



**Douglas Partners**  
Geotechnics • Environment • Groundwater

**REPORT  
on  
PRELIMINARY CONTAMINATION ASSESSMENT**

**SECTOR 3, MACPHERSON STREET  
WARRIEWOOD VALLEY**

**Prepared for  
MIRVAC HOMES (NSW) PTY LTD**

**Project No. 37273  
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## EXECUTIVE SUMMARY

This report presents the results of a Preliminary Contamination Assessment conducted by Douglas Partners Pty Ltd at Sector 3, MacPherson Street, Warriewood Valley. The assessment was conducted on behalf of the Mirvac Homes (NSW) Pty Ltd for proposed Warriewood Valley Sector 3 Rezoning. Development of medium density residential dwellings has been proposed.

The assessment included a site history review, drilling and sampling from 15 test bores, and analysis of 23 selected soil samples (including two field replicates for QA/QC purposes) for various combinations of the identified potential contaminants.

Reference to the title deeds and aerial photographs indicates that the site has previously been used for agriculture, with greenhouses and retail nurseries.

A review of the site geology indicates that the site is underlain by Quaternary deposits, including silty to peaty quartz sand, silt and clay. This is consistent with site observations. It is further noted that site observations and pH screening indicate that Acid Sulphate Soils (ASS) may be present on the site. If left undisturbed, ASS do not generally result in negative impacts on the surrounding environment or engineered structures. However if bulk excavation and/or groundwater dewatering are to be conducted at the site, an ASS assessment (including Peroxide Oxidation Combined Acidity and Sulphate – POCAS analysis) should be conducted, and if ASS is found, an Acid Sulphate Soil Management Plan should be developed and implemented to appropriately manage ASS.

Concentrations of potential chemical contaminants (viz heavy metals, TRH, BTEX, PAH, phenol, PCB, OCP and OPP) were low in all samples tested, and were within Human health-based investigation levels for residential sites with accessible soils and Guidelines for Assessing Service Station Sites, 1994 (with respect to petroleum hydrocarbons). Most of the recorded contaminant concentrations were also within the Provisional phytotoxicity-based investigation levels (PIL) with the exception of one sample (9/1.5). Whilst sample 9/1.5 marginally exceeded the Provisional phytotoxicity-based investigation levels (PIL) for zinc, with a detected concentration of 240 mg/kg compared to the guideline



of 200 mg/kg, the detected concentration is within published background levels for zinc in Australian soils, and the sample was collected at a depth of 1.5 m, which is below the root zone of most plants used in landscaping. It is therefore considered that the marginal zinc exceedance of the PPL is insignificant.

In summary, based on the analytical results, no signs of chemical contamination were noted in the samples.

A number of buildings constructed of fibre cement were present at the site. The fibre cement was observed to be in poor condition, with some fragments observable on the ground surface adjacent to the buildings. In this light, the existing/ former fibre cement buildings/ structures may be the source of the observed asbestos cement fragments/ debris noted on the ground surface.

Furthermore it is possible that the near surface soils at the site, particularly surficial soils in areas where existing or former sheds/ structures exist, may be impacted by asbestos material/ debris. Given the previous market gardens/ nursery activities, it is possible that (a) asbestos cement fragments/ debris, if present, may be present in the topsoil due to the filling/ cultivation activities; and (b) asbestos cement drains may have been laid for irrigation purposes.

Chrysotile asbestos fibres were detected in one of the three soil samples examined. This sample (4/0.5) was collected from near surface filling containing some brick fragments. The extent of asbestos contaminated filling material at the site has not been established at this stage, but is likely to be confined to the near surface horizon.

It is recommended that a hazardous material assessment is conducted at the site by an occupational hygienist, and that the identified hazardous materials, including asbestos containing materials, are managed/ disposed of in accordance NSW EPA and WorkCover requirements.

Furthermore it is recommended that additional investigation of asbestos in soil/ filling at the site be conducted to assess the extent of asbestos contaminated filling at the site.

Based on site observations, site history and laboratory results it is considered that the site can be rendered suitable for the proposed residential development by removal of asbestos containing materials and filling, and validation of the site with respect to asbestos.

It should be noted that the current assessment is conducted as a preliminary contamination assessment, thus the adopted sampling density does not meet the sampling density requirements recommended by the Department of Environment and Conservation to "fully characterise" a site. Further investigation will be required if the site is to be "fully characterised".

Having said this, the analytical results obtained from the sampling locations indicate consistently low levels of chemical contaminants in all samples, showing no signs of undue chemical contamination impacts, and further assessment (with respect to chemical contamination) may not be warranted.

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**REPORT ON**  
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**SECTOR 3, MACPHERSON STREET**  
**WARRIEWOOD VALLEY**

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**1. INTRODUCTION**

This report presents the results of a Preliminary Contamination Assessment conducted by Douglas Partners Pty Ltd at Sector 3, MacPherson Street, Warriewood Valley. The assessment was conducted on behalf of the Mirvac Homes (NSW) Pty Ltd for proposed Warriewood Valley Sector 3 Rezoning. Development of medium density residential dwellings has been proposed.

A Preliminary Geotechnical Assessment was undertaken concurrently with this contamination assessment, the results of which are presented separately (DP reference 37274).

**2. SCOPE OF WORK**

The scope of works can be summarised as follows:-

1. Conduct a review of site history information (including title deeds, aerial photographs and available council records).

2. Drill 15 bores, 8 to a nominal depth of 3 m, and 7 to a nominal depth of 1.5 m or prior refusal using a bobcat mounted drill rig. The bores were placed so as to gain representative coverage of the site.

3. Soil samples were collected at nominal depths of 0.5 m and 1.5 m in all bores, an additional deep sample was collected at a depth of 3 m, or upon bore completion in deeper test bores. An additional 10% field replicates were collected for QA/QC requirements.

4. Screen all samples collected with a photoionisation detector (PID) to detect the presence of volatile organic compounds.

5. Conduct laboratory analysis on 23 selected soil samples (including 2 field replicates) at a NATA accredited analytical laboratory for a combination of the following potential contaminants:

- Heavy metals (As, Cd, Cr, Cu, Pb, Hg, Ni, Zn) [23 samples];
- Polycyclic Aromatic Hydrocarbons (PAH) [15 samples];
- Total Recoverable Hydrocarbons (TRH) [15 samples];
- Monocyclic Aromatic Hydrocarbons (Benzene, Toluene, Ethylbenzene and Xylene – BTEX) [15 samples];
- Phenol [8 samples];
- Polychlorinated Biphenyls (PCB) [15 samples];
- Organochlorine Pesticides and Organophosphorus Pesticides (OCP/OPP) [15 samples];
- Asbestos [3 samples];

6. Provision of a Preliminary Contamination Assessment Report, providing general comments on the level of contamination in the subsoils and the suitability of the site for the proposed development.

### 3. SITE INFORMATION

#### 3.1 Site Identification

The site is identified as Lot 1, D.P. 592091; Lot 1, D.P. 604035 and Lot 4, DP 553816, and covers an area of approximately 6.07 ha. The site is located at 16 to 22 MacPherson Street, Warriewood in the local government area of Pittwater Council. A site plan and locality map is shown in Drawing 1, Appendix A.

#### 3.2 Site Description

The subject site is approximately trapezoidal in shape, covering an estimated area of 6.07 ha. The area is bounded by MacPherson Street to the south, Brands Lane to the east and Narrabeen Creek to the north. A site plan and locality map is shown in Drawing 1, Appendix A.

At the time of investigation the site was occupied by three commercial nurseries and two private residences. The majority of the site was occupied by greenhouses and plant storage areas, with commercial buildings and roads (both paved and unpaved) occupying most of the remaining land. The ground surface is approximately level, with a gentle (average 1°) slope from the south west to the north east of the property.

The western portion of the site, 22 MacPherson Street, was occupied by Flower Power. The majority of this sub-site was sealed with either concrete slabs or bitumen pavement. A car park area was present adjacent to MacPherson Street, a retail building with an eatery was present in the north western portion of the sub-site and a glass house in the north eastern portion. Display gardens were located along the western boundary, and landscaping supplies were kept between the retail building and glasshouse. The area north of the greenhouse was not paved.

The central portion of the site, 20 MacPherson Street, was occupied by ICN Plant market at the time of the assessment. This sub-site was occupied by several glasshouses, spread across the site, and a residential house in the south eastern corner of the sub-site. The main retail area, in the south eastern portion of this sub-site was paved. The majority of the



sub-site unpaved at the time of the assessment, with the ground surface covered in crushed terracotta/ ceramic.

The eastern portion of the site, 16 MacPherson Street, was occupied by Foleys Nursery and a residential house at the time of assessment. The residential house fronted MacPherson Street, with the retail nursery in the northern portion of the sub-site. Several small buildings/ glasshouses were present on the site. The majority of the sub-site was not paved at the time of the assessment.

A number of buildings on the site were partially constructed of fibre cement, probably containing asbestos.

### 3.3 Adjacent Site Use

The surrounding land usage is as follows:-

- **North** – Narrabeen Creek, then a new development;
- **East** – Brands Lane, then plant nurseries;
- **South** – a new residential development;
- **West** – commercial.

Due to the nature of the activities conducted on adjacent sites, it is considered that the potential for contaminant ingress from nearby sites is low. The proposed residential development is compatible with the surrounding land uses.

### 3.4 Proposed Development

It is understood that the proposed development at the site consists of medium density residential dwellings and associated light traffic roads. No detailed plans were available at the time of the investigation, and for assessment purposes a conservative approach was adopted and it is assumed that the development will have gardens and accessible soils such that the most stringent assessment guidelines were adopted.

#### 4. SITE HISTORY

Site historical information was obtained via a review of a historical title deed search and aerial photographs.

The historical title deed search was conducted on for the past 100 years by Peter S. Hopley Pty Limited (Legal Searches). The title deed search results have been included in Appendix B and are summarised in Table 1.

**Table 1 – Results of Title Deeds Search**

| Date                                                               | Registered Proprietor                                                                | Possible Land Use                             |
|--------------------------------------------------------------------|--------------------------------------------------------------------------------------|-----------------------------------------------|
| <b>As regards Lot 4 D.P. 553816</b>                                |                                                                                      |                                               |
| 19.03.1910                                                         | Warriewood Limited                                                                   | unknown, probably agricultural or undeveloped |
| 13.07.1926                                                         | Thomas William Brand (Dairy Farmer)                                                  | unknown, probably agricultural                |
| 17.04.1934 ?                                                       | Frederick Walter Brand (Dairy Farmer)                                                | unknown, probably agricultural                |
| 27.03.1934                                                         | Thomas Percival Brand (Gardener)                                                     | unknown, probably agricultural                |
| 06.11.1952                                                         | Petros Christos Dellios (Market Gardener)                                            | unknown, probably agricultural                |
| 22.01.1959                                                         | Green Fingers Pty Limited                                                            | unknown, probably agricultural                |
| 13.12.1972                                                         | Gerrit Jacob Ossedryver (Company Manager);<br>Elsie Beryl Ossedryver (Married Woman) | unknown, probably agricultural                |
| 13.09.1988                                                         | Winspear Holdings Pty Limited                                                        | unknown, probably agricultural                |
| 20.08.1992                                                         | # Lyndon Stuart Foley;<br># Angela Louise Foley                                      | Retail nursery                                |
| <b>As regards Lot 1 D.P. 604035</b>                                |                                                                                      |                                               |
| <b>As regards the part numbered 1 on the cadastre (Appendix B)</b> |                                                                                      |                                               |
| 19.03.1910                                                         | Warriewood Limited                                                                   | unknown, probably agricultural or undeveloped |
| 13.07.1926                                                         | Thomas William Brand (Dairy Farmer)                                                  | unknown, probably agricultural                |
| 17.04.1934 ?                                                       | Frederick Walter Brand (Dairy Farmer)                                                | unknown, probably agricultural                |
| 27.03.1934                                                         | Thomas Percival Brand (Gardener)                                                     | unknown, probably agricultural                |
| 06.11.1952                                                         | Petros Christos Dellios (Market Gardener)                                            | unknown, probably agricultural                |
| 22.01.1959                                                         | Green Fingers Pty Limited                                                            | unknown, probably agricultural or retail      |



| Date | Registered Proprietor | Possible Land Use |
|------|-----------------------|-------------------|
|------|-----------------------|-------------------|

*For search continued as to this part, see below*

*As regards the part numbered 2 on the cadastre (Appendix B)*

|            |                                                                                        |                                          |
|------------|----------------------------------------------------------------------------------------|------------------------------------------|
| 08.02.1910 | Joseph Frederick Hall (Engine Driver)                                                  | unknown, probably agricultural           |
| 18.12.1922 | Charles Rogers (Farmer)                                                                | unknown, probably agricultural           |
| 09.02.1926 | Margaret Burt (Married Woman)                                                          | unknown, probably agricultural           |
| 29.01.1936 | Simun Sanko (Farmer, as to a 1/2 share);<br>Bartul Nemcich (Farmer, as to a 1/2 share) | unknown, probably agricultural           |
| 07.02.1939 | Bartul Nemcich (Farmer)                                                                | unknown, probably agricultural           |
| 21.05.1957 | Ivan Nemcich (Farmer, as to a 1/2 share);<br>Vinko Nemcich (Farmer, as to a 1/2 share) | unknown, probably agricultural           |
| 28.04.1978 | Green Fingers (No. 2) Pty Limited                                                      | unknown, probably agricultural or retail |

*Search continued as to the whole of Lot 1 D.P. 604035*

|            |                                                                                      |                                          |
|------------|--------------------------------------------------------------------------------------|------------------------------------------|
| 07.05.1979 | Green Fingers Properties Pty Limited (Now<br>Premier Foliage Properties Pty Limited) | unknown, probably agricultural or retail |
| 09.04.1991 | Winspear Holdings Pty Limited                                                        | unknown, probably agricultural or retail |
| 02.07.1992 | # Andrew Georgiou;<br># Pamela Georgiou                                              | retail nursery                           |

**As regards Lot 1 D.P. 592091**

|                           |                                               |                                               |
|---------------------------|-----------------------------------------------|-----------------------------------------------|
| 19.03.1910                | Warriewood Limited                            | unknown, probably agricultural or undeveloped |
| 16.01.1920                | Agnes Bowen (Married Woman)                   | unknown, probably agricultural                |
| 12.07.1924                | Charles Craig Sellar (Retired Grazier)        | unknown, probably agricultural                |
| 23.12.1948                | Peter Franolich (Market Gardener)             | unknown, probably agricultural                |
| 04.06.1963 (eastern part) | Leslie Alma Braidwood Meredith (Nurseryman    | unknown, probably agricultural                |
| 25.02.1964 (western part) | or Draughtsman)                               |                                               |
| 07.12.1976                | Nock & Kirby Limited                          | unknown, probably agricultural or retail      |
| 07.05.1980                | Permanent Trustee Nominees (Canberra) Limited | unknown, probably agricultural or retail      |
| 15.02.1984                | Syesun Pty Limited                            | unknown, probably agricultural or retail      |
| 24.11.1988                | Winspear Holdings Pty Limited                 | unknown, probably retail nursery              |
| 28.02.1991                | Jenbend Pty Limited                           | unknown, probably retail nursery              |
| 03.11.2003                | # Syesun Pty Limited                          | retail nursery                                |

# Denotes Current Registered Proprietors



A review was undertaken of aerial photographs from 1947, 1951, 1961, 1970, 1986 and 1994, as shown in Appendix C. The 1930 photograph of the site was not available from the Department of Infrastructure, Planning and Natural Resources (DIPNR), and could not therefore be reviewed.

In the 1947 aerial photograph the site appears to be under agricultural/ market garden use. A small number of glasshouses are visible over the site. The surrounding area appears to be under agricultural use or uncultivated.

In the 1951 aerial photograph the site appears to be under agricultural/ market garden use. Additional glasshouse style buildings have been constructed since 1947, along with some larger warehouse style buildings. Two smaller buildings are also located at 20 MacPherson Street, and are consistent with residential type buildings. The surrounding area appears to be predominantly agricultural in use, with large numbers of glasshouse style buildings observable in the photograph.

In the 1961 aerial photograph the site appears to be under agricultural/ market garden use. Additional glasshouse style buildings have been constructed across the property since 1951. Two warehouse style buildings have been constructed on 22 MacPherson Street since the 1951 photograph. The surrounding area appears to be predominantly agricultural, with large numbers of glasshouse style buildings observable in the photograph.

In the 1970 aerial photograph the site appears to be under agricultural/ market garden use. Additional glasshouse style buildings have been added to 18 – 20 MacPherson Street since 1961.

In the 1986 aerial photograph the majority of the site is covered in buildings and glasshouses. The site structures are consistent with that of a commercial nursery and/ or retail of plants. The surrounding area is rural/ residential in nature.

The 1994 aerial photograph indicates only minor changes have occurred at the site. The site structures are consistent with that of a commercial nursery and/ or retail of plants. The surrounding area is residential and rural/ residential in nature.

Reference to the title deeds and aerial photographs indicates that the site has been used for agriculture and market gardening (with greenhouses) since at least 1947. Prior to this, the

site was probably under agricultural and/ or rural residential use. During the 1970's and 1980's the site appears to have been gradually developed into retail nurseries.

## 5. GEOLOGY AND HYDROGEOLOGY

### 5.1 Geology

Reference to the Sydney 1:100 000 Geological Series Map indicates the site is underlain by Quaternary deposits, consisting of silty to peaty quartz sand, silt and clay with ferruginous and humic cementation in places and common shell layers. The geological map indicates that the Quaternary deposits are underlain by the Newport Formation, part of the Narrabeen Group. This Formation consists of interbedded laminites, shale and quartz to lithic quartz sandstone. This is consistent with on-site observations.

Review of the Hornsby/ Mona vale *Acid Sulphate Soils Risk Map* (Edition 2, DLWC, 1997) indicated that the south western portion of the site, fronting MacPherson Street, had a low probability of Acid Sulphate Soil (ASS) occurring below a depth of 3 m. There was no known occurrence of ASS in the north eastern portion of the site.

Having said this on onsite observation and the results of pH screening suggest that ASS may potentially be present below the groundwater table.

### 5.2 Hydrogeology

A groundwater bore search was undertaken by the Department of Infrastructure, Planning and Natural Resources (DPNIR), and is included in Appendix D. Twenty five bores were registered in a 2.5 km radius of the subject site. Seven of the bores where registered for domestic usage, six for waste disposal, three for irrigation, 1 for groundwater exploration, six for domestic and stock, and two for domestic, stock and irrigation. It is noted that the six bores registered for waste disposal are all on the opposite side of Narrabeen Creek to the site and were drilled in the 1960's. It is therefore considered that groundwater at the site is unlikely to be impacted by these bores.



Groundwater was encountered in 10 of the 15 test bores drilled for the current assessment, and also in three of the five CPT bores for the geotechnical investigation (refer to report on the Preliminary Geotechnical Assessment, DP reference 37274). Groundwater was encountered at depths between 0.3 m and 2 m below ground level (bgl) in the above bores, but was not observed in the other bores to a depth of 3 m bgl.

Narrabeen Creek runs adjacent to the northern site boundary, and is the inferred receiving body for surface runoff and groundwater at the site.

## 6. POTENTIAL FOR CONTAMINATION

In general, contamination of soil and groundwater may occur due to past and present on-site activities, placement of contaminated fill over the site and migration of contaminants from adjacent areas. Identified potential sources of contamination at the site consist of previous agriculture/ market gardens at the site and the presence of filling material. On this basis samples were analysed for the following potential contaminants:-

- Heavy metals (As, Cd, Cr, Cu, Pb, Hg, Ni, Zn);
- Total Recoverable Hydrocarbons (TRH);
- Monocyclic Aromatic Hydrocarbons (Benzene, Toluene, Ethylbenzene and Xylene – BTEX);
- Polycyclic Aromatic Hydrocarbons (PAH);
- Total Phenols;
- Polychlorinated biphenyls (PCB);
- Organochlorine Pesticides and Organophosphorus Pesticides (OCP/OPP); and
- Asbestos.

## 7. FIELD WORK

### 7.1 Data Quality Objectives

The scope of the preliminary contamination assessment works has been devised broadly in accordance with the 7 step data quality objective process, as defined in Australian Standard "Guide to the Sampling and Investigation of Potentially Contaminated Soil Part 1: Non-volatile and semi-volatile compounds (AS 4482.1 – 1997). The DQO process is outlined as follows:

#### (a) State the Problem

It is proposed to rezone the site for residential development. The 'problem' to be addressed is to provide preliminary information on the presence and type (if any) of contamination that exists at that subject site, and to evaluate the likely health and environmental impacts associated with these contaminants.

#### (b) Identify the Decision

The analytical results will be compared to the guidelines for residential sites with accessible soils as specified in Section 8.

#### (c) Identify Inputs to the Decision

Historical sources, observation and anecdotal evidence will be used to determine the chemicals of environmental concern. The sampling plan will be systematically positioned over the subject site.

#### (d) Define the Boundary of the Assessment

The boundary of the assessment is defined by the boundary of the subject site, as summarised in Section 3.1 and shown on the site plan in Appendix A.



(e) Develop a Decision Rule

The assessment criteria are the NSW EPA Guidelines for residential sites with accessible soils as specified in Section 8.

(f) Specify Acceptable Limits on Decision Errors

In order to ensure that the results obtained are accurate and reproducible, appropriate and adequate quality assurance and quality control (QA/QC) measures and evaluations will be incorporated into the sampling and testing regime. These are summarised in Section 7.2.

(g) Optimise the Design for Obtaining Data

Procedures for the collection of environmental samples, as described in Section 7.3, were developed prior to undertaking the contamination assessment phase of works, which were in line with NSW EPA guidelines and current industry practice. DP employs NATA-registered analytical laboratories to conduct sample analysis.

It is therefore considered that the data quality of assessment was of a satisfactory standard.

## 7.2 Quality Assurance/Quality Control Objectives

Table 2 summarises Quality Assurance/Quality Control (QA/QC) objectives and the procedures designed to enable their achievement.

**Table 2 – Quality Assurance/Quality Control Objectives**

| QA/QC Objective                                  | Achievement Evaluation Procedure                                                                                            |
|--------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|
| Documentation completeness                       | Completion of chain of custody documentation, completion of test bore report sheets (Appendices E and F).                   |
| Data comparability                               | Use of NATA certified laboratory, use of consistent sampling technique (Section 7.3 and Appendix F).                        |
| Data representivity                              | Sampling on a systematic basis across the site (Section 7.4, Appendix A).                                                   |
| Precision and accuracy for sampling and analysis | Achievement of acceptable relative percentage difference (RPD) for replicate analysis, laboratory QC criteria (Appendix G). |

## 7.3 Sampling Procedures

Fifteen test bores were drilled to a maximum depth of 3 m using a Bobcat mounted drill rig with solid flight auger equipment. Soil samples were collected at nominal depths of 0.5 m, 1.5 m and 3.0 m. The approximate test bore locations are given in Drawing 1, Appendix A.

Samples were collected using stainless steel hand tools and disposable sampling equipment. Environmental sampling was undertaken by an experienced and qualified environmental scientist, performed according to standard operating procedures outlined in the DP *Field Procedures Manual*. All sampling data was recorded on DP chain of custody sheets, and the general sampling procedure comprised:-

- decontaminating all re-usable sampling equipment using a 3% solution of phosphate free detergent (Decon 90) and distilled water prior to collecting each sample;
- transferring samples into laboratory-prepared glass jars (soil) or glass and plastic containers (water), and capping immediately;
- labeling sample containers with individual and unique identification, including project number and sample number;
- collecting an additional replicate set of soil samples in sealed plastic bags for visual identification and records purposes;
- collecting 10% replicate samples;
- placing the samples into a cooled, insulated and sealed container for transport to the laboratory; and
- transporting the replicate bag samples to the DP laboratory under ambient conditions for storage.

## 7.4 Sampling and Analytical Rationale

Samples were collected from 15 test bore locations over the 6.07 ha site, giving an approximate sampling density of 2.5 points per hectare. It is considered that this number of sampling locations is suitable to provide preliminary assessment of the potential for contamination at the site. If a contamination assessment is required to fully characterise the site, a minimum of 62 additional sampling locations will be required to meet the NSW EPA Sampling Design Guidelines.



No specific potential sources of contamination were identified at the site, and test bore locations were therefore placed in an approximate grid pattern (subject to site access restrictions), to provide representative site coverage.

The analytical scheme was designed around the inferred potential for contamination. Analysis focused on the upper 0.5 m of soil/filling material, where pesticide residue (including heavy metals) is most likely to be present; and where filling material, which is of uncertain origin, has been placed. A summary of the analytical scheme is presented in Table 3. Analysis was conducted by SGS Environmental Services, a NATA accredited laboratory.

**Table 3 - Analytical Scheme**

| Sample ID | Heavy Metals | TRH/ BTEX | PAH | PCB/ OCP/ OPP | Phenol | Asbestos |
|-----------|--------------|-----------|-----|---------------|--------|----------|
| 1/0.5     | ✓            | ✓         | ✓   | ✓             | ✓      | -        |
| 2/0.2     | ✓            | ✓         | ✓   | ✓             | -      | -        |
| 2/1.0     | ✓            | -         | -   | -             | -      | -        |
| 3/0.5     | ✓            | ✓         | ✓   | ✓             | -      | -        |
| 3/3.0     | ✓            | -         | -   | -             | -      | -        |
| 4/0.5     | ✓            | ✓         | ✓   | ✓             | ✓      | ✓        |
| 5/0.3     | ✓            | -         | -   | -             | -      | -        |
| 5/1.5     | ✓            | ✓         | ✓   | ✓             | ✓      | -        |
| 6/0.5     | ✓            | ✓         | ✓   | ✓             | ✓      | -        |
| 7/0.5     | ✓            | ✓         | ✓   | ✓             | ✓      | -        |
| 8/0.3     | ✓            | ✓         | ✓   | ✓             | -      | -        |
| 9/0.1-0.5 | ✓            | -         | -   | -             | -      | -        |
| 9/1.5     | ✓            | ✓         | ✓   | ✓             | -      | -        |
| 10/0.2    | ✓            | ✓         | ✓   | ✓             | -      | ✓        |
| 10/1.5    | ✓            | -         | -   | -             | -      | -        |
| 11/0.5    | ✓            | ✓         | ✓   | ✓             | ✓      | -        |
| 12/0.5    | ✓            | ✓         | ✓   | ✓             | -      | ✓        |
| 13/0.4    | ✓            | ✓         | ✓   | ✓             | ✓      | -        |
| 14/0.1    | ✓            | ✓         | ✓   | ✓             | -      | -        |
| 15/0-0.5  | ✓            | ✓         | ✓   | ✓             | ✓      | -        |
| 15/3.0    | ✓            | -         | -   | -             | -      | -        |
| Z3        | ✓            | -         | -   | -             | -      | -        |
| Z8        | ✓            | -         | -   | -             | -      | -        |

QA/QC Samples:

- Z3 field replicate of 1/0.5
- Z8 field replicate of 12/0.5

## 7.5 Acid Sulphate Soil Screening

Twenty samples from eight bores were screened for potential for Acid Sulphate Soil (ASS), screening results are included in Table 4. It is noted that pH screening provides indicative results only, and may give 'false' positives or negatives due to interfering inclusions in the soil (eg, shells and organic matter). If bulk excavation or dewatering is to be conducted at



the site quantitative analysis should be conducted to confirm the presence or absence of ASS.

The following methodology was adopted for pH pre-screening:-

#### Field pH measurement

- Place approximately 5 g material in small glass container;
- add 25 mL demineralised water, mix; and
- measure pH using a calibrated pH meter with a TPS WP80D Dual pH-mV and Temperature probe.

#### Peroxide pH measurement

- Place approximately 5 g material in small glass container;
- add 2 mL of pH 4.5 – 5.5 30% peroxide;
- observe sample for effervescence, colour change or odour;
- allow sample to react for 30 minutes/ 2 hours, periodically adding peroxide until visible signs of reaction abate;
- add 18 mL water, mix; and
- measure pH using a pH meter with a TPS WP80D Dual pH-mV and Temperature probe.

Sampling and testing equipment was decontaminated with Decon 90 and rinsed with distilled water between samples.

### 8. SITE ASSESSMENT CRITERIA

The analytical findings provide the basis of the Contamination Assessment in accordance with the NSW EPA 'Contaminated Sites: Guidelines for the NSW Site Auditors Scheme'; 1998.

It is understood that a residential development is proposed for the site, although the detailed development plan was not available at the time of reporting. Given the proposed development involves medium density housing, the guidelines adopted for the purpose of Site Contamination Assessment are:-

- Health-based [soil] investigation levels (Column 1) for residential with gardens and accessible soils, as specified in NSW EPA *Guidelines for the NSW Site Auditors Scheme*. [HIL]
- Provisional phytotoxicity-based investigation levels (Column 5), as specified in NSW EPA *Guidelines for the NSW Site Auditors Scheme*. [PPIL]
- With respect to TRH and BTEX, threshold concentrations [in soil] for sensitive land use, from NSW EPA's *Guidelines for Assessing Service Station Sites*, 1994 (as no comprehensive TRH or BTEX health-based criteria are endorsed by the Department of Environment and Conservation).

## 9. RESULTS

### 9.1 Field Work Observations

Details of the subsurface conditions encountered are presented in the test bore report sheets included in Appendix E, together with notes defining classification methods and descriptive terms. The locations of the test bores are shown on Drawing 1, Appendix A.

Filling was identified in all test bores. Typically the extent of the filling layer was limited, generally less than 1 m, although the thickness of the filling layer was extended in bores 1 and 9 (>1.5 m). Bore 9 was located within a glass house, and the thickness of filling probably reflects the cultivation activities. Filling at the site included grey, brown and orange sand, clayey sand, sandy clay, silty clay and sandy clayey silt. Traces of crushed sandstone, charcoal, gravel and brick and terracotta fragments were observed in the near surface horizon (top 0.5 m) in some bores.



It is noted that Bore 15 was located on a stockpile of filling approximately 0.8 m high. The thickness of the filling layer (from the top of the stockpile) is 1.2 m, indicating a thickness of filling of 0.4 m from the level of the ground surface.

Natural materials at the site consisted of inter-bedded alluvial/ estuarine deposits including grey, orange and brown clayey sands, silty sands, silty clays and sand clays. A sulphur odour was noted in filling and silty sandy clay in Bore 12 between 0.2 m and 2.2 m below ground level.

Fibre cement fragments were noted on the ground surface of 20 MacPherson Street (the ICN property), adjacent to buildings containing fibre cement.

No visible signs of chemical contamination (e.g. stains, odours), or contamination sources (e.g. underground storage tanks) were observed during site investigations, with the exception of the above mentioned asbestos cement (AC) debris on the ground surface near buildings constructed of AC.

## 9.2 Field Results

### TOPIC Results

Screening for Total Photo-Ionisable Compounds (TOPIC) using a Photo-Ionisation Detector (PID) is used to give a general indication of likely presence of volatile compounds prior to dispatch to the laboratory. The replicate soil samples collected in zip-lock plastic bags were allowed to equilibrate under ambient temperatures before TOPIC screening. The TOPIC results from all soil samples ranged from 0 ppm to 6 ppm, as shown on the Test Bore Reports, presented in Appendix E. All PID were within the generally accepted background range of 0 to 10 ppm, and the results are therefore not considered to indicate the presence of volatile contaminants.

## 9.3 Acid Sulphate Soil Screening Results

The results of Acid Sulphate Soil (ASS) Screening results are tabulated in Table 4.

**Table 4 - Results of Acid Sulphate Soil Screening**

| Sample ID                 | Description                                          | Field pH<br>(in H <sub>2</sub> O) | Oxidised pH<br>(in H <sub>2</sub> O <sub>2</sub> )<br>after 3 hours | Change in pH<br>(field pH –<br>oxidised pH) | Reaction <sup>a</sup><br>Strength |
|---------------------------|------------------------------------------------------|-----------------------------------|---------------------------------------------------------------------|---------------------------------------------|-----------------------------------|
| 2/0.5                     | light grey sand filling                              | 7.7                               | 3.06                                                                | 4.64                                        | 2F                                |
| 2/1.5                     | dark brown sand                                      | 6.83                              | 4.76                                                                | 2.07                                        | 1-2                               |
| 2/3.0                     | orange clayey sand                                   | 5.64                              | 4.25                                                                | 1.39                                        | 1-2                               |
| 3/1.5                     | grey brown silty clay                                | 6.18                              | 4.67                                                                | 1.51                                        | 1-2                               |
| 3/2.6                     | dark grey silty clayey sand, trace<br>organic matter | 6.08                              | 4.37                                                                | 1.71                                        | 1-2                               |
| 4/0.7                     | light grey sand                                      | 6.32                              | 4.38                                                                | 1.94                                        | 1-2                               |
| 4/1.5                     | dark brown clayey silty sand                         | 6.34                              | 5.07                                                                | 1.27                                        | 1-2                               |
| 4/3.0                     | grey sandy clay/ clayey sand                         | 6.23                              | 4.2                                                                 | 2.03                                        | 2                                 |
| 7/1.5                     | grey and light brown clayey sand                     | 6.88                              | 4.86                                                                | 2.02                                        | 1-2                               |
| 7/3.0                     | light grey silty sand                                | 6.49                              | 3.9                                                                 | 2.59                                        | 2F                                |
| 8/0.5                     | grey and orange sandy clay                           | 6.38                              | 4.61                                                                | 1.77                                        | 1-2                               |
| 8/1.5                     | grey silty sandy clay, faint sulphur<br>odour        | 6.09                              | 4.55                                                                | 1.54                                        | 1-2                               |
| 12/1.5                    |                                                      | 6.07                              | 3.87                                                                | 2.2                                         | 1-2                               |
| 12/2.0                    | dark grey silty clay, faint sulphur<br>odour         | 6.6                               | 3.95                                                                | 2.65                                        | 2                                 |
| 12/3.0                    | yellow brown silty clay                              | 5.54                              | 4.6                                                                 | 0.94                                        | 1-2                               |
| 13/1.0                    | grey silty sandy clay, trace organic<br>matter       | 5.82                              | 3.59                                                                | 2.23                                        | 2                                 |
| 13/1.5                    | grey orange and brown silty clay                     | 6.04                              | 3.55                                                                | 2.49                                        | 2                                 |
| 13/3.0                    | with trace organic matter                            | 6.02                              | 3.49                                                                | 2.53                                        | 2                                 |
| 14/1.5                    | orange and brown silty clay                          | 5.74                              | 4.62                                                                | 1.12                                        | 1-2                               |
| 14/3.0                    | grey silty sandy clay                                | 5.84                              | 4.11                                                                | 1.73                                        | 1-2                               |
| <b>Indicators of ASS#</b> |                                                      |                                   |                                                                     |                                             |                                   |
| -                         | -                                                    | <4*                               | <3.5**                                                              | >1                                          | -                                 |

<sup>a</sup> strength of reaction  
1 denotes no or slight reaction  
2 denotes moderate reaction  
3 denotes vigorous reaction  
4 denotes 'volcanic' reaction  
F denotes bubbling/ frothy reaction indicative of organics  
H denotes heat generated  
# As given in ASSMAC (1998). Note these are indicators only, and do not confirm the presence or absence of ASS  
\* indicator for Actual Acid Sulphate Soil  
\*\* preferably <3

In summary, the ASS screening results show that:

- the field (un-oxidised) pH was greater than pH 4 in all samples;
- oxidised pH value was lower than pH 3.5 in two of the 20 samples screened;
- low to moderate effervescence was observed in most samples during oxidation;
- the change in pH (field pH – oxidised pH) was greater than 1 pH unit in 19 of the 20 samples screened.



## 9.4 Laboratory Analysis

The results of laboratory analysis are summarised in Tables 5 and 6. Complete NATA laboratory reports are included in Appendix F.

**Table 5 – Results of Laboratory Analysis for Soil**  
 (All results in mg/kg)

| Sample ID | Heavy Metals |      |    |      |    |       |     | TRH  |                                | Benzene | Toluene | Ethyl-Benzene | Xylene | PAH                              |       | Total PCB | Total OPP | OCP   |                   |           |      | Phenols |            |
|-----------|--------------|------|----|------|----|-------|-----|------|--------------------------------|---------|---------|---------------|--------|----------------------------------|-------|-----------|-----------|-------|-------------------|-----------|------|---------|------------|
|           | As           | Cd   | Cr | Cu   | Pb | Hg    | Ni  | Zn   | C <sub>6</sub> -C <sub>9</sub> |         |         |               |        | C <sub>10</sub> -C <sub>36</sub> | Total |           |           | B(a)P | aldrin + dieldrin | chlordane | DDT  |         | Heptachlor |
| 1/0.5     | <3           | <0.5 | 5  | 12   | 11 | <0.05 | 6   | 32   | <20                            | 171     | <0.50   | <0.50         | <0.50  | <1.5                             | 19    | 2.4       | <0.90     | <PQL  | <0.4              | <0.4      | <1.2 | <0.4    | <0.50      |
| 2/0.2     | <3           | <0.5 | 1  | 11   | 26 | <0.05 | 0.8 | 46   | <20                            | <120    | <0.50   | <0.50         | <0.50  | <1.5                             | 0.58  | 0.08      | <0.90     | <PQL  | <0.2              | <0.2      | <0.6 | <0.2    | -          |
| 2/1.0     | <3           | <0.5 | 6  | 0.5  | 5  | <0.05 | 2   | 0.7  | -                              | -       | -       | -             | -      | -                                | -     | -         | -         | -     | -                 | -         | -    | -       | -          |
| 3/0.5     | 12           | 0.9  | 4  | 2    | 10 | <0.05 | 1   | 7    | <20                            | <120    | <0.50   | <0.50         | <0.50  | <1.5                             | 0     | <0.05     | <0.90     | <PQL  | <0.2              | <0.2      | <0.6 | <0.2    | -          |
| 3/3.0     | <3           | <0.5 | 4  | <0.5 | 4  | <0.05 | 0.6 | <0.5 | -                              | -       | -       | -             | -      | -                                | -     | -         | -         | -     | -                 | -         | -    | -       | -          |
| 4/0.5     | <3           | <0.5 | 4  | 21   | 28 | 0.06  | 3   | 47   | <20                            | <120    | <0.50   | <0.50         | <0.50  | <1.5                             | 0     | <0.05     | <0.90     | <PQL  | <0.2              | <0.2      | <0.6 | <0.2    | <0.50      |
| 5/0.3     | 4            | <0.5 | 7  | 31   | 17 | <0.05 | 1   | 5    | -                              | -       | -       | -             | -      | -                                | -     | -         | -         | -     | -                 | -         | -    | -       | -          |
| 5/1.5     | <3           | <0.5 | 1  | <0.5 | <2 | <0.05 | 0.3 | <0.5 | <20                            | <120    | <0.50   | <0.50         | <0.50  | <1.5                             | 0     | <0.05     | <0.90     | <PQL  | <0.2              | <0.2      | <0.6 | <0.2    | <0.50      |
| 6/0.5     | <3           | <0.5 | 1  | 4    | 9  | <0.05 | 0.7 | 93   | <20                            | <120    | <0.50   | <0.50         | <0.50  | <1.5                             | 0     | <0.05     | <0.90     | <PQL  | <0.2              | <0.2      | <0.6 | <0.2    | <0.50      |
| 7/0.5     | 6            | <0.5 | 6  | 36   | 31 | <0.05 | 2   | 48   | <20                            | <120    | <0.50   | <0.50         | <0.50  | <1.5                             | 0     | <0.05     | <0.90     | <PQL  | <0.2              | <0.2      | 2.2  | <0.2    | <0.50      |
| 8/0.3     | <3           | <0.5 | 2  | 0.7  | 4  | <0.05 | 0.4 | 1    | <20                            | <120    | <0.50   | <0.50         | <0.50  | <1.5                             | 0     | <0.05     | <0.90     | <PQL  | <0.2              | <0.2      | <0.6 | <0.2    | -          |
| 9/0.1-0.5 | <3           | <0.5 | 6  | 7    | 12 | <0.05 | 3   | 86   | -                              | -       | -       | -             | -      | -                                | -     | -         | -         | -     | -                 | -         | -    | -       | -          |
| 9/1.5     | 9            | 0.5  | 6  | 21   | 37 | <0.05 | 3   | 240  | <20                            | <120    | <0.50   | <0.50         | <0.50  | <1.5                             | 0.48  | 0.08      | <0.90     | <PQL  | <0.2              | <0.2      | <0.6 | <0.2    | -          |
| 10/0.2    | 8            | <0.5 | 9  | 23   | 34 | 0.08  | 6   | 170  | <20                            | <120    | <0.50   | <0.50         | <0.50  | <1.5                             | 0     | <0.05     | <0.90     | <PQL  | <0.2              | <0.2      | <0.6 | <0.2    | -          |
| 10/1.5    | <3           | <0.5 | 2  | <0.5 | 2  | <0.05 | 1   | 3    | -                              | -       | -       | -             | -      | -                                | -     | -         | -         | -     | -                 | -         | -    | -       | -          |
| 11/0.5    | 3            | <0.5 | 1  | <0.5 | 2  | <0.05 | 0.6 | 0.7  | <20                            | <120    | <0.50   | <0.50         | <0.50  | <1.5                             | 0     | <0.05     | <0.90     | <PQL  | <0.2              | <0.2      | <0.6 | <0.2    | <0.50      |
| 12/0.5    | <3           | <0.5 | 3  | <0.5 | 4  | <0.05 | 0.5 | 2    | <20                            | <120    | <0.50   | <0.50         | <0.50  | <1.5                             | 0     | <0.05     | <0.90     | <PQL  | <0.2              | <0.2      | <0.6 | <0.2    |            |
| 13/0.4    | 4            | <0.5 | 6  | 4    | 39 | <0.05 | 0.5 | 26   | <20                            | <120    | <0.50   | <0.50         | <0.50  | <1.5                             | 3.7   | 0.3       | <0.90     | <PQL  | <0.2              | <0.2      | <0.6 | <0.2    | <0.50      |



| Sample ID                | Heavy Metals |      |     |      |     |       |     | TRH  |                                    | Benzene           | Toluene        | Ethyl-Benzene    | Xylene           | PAH                                  |       | Total PCB        | Total OPP | OCP   |                      |           |      | Phenols |            |
|--------------------------|--------------|------|-----|------|-----|-------|-----|------|------------------------------------|-------------------|----------------|------------------|------------------|--------------------------------------|-------|------------------|-----------|-------|----------------------|-----------|------|---------|------------|
|                          | As           | Cd   | Cr  | Cu   | Pb  | Hg    | Ni  | Zn   | C <sub>6</sub> -<br>C <sub>9</sub> |                   |                |                  |                  | C <sub>10</sub> -<br>C <sub>36</sub> | Total |                  |           | B(a)P | aldrin +<br>dieldrin | chlordane | DDT  |         | Heptachlor |
| 14/0.1                   | <3           | <0.5 | 3   | 2    | 5   | <0.05 | 0.9 | 7    | <20                                | <120              | <0.50          | <0.50            | <0.50            | <1.5                                 | 0     | <0.05            | <0.90     | <PQL  | <0.2                 | <0.2      | <0.6 | <0.2    | -          |
| 15/0-0.5                 | 12           | <0.5 | 8   | 14   | 26  | <0.05 | 3   | 45   | <20                                | <120              | <0.50          | <0.50            | <0.50            | <1.5                                 | 0     | <0.05            | <0.90     | <PQL  | <0.2                 | <0.2      | <0.6 | <0.2    | <0.50      |
| 15/3.0                   | 3            | <0.5 | 12  | 8    | 16  | <0.05 | 4   | 0.8  | -                                  | -                 | -              | -                | -                | -                                    | -     | -                | -         | -     | -                    | -         | -    | -       | -          |
| Z3                       | <3           | <0.5 | 7   | 14   | 12  | <0.05 | 7   | 37   | -                                  | -                 | -              | -                | -                | -                                    | -     | -                | -         | -     | -                    | -         | -    | -       | -          |
| Z8                       | <3           | <0.5 | 3   | <0.5 | 4   | <0.05 | 0.5 | 2    | -                                  | -                 | -              | -                | -                | -                                    | -     | -                | -         | -     | -                    | -         | -    | -       | -          |
| 95% UCL                  | -            | -    | -   | -    | -   | -     | -   | -    | -                                  | -                 | -              | -                | -                | -                                    | -     | 0.3 <sup>a</sup> | -         | -     | -                    | -         | -    | -       | -          |
| Site Assessment Criteria |              |      |     |      |     |       |     |      |                                    |                   |                |                  |                  |                                      |       |                  |           |       |                      |           |      |         |            |
| HIL <sup>1</sup>         | 100          | 20   | 12% | 1000 | 300 | 15    | 600 | 7000 | 65 <sup>3</sup>                    | 1000 <sup>3</sup> | 1 <sup>3</sup> | 1.4 <sup>3</sup> | 3.1 <sup>3</sup> | 14 <sup>3</sup>                      | 20    | 1                | 10        | ND    | 10                   | 50        | 200  | 10      | 8500       |
| PPIL <sup>2</sup>        | 20           | 3    | 400 | 100  | 600 | 1     | 60  | 200  | ND                                 | ND                | ND             | ND               | ND               | ND                                   | ND    | ND               | ND        | ND    | ND                   | ND        | ND   | ND      | 70         |

**Notes:**

1. NSW EPA Contaminated Sites: Guidelines for the NSW Site Auditors Scheme, 1998. Health-based guidelines for residential with gardens and accessible soils (Column 1);
  2. NSW EPA Contaminated Sites: Guidelines for the NSW Site Auditors Scheme, 1998. Provisional phytotoxicity-based investigation levels for sandy loams (Column 5)
  3. Threshold concentrations for sensitive sites, NSW EPA Guidelines for Assessing Service Station Sites, 1994. (for TRH and BTEX, for all landuses).
- not analysed/ not applicable
- ND Not defined
- 95% UCL 95% Upper Confidence Limit
- <sup>a</sup> lognormal 95% UCL used
- Z3 field replicate of sample 1/0.5;
- Z8 field replicate of sample 12/0.5;

Table 6 – Results of Laboratory Analysis for Asbestos

| Sample ID                 | Asbestos                     |
|---------------------------|------------------------------|
| 4/0.5                     | Chrysotile asbestos detected |
| 10/0.2                    | No asbestos detected         |
| 12/0.5                    | No asbestos detected         |
| Site Assessment Criteria  |                              |
| All landuses <sup>1</sup> | None at ground surface       |

1. No asbestos present in soil at the surface (Correspondence from NSW EPA Director of Contaminated Sites to Accredited Site Auditors)

### 9.5 QA/QC Results

Quality assurance/quality control procedures comprised an integral part of this Preliminary Contamination Assessment, and included both field and laboratory QA/QC procedures. Details of the QA/QC procedures and results are provided in Appendix G.

## 10. DISCUSSION AND CONCLUSIONS

### Heavy Metals

All heavy metal concentrations were very low and were below the Health-based investigation levels for residential sites with accessible soils in all samples analysed.

One sample, Sample 9/1.5 marginally exceeded the Provisional phytotoxicity-based investigation levels (PIL) for zinc, with a detected concentration of 240 mg/kg compared to the guideline of 200 mg/kg. This guideline provides an indication of the potential effect of contaminants on vegetation. It is noted that the detected concentration is within the published background ranges of 10 – 300 mg/kg<sup>1</sup> for Australian soils. It is further noted that as the sample was collected at a depth of 1.5 m, it is likely to be below the root zone of most plants used in landscaping.

<sup>1</sup> National Environmental Protection Council [NEPC] (1999). National Environmental Protection (Assessment of Site Contamination) Measure Schedule B(1) Guidelines on the Investigation Levels for Soil and Groundwater, Background Ranges



It is considered that heavy metals, including the marginal detected zinc exceedance, do not adversely impact the site. In overall terms, on the basis of the analytical results, no signs of unacceptable heavy metal contamination were noted.

#### **TRH and BTEX**

All detected concentrations were below laboratory practical quantitation limits, and the site assessment criteria for Total Recoverable Hydrocarbons (TRH) and Monocyclic Aromatic Hydrocarbons (Benzene, Toluene, Ethyl benzene and total Xylenes – BTEX) compounds.

On this basis, no adverse impacts due to TRH/ BTEX were detected.

#### **PAH**

Polycyclic Aromatic Hydrocarbons (PAH) were below the site assessment criteria in all samples analysed with the exception of benzo(a)pyrene in sample 1/0.5. A concentration of 2.4 mg/kg of benzo(a)pyrene was detected in sample 1/0.5 over the guideline of 1 mg/kg. Statistical analysis conducted in accordance with EPA guidelines for benzo(a)pyrene at the site indicated that this elevated concentration is not characteristic of the site, and does not pose a health risk for construction workers or future site users.

On this basis, no adverse impacts due to PAH were detected.

#### **Phenols**

Phenols were below laboratory practical quantitation limits and the site assessment criteria in all samples analysed. On this basis, no adverse impacts due to phenols were detected.

#### **PCB**

Polychlorinated Biphenyls (PCB) were below laboratory practical quantitation limits and the site assessment criteria in all samples analysed. On this basis, no adverse impacts due to PCB were detected.

#### **OCP**

Organochlorine Pesticides (OCP) were below the site assessment criteria in all samples analysed. On this basis, no adverse impacts due to OCP were detected.

## OPP

Organophosphorus Pesticides (OPP) were below laboratory practical quantitation limits in all samples analysed. On this basis, no adverse impacts due to OPP were detected.

## Asbestos

A number of buildings constructed of fibre cement are present at the site. The fibre cement was observed to be in poor condition, with some fragments observable on the ground surface adjacent to the buildings. In this light, the existing/ former fibre cement buildings/ structures may be the source of the observed asbestos cement fragments/ debris noted on the ground surface.

Furthermore it is possible that the near surface soils at the site, particularly surficial soils in areas where existing or former sheds/ structures exist, may be impacted by asbestos material/ debris. Given the previous market gardens/ nursery activities, it is possible that (a) asbestos cement fragments/ debris, if present, may be present in the topsoil due to the filling/ cultivation activities; and (b) asbestos cement drains may have been laid for irrigation purposes.

Three soil samples were analysed for asbestos. A 2 mm asbestos fibre bundle was detected in one of these samples, viz sample 4/0.5.

Sample 4/0.5 was collected from near surface filling containing some brick fragments. The extent of asbestos contaminated filling material at the site has not been established at this stage, but is likely to be confined to the near surface horizon.

## Acid Sulphate Soils

Review of the Acid Sulphate Soil (ASS) risk maps indicated that there was a low potential for finding ASS below 3 m at the site. A sulphur odour was, however, observed in one bore at the site.

The screening results indicate that Potential Acid Sulphate Soil (PASS) may be present at the site. PASS materials have the potential to produce acid if exposed to air, but do not currently contain significant quantities of acid. No Actual Acid Sulphate Soil (AASS), ie soils currently containing significant quantities of acid, was identified at the site.



Acid Sulphate Soils (ASS) are naturally occurring soils/ sediments containing iron sulphides, formed in estuarine conditions. When ASS are exposed to air (e.g. through bulk excavations or dewatering), the oxygen reacts with iron sulphides in the sediment, producing sulphuric acid. The acid can negatively impact the environment and corrode engineering materials. If left undisturbed, ASS do not generally result in negative impacts on the surrounding environment or engineered structures.

## 11. RECOMMENDATIONS

It is recommended that a hazardous material assessment is conducted at the site by an occupational hygienist. The identified hazardous materials, including asbestos containing materials, should be managed/ disposed of in accordance NSW EPA and WorkCover requirements.

Furthermore it is recommended that additional investigation of asbestos in soil/ filling at the site be conducted to assess the extent of asbestos contaminated filling at the site.

If bulk excavation or dewatering is proposed for the site it is considered that an Acid Sulphate Soil assessment, including in-situ sampling and Peroxide Oxidation Combined Acidity and Sulphate – POCAS analysis, will be required.

Based on site observations, site history and laboratory results it is considered that the site is suitable for the proposed residential development with respect to chemical contaminants. It is considered that the site can be rendered suitable for the proposed residential development by removal of asbestos containing materials and filling, and validation of the site with respect to asbestos.

It should be noted that the current assessment is conducted as a preliminary contamination assessment, thus the adopted sampling density does not meet the sampling density requirements recommended by the Department of Environment and Conservation to "fully characterise" a site. Further investigation will be required if the site is to be "fully characterised".

Having said this, the analytical results obtained from the sampling locations indicate consistently low levels of chemical contaminants in all samples, showing no signs of undue chemical contamination impacts, and further assessment (with respect to chemical contamination) may not be warranted.

## 12. LIMITATIONS OF THIS REPORT

DP have performed investigation and consulting services for this project in accordance with current professional and industry standards for environmental site assessments. The scope of the preliminary site assessment was limited to that detailed in the proposal dated 21 November, 2003 and accepted by Chris Dugan of Mirvac Homes (NSW) Pty Ltd on the 30<sup>th</sup> June, 2004.

DP's assessment is necessarily based on the result of limited site investigations and upon the program of soil sample screening and chemical testing which were set out in the proposal. Neither DP, nor any other reputable consultant, can provide unqualified warranties nor does DP assume any liability for site conditions not observed or accessible during the time of the investigations.

Despite all reasonable care and diligence, the ground conditions encountered and concentrations of contaminants measured may not be representative of conditions between the locations sampled and investigated. In addition, site characteristics may change at any time in response to variations in natural conditions, chemical reactions and other events, e.g. groundwater movement and or spillages of contaminating substances. These changes may occur subsequent to DP's investigations and assessment.

No site investigations can be thorough enough to provide absolute confirmation of the presence or absence of substances that may be considered contaminating, hazardous or polluting. Similarly the level of testing undertaken cannot be considered to unequivocally characterise the degree or extent of contamination on the site. In addition, regulatory or guideline criteria for the evaluation of environmental soil quality are frequently being reviewed and concentrations of contaminants which are considered acceptable at present



may in the future be considered to exceed or meet acceptance criteria. Similar conditions may prevail in regard to site remediation standards as different regulatory mechanisms are developed and implemented.

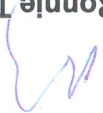
This report and associated documentation and the information herein have been prepared solely for the use of Mirvac Homes (NSW) Pty Ltd. Any reliance assumed by third parties on this report shall be at such parties' own risk. Any ensuing liability resulting from use of the report by third parties cannot be transferred to DP.

**DOUGLAS PARTNERS PTY LTD**

Reviewed by:



**Nerilee Edwards**  
Environmental Consultant



**Ronnie Tong**  
Manager, Environmental Service

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**APPENDIX A**  
**Site Drawing**

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**Douglas Partners**  
Geotechnics, Environment, Groundwater

Sydney, Newcastle, Brisbane,  
Melbourne, Perth, Wroong,  
Campbelltown, Townsville  
Cairns, Wollongong

**TITLE:**

Location of Test Bores  
Warriewood Valley Sector 3 Rezoning  
MacPherson Street  
WARRIEWOOD

CLIENT: Mirvac Homes (NSW) Pty Ltd

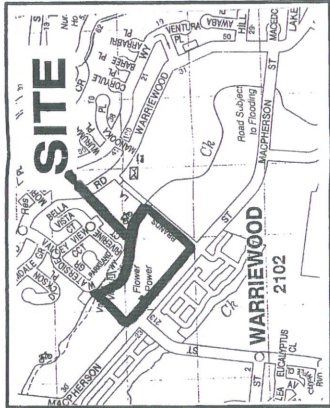
DRAWN BY: PSCH SCALE: As shown PROJECT No: 37273 OFFICE: SYDNEY

APPROVED BY:

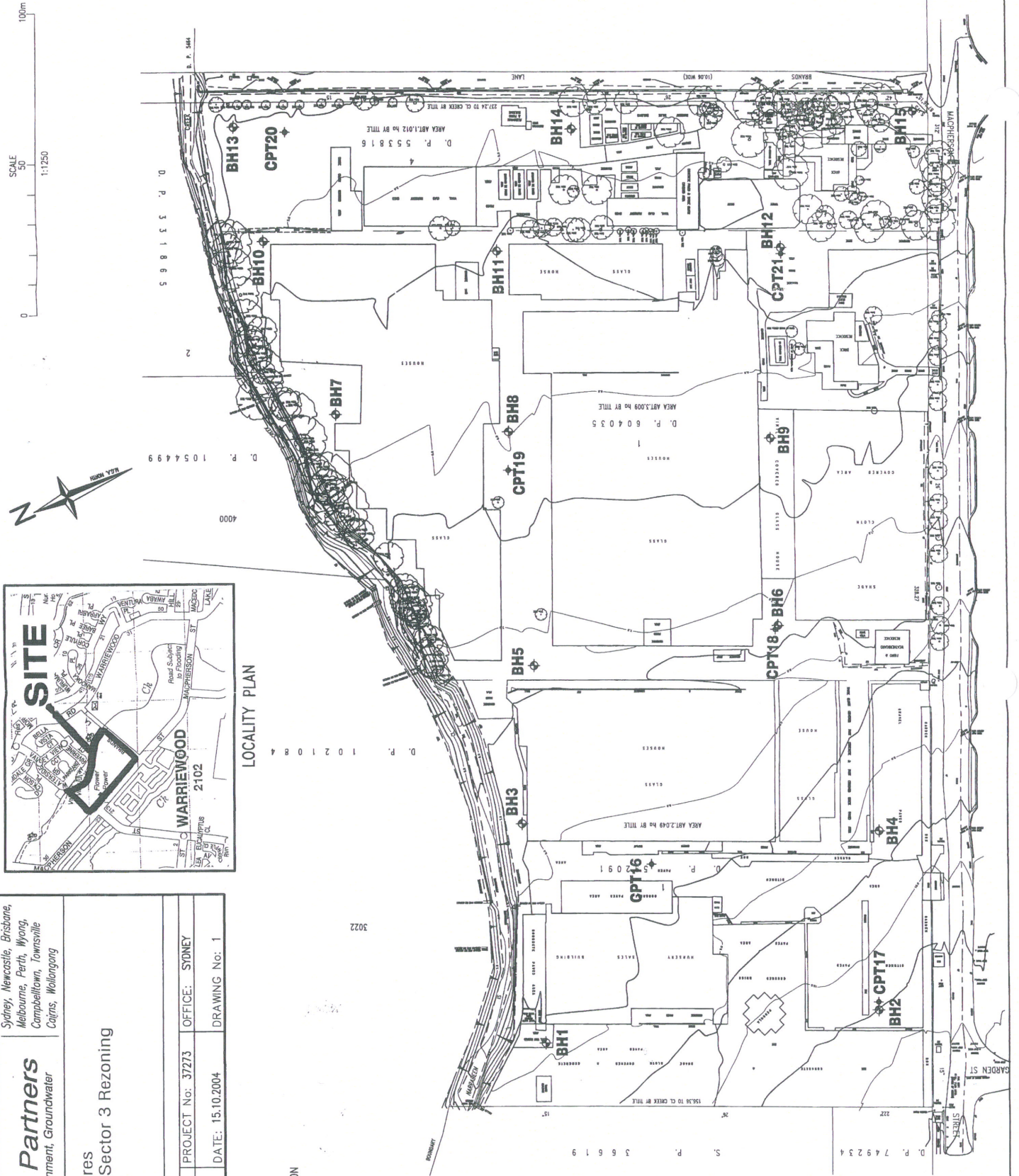
DATE: 15.10.2004 DRAWING No: 1

**LEGEND**

- ◆ TEST BORE LOCATION
- ◆ CONE PENETRATION TEST LOCATION



**LOCALITY PLAN**



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**APPENDIX B**  
***Historical Title Deed Search***

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ACN: 093 398 611  
ABN: 61 093 412 474

*Peter S. Hopley Pty Limited*  
*Legal Searchers*

1 Boronia Avenue  
Mount Annan, NSW, 2567  
Mobile: 0412 199 304  
Fax 9233 4590 (Attn Box 29)

## SUMMARY AS TO OWNERS.

Property: 14 - 18 MacPherson Street, Warriewood

Description: Lot 4 D.P. 553816, Lot 1 D.P. 604035 & Lot 1 D.P. 592091

As regards Lot 4 D.P. 553816

|            |                                                                                                  |                   |
|------------|--------------------------------------------------------------------------------------------------|-------------------|
| 19.03.1910 | Warriewood Limited                                                                               | Vol 2045 Fol 47   |
| 13.07.1926 | Thomas William Brand (Dairy Farmer)                                                              | Vol 3891 Fol 143  |
| 17.04.1934 | Frederick Walter Brand (Dairy Farmer)<br>(We have not investigated the Transmission Application) | Vol 3891 Fol 143  |
| 27.03.1934 | Thomas Percival Brand (Gardener)                                                                 | Vol 4725 Fol 112  |
| 06.11.1952 | Petros Christos Dellios (Market Gardener)                                                        | Vol 4725 Fol 112  |
| 22.01.1959 | Green Fingers Pty Limited                                                                        | Vol 11786 Fol 250 |
| 13.12.1972 | Gerrit Jacob Ossedryver (Company Manager)<br>Elsie Beryl Ossedryver (Married Woman)              | 4/553816          |
| 13.09.1988 | Winspear Holdings Pty Limited                                                                    | 4/553816          |
| 20.08.1992 | # Lyndon Stuart Foley<br># Angela Louise Foley                                                   | 4/553816          |

# Current Registered Proprietors

ACN: 093 398 611  
ABN: 61 093 412 474

*Peter S. Hopley Pty Limited*  
*Legal Searchers*

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Mount Annan, NSW, 2567  
Mobile: 0412 199 304  
Fax 9233 4590 (Attn Box 29)

*As regards Lot 1 D.P. 604035*

*As regards the part numbered 1 on the attached cadastre.*

|              |                                                         |                   |
|--------------|---------------------------------------------------------|-------------------|
| 19.03.1910   | Warriewood Limited                                      | Vol 2045 Fol 47   |
| 13.07.1926   | Thomas William Brand (Dairy Farmer)                     | Vol 3891 Fol 143  |
| 17.04.1934 ? | Frederick Walter Brand (Dairy Farmer)                   | Vol 3891 Fol 143  |
|              | (We have not investigated the Transmission Application) |                   |
| 27.03.1934   | Thomas Percival Brand (Gardener)                        | Vol 4725 Fol 112  |
| 06.11.1952   | Petros Christos Dellios (Market Gardener)               | Vol 4725 Fol 112  |
| 22.01.1959   | Green Fingers Pty Limited                               | Vol 11786 Fol 249 |

*For search continued as to this part, See Page No. 3*

*As regards the part numbered 2 on the attached cadastre.*

|            |                                            |                  |
|------------|--------------------------------------------|------------------|
| 08.02.1910 | Joseph Frederick Hall (Engine Driver)      | Vol 2034 Fol 208 |
| 18.12.1922 | Charles Rogers (Farmer)                    | Vol 2034 Fol 208 |
| 09.02.1926 | Margaret Burt (Married Woman)              | Vol 2034 Fol 208 |
| 29.01.1936 | Simun Sanko (Farmer, as to a 1/2 share)    | Vol 4747 Fol 90  |
|            | Bartul Nemcich (Farmer, as to a 1/2 share) | Vol 4747 Fol 91  |
| 07.02.1939 | Bartul Nemcich (Farmer)                    | Vol 5026 Fol 221 |



*Peter S. Hopley Pty Limited  
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|            |                                           |                   |
|------------|-------------------------------------------|-------------------|
| 21.05.1957 | Ivan Nemcich (Farmer, as to a 1/2 share)  | Vol 7318 Fol 19   |
|            | Vinko Nemcich (Farmer, as to a 1/2 share) | Vol 7318 Fol 20   |
| 28.04.1978 | Green Fingers (No. 2) Pty Limited         | Vol 13629 Fol 105 |

Search continued as to the whole of Lot 1 D.P. 604035

|            |                                              |          |
|------------|----------------------------------------------|----------|
| 07.05.1979 | Green Fingers Properties Pty Limited         | 1/604035 |
|            | (Now Premier Foliage Properties Pty Limited) |          |
| 09.04.1991 | Winspear Holdings Pty Limited                | 1/604035 |
| 02.07.1992 | # Andrew Georgiou<br># Pamela Georgiou       | 1/604035 |

# Current Registered Proprietors

|            |                                          |                         |
|------------|------------------------------------------|-------------------------|
| 19.03.1910 | Warriewood Limited                       | Vol 2045 Fol 47         |
| 16.01.1920 | Agnes Bowen (Married Woman)              | Vol 3014 Fol 236        |
| 12.07.1924 | Charles Craig Sellar (Retired Gasfitter) | Vol 3014 Fol 236        |
| 23.12.1948 | Peter Franolich (Market Gardener)        | Vol 9429 Fols 160 & 161 |

ACN: 093 398 611  
ABN: 61 093 412 474

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04.06.1963 Leslie Alma Braidwood Meredith (*Nursewoman or Draughtsman*)  
Vol 9429 Fol's 160 & 161  
(*eastern part*)  
25.02.1964  
(*western part*)

07.12.1976 Nock & Kirby Limited  
Vol 13467 Fol 216

07.05.1980 Permanent Trustee Nominees (Canberra) Limited  
Vol 13467 Fol 216

15.02.1984 Syesun Pty Limited  
1/592091

24.11.1988 Winspear Holdings Pty Limited  
1/592091

28.02.1991 Jenbend Pty Limited  
1/592091

03.11.2003 # Syesun Pty Limited  
1/592091

# Current Registered Proprietor

email: grolly@optusnet.com.au

09/10/04



Date: 06-OCT-04 08:47am

Enquiry: Lot 1 DP604035

