1901	Sep 04, 2014		Soil	M14-Se07234	X	X	X	X	X	X	X	X	X

APPENDIX F

Limitations

LIMITATIONS

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