Appendix 10 Contamination Assessment

Douglas Partners

May 2008

Warner Industrial Park Concept Plan and Project Application

Precinct 14 WEZ

Sparks Rd and Hue Hue Rd
Warnervale
June 2008

80
TERRACE
TOWER
GROUP

Warner Business Park Pty Ltd
Part of the Terrace Tower Group

Peter Andrews + Associates Pty Ltd
architecture planning urban design

Douglas Partners
Geotechnics • Environment • Groundwater

Integrated Practical Solutions

REPORT
on
TARGETED PHASE 2
CONTAMINATION ASSESSMENT

PROPOSED WARNER INDUSTRIAL PARK
CORNER HUE HUE ROAD AND SPARKS ROAD
WARNERVALE

Prepared for
MM CONSULTANTS

Acting on Behalf of
WARNER BUSINESS PARK PTY LIMITED

PROJECT 41615.01
May 2008

Douglas Partners
Geotechnics • Environment • Groundwater

REPORT
on
TARGETED PHASE 2
CONTAMINATION ASSESSMENT

PROPOSED WARNER INDUSTRIAL PARK
CORNER HUE HUE ROAD AND SPARKS ROAD
WARNERVALE

Prepared for
MM CONSULTANTS

Acting on Behalf of
WARNER BUSINESS PARK PTY LIMITED

PROJECT 41615.01
May 2008

Douglas Partners Pty Ltd
ABN 75 053 980 117

Unit D, 7 Donaldson Street
WYONG NORTH NSW 2259
Phone (02) 4351 1422
Fax (02) 4351 1410
Hwyong@douglaspartners.com.au

ACEA
The Association of Consulting Engineers Australia

EXECUTIVE SUMMARY

This report presents the results of a Targeted Phase 2 Contamination Assessment (CA) undertaken at the "Warner Industrial Park" by Douglas Partners Pty Ltd (DP). It is understood that the site will be developed for an industrial land use. The work was requested by MM Consultants Pty Ltd, acting on behalf of Warner Business Park Pty Ltd, owners of the site.

This CA has been prepared to assess the Areas of Environmental Concern (AEC) identified in the updated Preliminary Contaminated Land Assessment (PCLA) and Acid Sulfate Soil (ASS) Assessment prepared by Coffey Geosciences Pty Ltd (Coffey) for Wyong Shire Council (WSC) for the proposed Wyong Employment Zone (WEZ) (dated May 2006, Ref 1). The findings of the 2006 assessment were referenced in this report.

The AEC identified at the site comprised:

- The "Heli Aust" helicopter operation on Lot 15 DP259530; and
- Potential run-on of contaminated materials from Buttonderry Landfill and its approaches on the NW corner of Lot 8 DP239704.

It is understood that the work was required to assess the suitability of the site, from a contamination perspective, for a proposed industrial land use. The CA comprised a site inspection of the AEC and intrusive investigations (eight test pits, five sediment sampling locations and four surface water sampling locations) targeting at the identified AEC.

DP completed a preliminary geotechnical investigation (Ref 3) at the site concurrently with the CA. Based on the observations and results the geotechnical investigation a number data gaps were identified that would require further assessment prior to or during redevelopment of the site.

Subsurface conditions encountered in the former "Heli Aust" operation area comprised filling ranging in thickness from 0.1 to greater than 1.7 m. The filling encountered appeared to have resulted from construction of building platform for the workshop. The filling appeared to generally comprise a mix of site sourced silty clay and some possibly imported quarried sandstone. Notwithstanding this, Pit 108 encountered variable filling below a depth of 1.3 m comprising soils mixed with waste materials including fibrous cement fragments.

The fibrous cement fragments in Pit 108 were later determined by laboratory testing to contain asbestos fibres. Sediment samples collected from the drainage alignments comprised a mix of clay, silt, sand and gravel mixed with some organic matter.

No significant soil odours or elevated PID results were noted at any of the investigation locations with PID results ranging between 0.0 – 0.3 ppm, although surface staining was noted in the vicinity of Pit 102 adjacent to "fly tipped" drums labelled as turbine oil. With the exception of waste materials encountered in Pit 108, no significant signs of deleterious inclusions were noted in the filling. Minor inclusions observed included clay roof tile fragments at the ground surface in Pit 101 and a single piece of timber and metal in the filling at Pit 103. Groundwater seepage was not encountered in any of the CA pit locations, with the exception of Pit 108 where some seepage was encountered within the filling at a depth of 1.3 m. This seepage was thought to be related to the inclusions within the filling below 1.3 m and also the proximity of the pit to the nearby dam.

With respect to the CA, soil/sediment chemical contaminant levels were generally low, with levels less than the health-based assessment criteria for commercial/industrial land use (Ref 7 & 8) with the exception of TRH C_{10} – C_{36} concentration encountered in the surface soils at Pit 102 (sample ID 102/0.1). The pit was positioned adjacent to drums labelled as turbine oil and also corresponded to an area of surface staining. No asbestos was detected in any of the soil samples tested as well as in the fibrous cement building material fragment collected from materials scattered across the workshop slab. The fibrous cement fragment (sample ID 108/FC) encountered in the filling in Pit 108 at a depth of 1.5 m was reported to contain asbestos fibres.

Surface water monitoring results were all below trigger values for the protection of 95% of species in freshwaters (Ref 11), with the exception of marginal exceedances for pH at locations 111 and 113 (pH results of 6.4 and 5.8, respectively). These marginal exceedances are not considered to be significant and do not indicate that significant levels of contaminants were migrating onto site as a results of run-on of contaminated materials from Buttonderry Landfill.

In summary, based on the conclusions of the PLCA (Ref 1) and the Target Phase 2 Contamination Assessment the "Warner Industrial Park" site is considered to be generally compatible with the proposed industrial land use on the proviso that the "data gaps" identified are further assessed and remediated (if required) and also the areas found to be contaminated (i.e. Pit 102 & Pit 108) are remediated and validated.

Isolated areas of contamination or “data gaps” are commonly identified/encountered on rural properties that are being redeveloped and can be relatively straight-forword to addressed prior to or during redevelopment of the site. It is recommended that the most appropriate time to undertake further assessment and/or remedial works would be immediately following the completion of demolition works of the buildings present within each of the lots, but prior to the commencement of any bulk earthwork activities. Notwithstanding this, it is recommended that prior to demolition works a detailed site walkover is undertaken to identify and demarcate the areas requiring further assessment and/or remediation and immediately following the demolition undertake the recommended remedial works.

TABLE OF CONTENTS

BJK:bjk
Project 41615.01
May 2008

REPORT ON
TARGETED PHASE 2 CONTAMINATION ASSESSMENT
WARNER INDUSTRIAL PARK
CORNER OF HUE HUE ROAD & SPARKS ROAD, WARNERVALE, NSW

1 INTRODUCTION

This report presents the results of a Targeted Phase 2 Contamination Assessment (CA) undertaken at the above site by Douglas Partners Pty Ltd (DP). It is understood that the site will be developed for an industrial land use. The work was requested by MM Consultants Pty Ltd, acting on behalf of Warner Business Park Pty Ltd, owners of the site.

This CA has been prepared to assess the Areas of Environmental Concern (AEC) identified in the updated Preliminary Contaminated Land Assessment (PCLA) and Acid Sulfate Soil (ASS) Assessment prepared by Coffey Geosciences Pty Ltd (Coffey) for Wyong Shire Council (WSC) for the proposed Wyong Employment Zone (WEZ) (dated May 2006, Ref 1). The WEZ comprised several parcels of land located in the Warnervale and Halloran areas, although this CA was limited to a portion of the WEZ identified as Precinct 14. The assessment area is presented in Drawing 1, Appendix A.

The findings of the PLCA (Ref 1) were referenced in this report.

This assessment comprised a review of previous report findings and other relevant background information as well as a site inspection of the identified AEC and targeted intrusive investigations. The intrusive investigations comprised soil/sediment and surface water sampling and laboratory testing. The scope of the intrusive investigations was limited to targeting the AEC that were recommended to be assessed in the PLCA (Ref 1).

The intrusive investigations undertaken targeted these potential contamination sources, although the sampling density adopted was less than that recommended by the NSW EPA's publication *Contaminated Site: Sampling Design Guidelines* (Ref 2) for site characterisation based on systematic sampling pattern.

Douglas Partners Pty Ltd completed a concurrent geotechnical investigation at the site, the results of which were provided in a report titled *Report on Preliminary Geotechnical Investigation, Proposed Warner Industrial Park, Corner of Hue Hue Road and Sparks Road, Warnervale*, Project 41615, May 2008 (Ref 3). Observations made during the geotechnical investigation are also summarised in this report.

1.1 Purpose of Assessment

The objectives of the assessment were to:

- provide a targeted assessment of the AEC identified in the *Preliminary Contaminated Land Assessment and Acid Sulphate Soil Assessment* (Ref 1) that were recommended for assessment.
- assess the suitability of these AEC for the proposed industrial land use; and
- recommend any additional assessment or remedial works required for the proposed redevelopment of the site.

1.2 Site Identification

The site comprises an irregular shaped parcel of land with an area of approximately 104 hectares. Three existing roads, namely Sparks Road, Hue Hue Road and Kiar Ridge Road, bound the site to the south-west, west and north respectively (refer Drawing 1). The F3 Sydney to Newcastle freeway bounds the site to the south-east. Existing rural land bounds the site to the east.

The parcel of land encompasses thirteen existing allotments, as follows:

- Lots 15 to 19 in DP259530;
- Lots 4 and 6 to 9 in DP239704;

- Lots 25 and 26 in DP259530; and
- Lot 5 in DP259531.

The site is located in the Wyong Shire Council local government area, parish of Munmorah and county of Northumberland.

1.3 Data Quality Objectives

Data quality objectives (DQOs) have been developed to define the type and quality of data required to achieve the project objectives. The DQO process consists of a seven step planning approach, 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) (Ref 3). The DQO process includes the following steps:

1 State the Problem
2 Identify the Decision
3 Identify Inputs to the Decision
4 Define the Boundary of the Assessment
5 Develop a Decision Rule
6 Specify Acceptable Limits on Decision Errors
7 Optimise the Design for Obtaining Data

Table 1 summarises the data quality objectives, indicating the components of each step and the sections where the steps have been addressed.

Table 1 - Data Quality Objectives

DQO Step	Section Where DQO Addressed
Define the problem	S 1 Introduction S 1.1 Purpose of Assessment
Identify the problem	S 1 Introduction S 1.2 Site Identification
Identify the inputs of the decision	S 2 Scope of Work S 3 Physical Setting S 4 Background Information S 5 Data Gaps
Define the study boundaries	S 1.2 Site Identification S 2 Scope of Works App A Drawings 1 to 3
Develop a decision rule	S 6 Assessment Criteria App C Laboratory Internal QA data on Reports
Specify tolerable limits on decision errors	S 2 Scope of Work S 11 Limitations of this Report App C Laboratory Internal QA data on Reports App D QA/QC Procedures & Results
Optimise the design	S 9 Discussion of Results S 10 Conclusions Recommendations

2 SCOPE OF WORK

The CA was carried out with respect to the approach outlined in *State Environmental Planning Policy No. 55 – Remediation of Land* (SEPP 55 – Ref 4) and the *Contaminated Sites: Guidelines for Consultants Reporting on Contaminated Sites* (NSW EPA – Ref 5).

In summary, DP's scope of work comprised:

- Brief site inspection to provide a visual assessment of site conditions and identification of the AEC identified in the PLCA (Ref 1) that were recommended for a Phase 2 assessment;
- Excavation and sampling of eight test pits targeting the former "Heli Aust" helicopter operation on Lot 15 DP 259530;
- Collection of sediment and/or surface water samples at five locations across the site to provide preliminary assessment of inflow and outflow sediment and/or water quality;

- Analytical testing of selected soil/sediment samples at a NATA accredited laboratory for potential contaminants including:
  - Heavy Metals: Arsenic (As); Cadmium (Cd); Chromium (Cr); Copper (Cu); Lead (Pb); Mercury (Hg); Nickel (Ni); Zinc (Zn).
  - Total Recoverable Hydrocarbons (TRH);
  - Benzene, Toluene, Ethyl Benzene, Xylene (BTEX);
  - Polycyclic Aromatic Hydrocarbons (PAH);
  - Organochlorine Pesticides (OCP);
  - Organophosphorus Pesticides (OPP);
  - Polychlorinated Biphenyls (PCB);
  - Volatile Organic Compounds (VOC);
  - Phenols; and
  - Asbestos (soils or building material waste only).
- Analytical testing of selected surface water samples at a NATA accredited laboratory for potential contaminants including:
  - Heavy Metals: Arsenic (As); Cadmium (Cd); Chromium (Cr); Copper (Cu); Lead (Pb); Mercury (Hg); Nickel (Ni); Zinc (Zn).
  - Total Recoverable Hydrocarbons (TRH);
  - Benzene, Toluene, Ethyl Benzene, Xylene (BTEX);
  - Polycyclic Aromatic Hydrocarbons (PAH);
  - Ammonia;
  - Nitrate;
  - pH; and
  - Total Dissolved Solids.
- Preparation of a report outlining the works undertaken and the findings of the CA.

3 PHYSICAL SETTING

3.1 Site Features

The site mainly consists of either cleared pastoral land supporting grass and scattered timber or heavily timbered undeveloped rural land. Reference to Drawing 2, which is an aerial photo of the site retrieved from the Landinfo website, roughly shows the timbered and cleared areas of the site.

It should be noted that the aerial photo is not current and land clearing may have taken place after the photo was taken. Generally, the majority of the northern part of the site has been cleared, together with the southern area of the site, with remnant bushland within the mid to southern central portion of the site.

Numerous existing dwellings are located throughout the site predominantly within 100 m of the western boundary. A number of existing residences and stables are located within the site in proximity to Kiar Ridge Road. Numerous farm dams (in excess of twenty) are located throughout the site. The majority of these have been formed by a combination of cut and fill operations and are in the order of 10 m to 30 m in diameter.

Other developments throughout the site include a former "Heli Aust" operations in the south-eastern corner. A number of unsealed access tracks are present throughout the site, mainly providing access to the rear (eastern) sections of the individual allotments.

3.2 Topography and Surface Drainage

Topography at the site is broadly summarised as rolling hills within the majority of the site, falling gently to the south-east. Generally two high points are located along the western boundary of the site and a further high point in the north-east corner. Slopes fall down from these high points at slopes of less than 5° to the north-east, east and south-east.
The site has two distinct areas, which are roughly delineated by the RL 20 m AHD contour (refer Drawing 3). The land surface below this contour is mostly situated in the eastern area of the site and generally consists of low lying relatively flat ground. The area around Buttonderry Creek is also below this contour level and consists of relatively flat ground. The land surface above this contour is mostly situated in the western and northern area of the site and generally consists of gently sloping ground.

Based on review of the survey plan provided by the client and a site walkover undertaken for the geotechnical investigation (Ref 3), the high points of the site and relevant elevations are located as follows:

- Broad elevated area within the south-western corner at the intersection of Hue Hue Road and Sparks Road with an elevation of approximately RL 25 m AHD;

- Broad rounded spur along the western frontages of Lots 6 and 7 in DP239704 with an elevation of approximately RL 32 m AHD; and
- Planar hill slope in the north-eastern corner of the site (Lot 8 in DP239704), with an elevation of approximately RL29 m AHD.

It should be noted that limited survey information has been provided for the north-eastern area of the site (Lot 5 in DP259531 and Lot 9 in DP 239704). In general, however, the topography in this area of the site falls from the north-eastern corner in a southerly direction to approximately RL 17 m AHD along the southern boundary. The exception to this general topography is the large mound of filling located in the south-eastern corner of Lot 5, which is understood to have been placed there during the construction of the F3 freeway (refer Photo 1 in Section 4.3).

Drainage at the site comprises an intermittent stream identified as Buttonderry Creek entering the site via two tributaries located in the south western corner and also midway along the western boundary. The mapping indicates Buttonderry Creek discharges at one point along the eastern site boundary. A third unnamed intermittent stream enters near the north western corner, although terminates within the site area. The mapped inflow and outflow points were inspected and sampled as part of this assessment (identified in Drawing 1).

Buttonderry Creek discharges to the Porters Creek Wetland area located approximately 5 km to the south of the site, then finally discharging to Wyong River and Tuggerah Lakes.

3.3 Adjacent Site Uses

Adjacent land uses to the site include the following:

- North (across slope) – Across Kiar Ridge Road are semi-rural properties.
- East (down slope) – F3 Freeway and bushland.
- South (up slope) – Across Sparks Road are semi-rural properties.
- West (up slope) – Across Hue Hue Road are semi-rural properties, bushland and Buttonderry Landfill. Buttonderry Creek is an intermittent watercourse that bisects the landfill site before discharging through the subject site to the Porters Creek Wetland.

The PLCA (Ref 1) considered that the potential for contamination from the surrounding land uses was generally low, with the exception of the potential for run-on of contaminated materials from Buttonderry Landfill. It is noted that WSC undertake environmental monitoring, including surface and groundwater monitoring, at Buttonderry Landfill. Past reports prepared for the site have indicated that groundwater flow direction from the landfill was reportedly generally towards the west and south and that the landfill did not appear to be having a significant impact on the surrounding environment (including Buttonderry Creek).

3.4 Geology & Soil Landscape

Reference to the interim Wyong 1:25 000 Geological Series indicates that the site is underlain by rocks of the Tuggerah Formation, which is a member of the Clifton Subgroup and Narrabeen Group. The Tuggerah Formation typically comprises lithic sandstone, red-brown and grey-green claystone and siltstone, grey siltstone and laminate, rare conglomerate. Areas to the west of the site are mapped as being underlain by rocks of the Patonga Claystone formation.

Conditions encountered in the geotechnical pits included sand and clay soils underlain by sandstone or claystone bedrock. The soils were consistent with residual soils derived from the underlying bedrock.

Reference to the Department of Conservation and Land Management, Gosford-Lake Macquarie, Soil Landscape Series map indicates that the majority of the site is underlain by soils of the Wyong Soil Landscape Group.

The southern portion of the site (roughly Lots 15 to 17) and also the north eastern portion of the site (roughly the north-eastern areas of Lots 8 and 9) are shown to be underlain by soils of the Gorokan Soil Group, which is categorised as undulating low hills and rises of the Tuggerah Formation with slope gradients of less than 15%. Soils within this group are said to be between 0.5 m and 1.5 m deep. The limitations associated with these soils include extreme erosion hazard, rock outcrop, shallow highly permeable soils and very low soil fertility.

The mapping also shows that the south-western area of the site (isolated to the western part of Lots 16 and 17) is underlain by soils of the Woodburys Bridge Landscape Group. This soil group is characterised by gently undulating rises and rolling low hills on Patonga Claystone.

Limitations within this soil unit include extreme erosion hazard, high foundation hazard, localised seasonal waterlogging, acid soil of very low fertility and low wet bearing strength.

3.5 Acid Sulphate Soils

Reference to the Wyong Acid Sulphate Soil Risk map indicates that there is no known occurrence of acid sulphate soils at the site. Given the elevation of the site, above RL 17, and the underlying geology, it is unlikely that acid sulphate soils will be present at this site.

Reference to the previous investigation undertaken by Coffey indicates that there is a low risk of acid sulphate soils along the margins of Buttonderry Creek. Hence, the scope of work for the assessment of acid sulphate soils at this site was limited to the location of the proposed bridge over Buttonderry Creek.

The Preliminary Geotechnical Assessment (Ref 3) concluded that given the acid sulphate mapping indicates that there is no known occurrence of acid sulphate soils at the site. Based on the elevation of the site (above RL 17 m AHD) and the results of the acid sulphate screening tests from Bores 401 and 402 (refer to Drawing 1), it is considered that acid sulphate soil conditions are not present at the site of the proposed bridge in the vicinity of Bores 401 and 402. Notwithstanding this, in the event that excavation is proposed within 20 m of the banks of the creek, it is suggested that additional assessment of the presence of acid sulphate soils at the location of the proposed excavation is undertaken prior to commencement.

3.6 Groundwater

A permanent groundwater table is likely to be present within the claystone, siltstone or sandstone lithology and would be expected within approximately 20 m of the ground surface. Some minor seepage layers may be located at the interface of localised permeability boundaries such as at the interface between filling, residual soils and/or weathered bedrock.

A groundwater bore search was conducted as part of the PCLA (Ref 1); the search identified four registered bores within an approximate 4 km radius of the site. The bores had a registered purpose of domestic and stock purposes, extracting groundwater from shallow, fractured rock aquifers.

Given the site's topography, distance to the bores and the low permeability of the geology, these bores were unlikely to be impacted by groundwater contamination (if present) originating from the site.

Groundwater was not encountered in the majority of the pits during the Preliminary Geotechnical Investigation (Ref 3). Free groundwater was observed at depths ranging from 0.4 m to 2.1 m in a number of pits located within the lower eastern area of the site. Further, elevated moisture contents were observed within the upper soils in a number of pits located in the lower eastern section of the site.

No free groundwater was encountered within the pits and bores (undertaken for Reference 3) located within the higher sections of the site, where excavation is proposed.

4 BACKGROUND INFORMATION

4.1 Summary of Site History

Reference to the PLCA (Ref 1) indicated the following:

- The majority of the properties in the site (identified as Precinct 14) were undeveloped bushland until the early 1970s, and only used for grazing purposes until at least the late 1980s early 1990s.
- The majority of properties were owned by farmers and graziers since a Crown grant was made in 1904/1905; and
- The "Heli Aust" helicopter operations on Lot 15 began in approximately 1987.

Coffey considered that the historical review conducted as part of the PLCA (Ref 1) was comprehensive enough to gather information on the significant activities that have occurred on the proposed Wyong Employment Zone (which includes that subject site).

Notwithstanding this, Coffey identified a gap in the site history comprising the disturbed ground on the southern edge of Lot 5 DP259531. This area was not able to be fully assessed by Coffey during the site walkover as site access was not possible at that time.

This disturbed area has subsequently been identified as an area containing a significant volume of filling reportedly sourced during construction of the F3 Freeway. No intrusive assessment of this area of filling was undertaken for the geotechnical investigation (Ref 3) or this CA.

4.2 Updated Preliminary Land Contamination Assessment (Ref 1)

An updated Preliminary Contaminated Land Assessment (PCLA) and Acid Sulfate Soil (ASS) Assessment was undertaken by Coffey Geosciences Pty Ltd (Coffey) for Wyong Shire Council (WSC) of the proposed Wyong Employment Zone (WEZ) in May 2006. The WEZ comprises several parcels of land located at Warnervale and Halloran in Wyong Shire including the subject site that was identified as Precinct 14 in the report. The report updated an original PCLA, prepared by Coffey in 2005.

The objectives of the PCLA were to identify all past and present potentially contaminating activities, identify potential contamination types, assess and discuss the existing site conditions, provide a preliminary assessment of site contamination, and provide preliminary advice on remediation and management of any identified site contamination.

The scope of work for the PCLA included a desktop review of past activities over the WEZ, including Land Title documents indicating historical ownership, s149 certificates of the area for contamination notifications, NSW EPA contamination Notices (issued under the *Contaminated Land Management Act*, 1997, WSC Development Applications (DA) and Building Applications (BA) records, previous environmental reports of the area as available from WSC, interviews with landowners and managers, as available, and historical aerial photographs.

The scope also included an assessment of the topography, geology and regional groundwater and surface water details to assess the potential for migration of contaminants from off-site or on-site sources, and a site walkover to 'ground-truth' historical review results, and identify additional potential Areas of Environmental Concern (AEC) and possible Chemicals of Concern (CoC).

Coffey noted that, of the identified AEC in the WEZ, only two potential AEC were identified in Precinct 14 (the site) that could affect the proposed commercial/industrial redevelopment:

- The "Heli Aust" helicopter operation on Lot 15 DP259530; and

- Potential run-on of contaminated materials from Buttonderry Landfill and its approaches on the NW corner of Lot 8 DP239704.

It was recommended by Coffey that Stage 2 Environmental Site Assessments (or Phase 2 Contamination Assessment), including field investigations and laboratory analyses, be undertaken on those properties identified during redevelopment to assess the AEC for contamination.

4.3 Preliminary Geotechnical Investigation (Ref 3)

A concurrent preliminary geotechnical investigation for the proposed Warner Industrial Park was carried out by DP. The scope of the geotechnical investigation comprised the excavation of test pits, *in situ* testing and sampling, a walkover survey by a senior geotechnical engineer followed by laboratory testing, engineering evaluation and reporting.

The purpose of the investigation was to obtain subsurface information and provide engineering comment on the following geotechnical issues:

- Subsurface conditions at test locations;
- Suitability of the site soils to accept filling;
- Assessment of the presence of acid sulphate soils at the site of the proposed bridge over Buttonderry Creek;
- Excavation conditions in areas of cut;
- Safe batter slopes in areas of cut and fill;
- Recommended site preparation measures.
- Anticipated site classifications in accordance with AS2870 for the industrial sites;
- Geotechnical parameters for the design of foundations
- Design parameters for piled foundations for the proposed bridge across Buttonderry Creek;
- Flexible and rigid pavement thickness design for the proposed internal roads;
- Thickness design for a rigid (concrete) roundabout at the proposed intersection at Sparks Road; and
- Flexible pavement thickness design for an intersection with Hue Hue Road;

The subsurface conditions encountered throughout the majority of the site included relatively shallow sand or silty sand (up to 0.7 m depth) overlying, initially, firm to stiff clay soils overlying stiff or stronger clay soils. Extremely low strength claystone or sandstone bedrock is present at depths ranging from approximately 1 m to 3 m, particularly within the western and northern areas of the site. Weaker subsurface conditions, characterised by firm clay soils or loose sand soils within the upper 0.4 m to 0.8 m depth were present within the majority of pits excavated within the lower lying areas of the site, below approximately RL 20 m AHD.

Localised filling is anticipated to be present in the area of the existing dwellings within the filling platforms placed during construction and also within the existing dam embankments. It is likely that silt will be present within the base of the existing dams.

The filling encountered in Pit 6 and 6A is considered unsuitable under proposed building areas for the support of engineered filling, footings or pavements and should be removed and replaced. It is noted that fibrous sheeting was present within the filling. No testing for the presence of asbestos or chemical contaminants were undertaken in this area.

Photo 1 – Waste materials excavated from Pit 6

Partially buried waste materials were also noted in the vicinity of Pit 6 as shown in Photo 2.

Photo 2 – Partially buried waste materials located in the vicinity of Pit 6

Filling platforms or stockpiles were observed in several areas throughout the site including the following:

- Within the south-eastern corner of Lot 5 in DP259531 where filling is understood to have been won from excavations in connection with the construction of the F3 freeway has been placed (refer Photo 3 below);
- Surrounding a number of the existing residences, such as in Photo 4; and
- Scattered throughout the bush in numerous locations throughout the site (refer Photo 5).

Photo 3 – Filling in south-eastern corner of Lot 5 (believed to be associated with construction of F3)

Photo 4 – Filling platform in Lot 7 – Looking north

Photo 5 – Rubbish and filling scattered throughout the bush

5 DATA GAPS

Based on a review of the geotechnical investigation (Ref 3), a number data gaps were identified that would require further assessment prior to or during redevelopment of the site. The data gaps identified included:

- Buried waste materials encountered in geotechnical Test Pit 6 (and Pit 6a).

- Significant quantity of filling placed in the south-eastern corner of Lot 5 in DP259531. The filling was understood to have been won from excavations in connection with the construction of the F3 freeway;
- Filling platforms, regraded areas and general rural activities surrounding a number of the existing or former residences/buildings; and
- Waste materials and small soil stockpiles scattered in a number of locations throughout the site.

The issues outlined above are commonly encountered on rural properties that are being redeveloped and can be readily addressed prior to or during redevelopment of the site. Based on the observations made these data gaps would not materially change the overall compatabilty of the site for the proposed industrial land use, although the data gaps should be further assessed and remediated (if required).

6 ASSESSMENT CRITERIA

Given the site's proposed industrial land use results of the laboratory analyses were compared to the following NSW DECC endorsed guidelines.

- NSW DEC (2006). *Contaminated Sites – Guidelines for the Site Auditor Scheme* (2nd Ed), 2006 (Ref 7);
- NSW EPA (1994). *Contaminated Sites - Guidelines for Assessing Service Station Sites*, 1994, (Ref 8); and
- NSW DECC (2008). *Waste Classification Guidelines*, Part 1: Classifying Waste (Ref 9).
- NEPC (1999). The National Schedule B(1) Guideline on the Investigation Levels for Soil and Groundwater (Ref 10);
- ANZECC (2000) *Fresh and Marine Water Quality Guidelines* (Ref 11).

The NSW DEC *Guidelines for the NSW Site Auditor Scheme* contain National Environmental Health Forum (NEHF) levels for various beneficial use scenarios including: low density residential, high density residential with minimal access so soil, recreational and commercial/industrial. These criteria are applicable depending on the proposed land use and, in addition, soil aesthetic and ecological concerns (specifically phytotoxicity) are to be addressed.

Phytotoxic concentrations of contaminants are not considered where the proposed land use is an industrial one. Given the proposed industrial land use of the site, the selected site assessment criteria are the Health-based Investigation Levels for a commercial or industrial land use (HIL - Column 4 in Appendix II, Soil Investigation Levels for Urban Development Sites in NSW).

The NSW EPA *Guidelines for Assessing Service Station Sites* has been used to assess Petroleum Hydrocarbons (Total Recoverable Hydrocarbons (TRH), Benzene, Toluene, Ethyl Benzene & Xylenes (BTEX)) contamination across the site. The criteria adopted for TRH and BTEX are those for a sensitive land use in accordance with DECC guidance.

The NSW DECC *Waste Classification Guidelines, Part 1: Classifying Waste* have been used to assess the fill/soils for preliminary (provisional) waste classification of the soils for landfill disposal purposes. Final classification (or re-classification) of materials for landfill disposal purposes may be undertaken at a later stage of assessment or following remediation to verify the provisional waste classification results. The waste classification results are for landfill waste disposal purposes only and are not relevant for the assessment of the suitability of site soils for the proposed land use.

National Environmental Protection (Assessment of Site Contamination) Measure 1999, Schedule B(1) Guideline on the Investigation Levels for Soil and Groundwater, Background Ranges have been used for the purposes of classifying virgin excavated natural soils for off-site disposal or off-site re-use.

There are currently no national or NSW guidelines for asbestos in soil. Advice provided by NSW DECC stated that “no asbestos in the soil at the surface is permitted”.

The ANZECC (2000) *Guidelines for Fresh and Marine Water Quality* was used to assess groundwater quality. The protection of aquatic ecosystem guidelines is considered to be relevant due to the proximity of the site to Porter Creek Wetlands and Wyong River and the absence of other sensitive receptors. The ultimate receiving waters are considered to be a ‘slightly to moderately disturbed system’ freshwater ecosystem system. The 95% species protection trigger values for freshwaters have been used as the assessment criteria.

7 FIELD WORK

7.1 Sampling Rationale

The field work for the assessment was undertaken on 25 March and 4 April 2008. The field investigation comprised the excavation of eight test pits (Pits 101 to 108) and the collection of five sediment samples (109Sed to 113Sed) and four surface water samples (109W to 111W and 113W) providing targeted assessment of the issues requiring assessment identified in the PLCA (Ref 1). The issues identified comprised:

- The "Heli Aust" helicopter operation on Lot 15 DP259530; and
- Potential run-on of contaminated materials from Buttonderry Landfill and its approaches on the NW corner of Lot 8 DP239704.

Test pits 101 to 108 targeted the former "Heli Aust" helicopter operations, whilst sediment samples 109Sed to 113Sed and surface water samples 109W to 111W and 113W targeted potential run-on of contaminated materials from Buttonderry Landfill and its approaches. The investigation locations are presented on Drawing 1, Appendix A.

All field work was supervised by an experienced environmental engineer who collected soil samples at regular depth intervals for strata identification and testing purposes from the test pits. The engineer was also responsible for collection of sediment and surface water samples. Sampling was carried out in accordance with the DP *Field Procedures Manual* which generally conforms to NSW EPA (or DECC) requirements.

Test locations and samples were selected for analysis based on their observed potential for contamination. This was generally based on the proximity to the identified contamination source, observations and field screening results, material type, visual or olfactory evidence of possible contamination (i.e. odour or staining).

At the time of the CA the majority of the residential dwellings had been vacated, although the dwellings and sheds were generally still intact (except for "Heli Aust" operations). Comparision to the PCLA (Ref 1) indicates that the former "Heli Aust" operations formerly comprised a large workshop and surrounding storage areas which had been demolished and removed from the site.

Visual inspection of the workshop area noted some minor staining of the concrete slab and some fibrous cement fragments, possibly containing asbestos, scattered near the edges of the concrete slab.

Photo 6 – Former "Heli Aust" operations, Pit 103 located in the foreground

Visual inspection also identified some recent fly tipping comprising tyres, televisions and partially filled oil drums. Some staining of the surface soils was observed in the area surrounding the oil drums. Other, recent fly tipping comprising generally soils was observed between Sparks Road and the former workshop.

Photo 7 – Fly tipping (including drums containing turbine oil), Pit 102 located in the foreground

Photo 8 – Waste materials excavated from Pit 108

Table 2 below provides a summary of the investigation/sampling locations, the potential contaminants of concern and the soil analytical laboratory program undertaken.

Table 2: Investigation/Sampling Locations and Potential Contaminants of Concern

Investigation Location / ID	Location / Reason	Soil Laboratory Program
100FC	Former "Heli Aust" operations / Fibrous cement fragments on "Heli Aust" slab	Asbestos
101	Former "Heli Aust" operations / Former storage area identified in PLCA (Ref 1)	Heavy Metals, TRH, BTEX, PAH, VOC, Phenols & Asbestos
102	Former "Heli Aust" operations / Fly tipping including partially filled oil drums (Photo 7)	Heavy Metals, TRH, BTEX, PAH, VOC & Phenols
103	Former "Heli Aust" operations / Adjacent to main entry to shed (Photo 6)	Heavy Metals, TRH, BTEX, PAH, Phenols & Asbestos
104	Former "Heli Aust" operations / Down slope of operations and adjacent to in-ground water storage tank	Heavy Metals, TRH, BTEX & PAH
105	Former "Heli Aust" operations / Down slope of sealed operational area	Heavy Metals, OCP, OPP, TRH, BTEX, PAH & PCB
106	Former "Heli Aust" operations / Adjacent to sealed operational area	Heavy Metals, OCP, OPP, TRH, BTEX, PAH, PCB, VOC & Phenols
107	Former "Heli Aust" operations / Shallow drainage depression diverting surface water towards nearby dam	Heavy Metals, OCP, OPP, TRH, BTEX, PAH, PCB & VOC
108	Former "Heli Aust" operations / Shallow drainage depression diverting surface water towards nearby dam (filling encountered)	Heavy Metals, OCP, OPP, TRH, BTEX, PAH, PCB, VOC, Phenols & Asbestos
109Sed	Buttonderry Creek adjacent eastern site boundary / Outflow point from site, sediment sample	Heavy Metals, OCP, OPP, TRH, BTEX, PAH & PCB
109W	Buttonderry Creek adjacent eastern site boundary / Outflow point from site, surface water sample	Heavy Metals, TRH, BTEX PAH, pH TDS, Ammonia & Nitrate
110Sed	Buttonderry Creek adjacent western site boundary / Inflow point to site, sediment sample	Heavy Metals, OCP, OPP, TRH, BTEX, PAH, PCB & Asbestos
110W	Buttonderry Creek adjacent western site boundary / Inflow point to site, surface water sample	Heavy Metals, TRH, BTEX PAH, pH TDS, Ammonia & Nitrate
111Sed	Unnamed intermittent watercourse adjacent to North west site boundary / Inflow point to site, sediment sample	Heavy Metals, OCP, OPP, TRH, BTEX, PAH, PCB & Asbestos
111W	Unnamed intermittent watercourse adjacent to North west site boundary / Inflow point to site, surface water sample	Heavy Metals, TRH, BTEX PAH, pH TDS, Ammonia & Nitrate
112Sed	Unnamed intermittent watercourse adjacent to eastern site boundary / Outflow point from site, sediment sample (dry at the sampling)	Heavy Metals, OCP, OPP, TRH, BTEX, PAH & PCB
113Sed	Tributary of Buttonderry Creek adjacent south western site boundary / Inflow point to site, sediment sample	Heavy Metals, OCP, OPP, TRH, BTEX, PAH, PCB & Asbestos
113W	Tributary of Buttonderry Creek adjacent south western site boundary / Inflow point to site, surface water sample	Heavy Metals, TRH, BTEX PAH, pH TDS, Ammonia & Nitrate

Notes:
Heavy Metals = Arsenic, Cadmium, Copper, Chromium, Copper, Lead, Mercury, Nickel and Zinc
OCP = Organochlorine Pesticides, OPP = Organophosphorus Pesticides
TRH = Total Recoverable Hydrocarbons BTEX = Benzene, Toluene, Ethyl Benzene and total Xylenes
PAH = Polycyclic Aromatic Hydrocarbons
Asbestos = Identification of asbestos fibres in soil or building material fragment
VOC = Volatile Organic Compounds
TDS = Total Dissolved Solids

With respect to the CA, a targeted sampling regime was adopted, such that intrusive investigations were limited to areas requiring further assessment as identified in Reference 1. Therefore, with respect to the Targeted Phase 2 Contamination Assessment the number of sampling locations undertaken is less than the minimum number of sampling locations required for site characterisation in accordance with NSW EPA *Sample Design Guidelines* (Ref 2) based on a systematic sampling pattern.

7.2 Field Work Methods

Environmental sampling was performed according to standard operating procedures outlined in the DP Field Procedures Manual.

7.2.1 Soil Sampling

The test pits were excavated using a 4 tonne excavator fitted with a 450 mm wide bucket.

The general sampling procedure comprised the following:

- collection of soil samples directly from the excavator bucket or test pit wall using disposable gloves or stainless steel sampling equipment. Due to the low water levels in the intermittent watercourses sediment samples were collected using the stainless steel sampling equipment. Care was taken to remove any extraneous material deposited on the excavator bucket or trowel before the samples were collected;
- changing of disposable gloves between each sampling event to prevent cross contamination;
- decontaminating all sampling equipment using a 3% solution of phosphate free detergent (Decon 90) and tap water prior to collecting each sample;
- transferring samples into laboratory-prepared glass jars and capping immediately;
- collection of replicate samples in zip-lock plastic bags for screening of samples using a calibrated photoionisation detector (PID). The PID is capable of detecting a wide range of volatile hydrocarbons and solvents, and the PID reading provdes a qualitative indication for the presence of these contaminants in a sample;
- labelling sample containers with individual and unique identification, including project number, sample location and sample depth;

- placing the glass jars into a cooled, insulated and sealed container while on site; and
- Use of chain of custody (COC) documentation ensuring that sample tracking and custody could be cross-checked at any point in the transfer of samples from the field to the laboratory.

7.2.2 Surface Water Sampling

Surface water samples were collected directly into the laboratory prepared containers for analysis. Samples were collected under strict QA/QC protocols and were delivered to the laboratory within the recommended holding times for analysis. New sampling equipment (gloves) was used to minimise the potential for cross-contamination.

7.3 Field Work Results and Observations

Results of the field work are summarised below and are included in the test pit report sheets and sample register presented in Appendix B. These reports should be read in conjunction with the attached notes which define the descriptive terms and classification methods used. The summary of subsurface conditions encountered broadly across the site during the concurrent geotechnical investigation (Ref 3) is presented in Section 4.3.

The pits undertaken as part of the CA targeting the former “Heli Aust” operations encountered slightly varied conditions. Conditions encountered during the intrusive investigations can be generalised as follows:

FILLING: Filling was encountered in all of the pit locations, with the filling ranging in thickness from 0.1 m to 1.3 m. The filling encountered in Pits 101, 102, 103 and 107 comprised a hardstand surface cover of silt or sand mixed with gravels. Pits 103 to 106 and 108 comprised a mix of yellow/brown/grey silty or sandy clay with some clayey sands. The filling encountered may have resulted from cutting and filling activities to create a level building platform although it was possible that some of the sand filling with sandstone gravels and cobbles was an imported quarried product.

SILT: Light grey brown sandy or clayey silt with trace rootlets was encountered at either the near surface or directly underlying the filling in Pits 101, 104 and 105. The the silt ranged in thickness from 0.2 m to 0.5 m.

SILTY CLAY: Grey mottled red/brown high plasticity silt clay with some ironstone gravels was encountered in all pits (except Pit 108) and the silty clays generally extended to depths of greater than 1.5 m.

SANDSTONE: Extremely weathered light grey sandstone was only encountered in one pit (Pit 101) at a depth 1.55 m.

Groundwater seepage was not encountered in any of the investigation locations during test pitting, with the exception of Pit 108 where some seepage was encountered within the filling at a depth of 1.3 m. This seepage was probably related to the inclusions within the filling below 1.3 m and also the proximity of the pit to the nearby dam. Further it should be noted that groundwater levels are affected by climatic conditions and soil permeability and will therefore vary with time.

With the exception of Pit 108 and the gravel inclusions at the ground surface in some of the pits no signs of deleterious inclusions were observed. Pit 108 encountered a clayey silt filling mixed with waste materials including fibrous cement pipe fragments, possibly containing asbestos, timber, rail ballast and plastic to the maximum depth of the pit (1.7 m).

In addition to the test pits targeting the former “Heli Aust” operations, five sediment samples and four surface water samples were collected from the intermittent watercourses bisecting the site to assess the possible run-on of contaminated materials Buttonderry Landfill. Descriptions of each of the samples collected are provided below:

- Location 109 – The sediment sample was described as brown clayey silt with organic matter and trace sand. No significant quantities of garbage or storm debris was located in the vicinity of the sampling location. Surface water was flowing at the time of sampling.
- Location 110 – The sediment sample was described as brown clayey silt with organic matter and trace sand. Minor quantities of garbage or storm debris was located in the vicinity of the sampling location. Surface water was flowing at the time of sampling.

- Location 111 – The sediment sample was described as brown clayey silt with organic matter and trace sand. No significant quantities of garbage or storm debris was located in the vicinity of the sampling location. Surface water was not flowing but had ponded within the alignment.
- Location 112 – The sediment sample was described as brown silty clay with rootlets. No significant quantities of garbage or storm debris was located in the vicinity of the sampling location. No surface water was present at the sampling location.
- Location 113 – The sediment sample was described as brown clayey silt with gravels and trace sand. No significant quantities of garbage or storm debris was located in the vicinity of the sampling location. Surface water was not flowing but had ponded within the drain.

7.3.1 Photoionisation Detector Results

Replicates for all samples were collected in plastic bags and allowed to equilibrate under ambient temperatures before screening for Total Photoionisable Compounds (TOPIC) using a Photoionisation Detector (PID). The PID was calibrated prior to use, using ambient air as the "zero" air (0.0 ppm) and isobutylene at a concentration of 100 ppm as the calibration "span" gas.

Field measurement of volatile organic compounds (VOCs) indicated low results ranging between 0.0 – 0.3 ppm. The recorded readings were considered typical of background levels. The results of sample screening are shown on the test pit logs or sample register in *Appendix B*.

8 LABORATORY TESTING

8.1 Soil Laboratory Results

All soil samples were sent to SGS Environmental Services Pty Ltd (SGS), a NATA accredited analytical laboratory. Analytical methods used are shown in the laboratory report presented in Appendix C.

A total of 16 soil samples (including 2 QA/QC samples) were selected to provide an assessment of site contamination conditions. Selected samples were analysed for the following suite of potential contaminants:

- Metals: Arsenic; Cadmium; Chromium; Copper; Lead; Mercury; Nickel; Zinc;
- Total Recoverable Hydrocarbons (TRH);
- Benzene, Toluene, Ethyl Benzene, Xylene (BTEX);
- Polycyclic Aromatic Hydrocarbons (PAH);
- Organochlorine Pesticides (OCP);
- Organophosphorus Pesticides (OPP);
- Polychlorinated Biphenyls (PCB);
- Volatile Organic Compounds (VOC);
- Phenols; and
- Asbestos identification in soil.

Two samples of a building material fragment (sample ID: 100/FC & 108/FC) were also tested for asbestos identification.

Soil Quality Control/Quality Assurance (QA/QC) testing comprised:

- one soil replicate sample (QA101) tested for selected chemical contaminants specified above; and
- one equipment rinsate blank tested for selected chemical contaminants specified above.

The QA/QC procedures and results are discussed in Appendix D.

The laboratory test results are summarised below in Tables 3, 4 and 5. Detailed laboratory test report sheets are presented as Appendix C.

Table 3 - Results of Soil Analysis for Metals & Asbestos

Sample Identification	Depth (m)	PID (ppm)	Metal								Asbestos Identification
			As	Cd	Cr	Cu	Pb	Hg	Ni	Zn	
101/0.1	0.1	0.0	<PQL	2.7	16	49	25	<PQL	77	100	No asbestos detected
102/0.1	0.1	0.3	4	1.5	9.1	15	11	<PQL	12	56	NT
QA101	0.1	0.3	3	1.4	9.1	16	11	<PQL	13	62	NT
103/0.1	0.1	0.0	<PQL	2.5	12	14	44	<PQL	16	37	No asbestos detected
104/0.1	0.1	0.0	4	<PQL	9.7	4.2	11	<PQL	4.1	30	NT
105/0.1	0.1	0.0	<PQL	<PQL	2.7	5.5	10	<PQL	1.3	16	NT
106/0.1	0.1	0.0	9	0.8	16	10	15	<PQL	3.2	14	NT
107/0.1	0.1	0.0	<PQL	0.4	17	13	7	<PQL	14	50	NT
108/0.1	0.1	0.0	5	<PQL	6.5	1.2	8	<PQL	1.1	5.2	No asbestos detected
108/1.5	1.5	0.0	7	0.4	15	16	17	<PQL	2.7	27	No asbestos detected
108/FC	1.5	NT	NT	NT	NT	NT	NT	NT	NT	NT	***Chrysotile & Amosite asbestos detected***
109Sed	0.1	0.0	6	0.5	11	13	12	<PQL	10	65	NT
110Sed	0.1	0.2	6	0.5	11	14	16	<PQL	12	80	No asbestos detected
111Sed	0.1	0.2	6	<PQL	13	11	28	<PQL	9	66	No asbestos detected
112Sed	0.1	0.1	4	<PQL	13	5.3	16	<PQL	6.4	24	NT
113Sed	0.1	0.0	5	<PQL	16	3.9	9.8	<PQL	4.7	15	No asbestos detected
100/FC	0.0	NT	NT	NT	NT	NT	NT	NT	NT	NT	No asbestos detected
Laboratory PQL			3	0.3	0.3	0.5	1	0.05	0.5	0.5	-
NSW EPA - NEHF F [2] (Ref 7)			500	100	500	5000	1500	75	3000	35000	[4] Free of Asbestos
NSW EPA Criteria for Service Station Sites [3] (Ref 8)			NC	NC	NC	NC	300	NC	NC	NC	
NEPM - Background Ranges (Ref 10)			1-50	1	1-40	2-100	2-200	0.03	5-500	10-300	
NSW EPA - General Solid Waste Guidelines - CT1 (Ref 9)			100	20	100	NC	100	4	40	NC	

Notes:

All results in mg/kg on a dry weight basis
PQL - Practical Quantification Limits
NC - No Criteria
NT - Not Tested
N/A - Not Applicable
PID - Photoionisation Detector
1 - Human Health Based Protection Level.
2 - Health Based Criteria for Commercial or Industrial Land use
3 - Threshold Concentration for Sensitive Land Use
4 - Correspondence from NSW EPA Director of Contaminated Sites

Exceeds Health Based Criteria for NEHF F
Exceeds General Solid Waste Guidelines without leachability testing

Table 4 - Results of Soil Analysis for TRH/BTEX & VOC

Sample Identification	Depth (m)	PID (ppm)	Analyte								
			TRH				BTEX				Total VOC
			C_6 - C_9	C_{10} - C_{14}	C_{15} - C_{28}	C_{29} - C_{36}	Benzene	Toluene	Ethyl Benzene	Xylene	
101/0.1	0.1	0.0	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
102/0.1	0.1	0.3	<PQL	**310**	**28000**	**1400**	<PQL	<PQL	<PQL	<PQL	NT
QA101	0.1	0.3	<PQL	**310**	**23000**	**1100**	<PQL	<PQL	<PQL	<PQL	NT
103/0.1	0.1	0.0	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	NT
104/0.1	0.1	0.0	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	NT
105/0.1	0.1	0.0	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	NT
106/0.1	0.1	0.0	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
107/0.1	0.1	0.0	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
108/0.1	0.1	0.0	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	NT
108/1.5	1.5	0.0	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
108/FC	1.5	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
109Sed	0.1	0.0	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	NT
110Sed	0.1	0.2	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	NT
111Sed	0.1	0.2	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	NT
112Sed	0.1	0.1	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	NT
113Sed	0.1	0.0	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	NT
100/FC	0.0	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Laboratory PQL			20	20	50	50	0.5	0.5	0.5	1.5	0.5/10
NSW EPA - NEHF F [2] (Ref 7)			NC	NC			NC	NC	NC	NC	NC
NSW EPA Criteria for Service Station Sites [3] (Ref 8)			65	1000 total			1	1.4/130 [1]	3.1/50 [1]	14/25 [1]	NC
NEPM - Background Ranges (Ref 10)			NC	NC			NC	NC	NC	NC	NC
NSW EPA - General Solid Waste Guidelines - CT1 (Ref 9)			650 SCC1	10000 total SCC1			10	288	600	1000	NC

Notes:

All results in mg/kg on a dry weight basis
PQL - Practical Quantification Limits
NC - No Criteria
NT - Not Tested
N/A - Not Applicable
PID - Photoionisation Detector
1 - Human Health Based Protection Level.
2 - Health Based Criteria for Commercial or Industrial Land use
3 - Threshold Concentration for Sensitive Land Use
SCC - Specific Contaminant Concentration
CT - Concentration Threshold
Exceeds Health Based Criteria for NEHF F
Exceeds General Solid Waste Guidelines without leachability testing

Table 5 - Results of Soil Analysis for Various Organic Compounds (all results in mg/kg)

Sample Identification	Depth (m)	PID (ppm)	Total +ve PAH	Benzo(a) Pyrene	Total Phenols	PCB	Total OCP	Aldrin + Dieldrin	Chlordane	DDT	Heptachlor	Total OPP
101/0.1	0.1	0.0	<PQL	<PQL	<PQL	NT	NT	NT	NT	NT	NT	NT
102/0.1	0.1	0.3	<PQL	<PQL	0.3	NT	NT	NT	NT	NT	NT	NT
QA101	0.1	0.3	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
103/0.1	0.1	0.0	<PQL	<PQL	<PQL	NT	NT	NT	NT	NT	NT	NT
104/0.1	0.1	0.0	<PQL	<PQL	NT	NT	NT	NT	NT	NT	NT	NT
105/0.1	0.1	0.0	<PQL	<PQL	NT	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
106/0.1	0.1	0.0	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
107/0.1	0.1	0.0	<PQL	<PQL	NT	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
108/0.1	0.1	0.0	<PQL	<PQL	NT	NT	NT	NT	NT	NT	NT	NT
108/1.5	1.5	0.0	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
108/FC	1.5	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
109Sed	0.1	0.0	<PQL	<PQL	NT	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
110Sed	0.1	0.2	<PQL	<PQL	NT	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
111Sed	0.1	0.2	0.91	0.11	NT	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
112Sed	0.1	0.1	<PQL	<PQL	NT	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
113Sed	0.1	0.0	<PQL	<PQL	NT	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL
100/FC	0.0	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT
Laboratory PQL			0.1/0.2	0.05	0.1	0.1/0.9	0.1/2.5	0.1/0.2	0.1/0.2	0.1/0.2	0.1	0.1/0.4
NSW EPA - NEHF F [2] (Ref 7)			100	5	42500	50	NC	50	250	1000	50	NC
NSW EPA Criteria for Service Station Sites [3] (Ref 8)			20	1	NC	NC	NC	NC	NC	NC	NC	NC
NEPM - Background Ranges (Ref 10)			NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
NSW EPA - General Solid Waste Guidelines - CT1 (Ref 9)			200 SCC1	0.08	288	2 SCC1	50	NC	NC	NC	NC	NC

Notes:

All results in mg/kg on a dry weight basis
PQL - Practical Quantification Limits
NC - No Criteria
NT - Not Tested
N/A - Not Applicable
PID - Photoionisation Detector
1 - Health Based Criteria for Various Land Uses
2 - Health Based Criteria for Commercial or Industrial Land use
3 - Threshold Concentration for Sensitive Land Use
SCC - Specific Contaminant Concentration
CT - Concentration Threshold
Exceeds Health Based Criteria for NEHF F
Exceeds General Solid Waste Guidelines without leachability testing

8.2 Surface Water Laboratory Results

All surface water samples were sent to SGS. Analytical methods used are shown on the laboratory sheets in Appendix C. A total of five samples (including one QA/QC sample) were analysed for the following suite of potential contaminants:

- Metals: Arsenic; Cadmium; Chromium; Copper; Lead; Mercury; Nickel; Zinc;
- Total Recoverable Hydrocarbons;
- Benzene, Toluene, Ethyl Benzene, Xylene;
- Polycyclic Aromatic Hydrocarbons;
- pH;
- Total Dissolved Solids (TDS)
- Ammonia; and
- Nitrate.

Quality Control/Quality Assurance testing comprised one field replicate sample tested for metals only. Results of the QA/QC samples are discussed in Appendix D.

The surface water test results are summarised below in Table 6.

Table 6 - Laboratory Results for Groundwater

Sample Identification	109W	QAW1	110W	111W	113W	RB101	Laboratory PQL	Australian Drinking Water Guidelines - Health Based (mg/L)	ANZECC (2000) - Trigger Values	
									Slightly to Moderately disturbed systems Fresh	Irrigation Waters
Metals										
As	<PQL	0.001	<PQL	0.001	<PQL	<PQL	0.001	0.007	0.013 (14)	0.1 (5)
Cd	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.0001	0.002	0.0002	0.01 (5)
Cr	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	0.001	NC (12)	NC (12)	NC (12)
Cu	<PQL	<PQL	<PQL	<PQL	0.0026	<PQL	0.001	2	0.0014	0.2 (5)
Ni	0.003	0.0037	0.0035	0.0033	0.0012	<PQL	0.001	0.02	0.011	0.2 (5)
Pb	<PQL	<PQL	<PQL	<PQL	0.0018	<PQL	0.001	0.01	0.0034	2 (5)
Zn	0.0025	0.0023	0.0011	0.0039	0.0047	0.0045	0.001	NC	0.008	2 (5)
Hg	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	0.0005	0.0001	0.0006 (15)	0.002 (5)
TRH										
C_6 - C_9	<PQL	NT	<PQL	<PQL	<PQL	<PQL	0.04	NC	NC	NC
C_{10} - C_{14}	<PQL	NT	<PQL	<PQL	<PQL	<PQL	0.1	NC	NC	NC
C_{15} - C_{28}	<PQL	NT	<PQL	<PQL	<PQL	<PQL	0.2	NC	NC	NC
C_{29} - C_{36}	<PQL	NT	<PQL	<PQL	<PQL	<PQL	0.2	NC	NC	NC
BTEX										
Benzene	<PQL	NT	<PQL	<PQL	<PQL	<PQL	0.001	0.001	0.95	NC
Toluene	<PQL	NT	<PQL	<PQL	<PQL	<PQL	0.001	0.8	NC	NC
Ethyl Benzene	<PQL	NT	<PQL	<PQL	<PQL	<PQL	0.001	0.3	NC	NC
Xylene	<PQL	NT	<PQL	<PQL	<PQL	<PQL	0.003	0.6	0.2 (16)	NC
PAHs										
Total +ve PAHs	<PQL	NT	<PQL	<PQL	<PQL	NT	0.008	NC	NC	NC
Naphthalene	<PQL	NT	<PQL	<PQL	<PQL	NT	0.0005	NC	0.016	NC
Benzo(a)pyrene	<PQL	NT	<PQL	<PQL	<PQL	NT	0.0005	0.00001	NC	NC
pH	7	NT	7.2	**6.4**	**5.8**	NT	0.01	6.5-8.5 (13)	6.5-8.5 (1)	>6 (7)
Total Dissolved Solids	300	NT	170	170	600	NT	5	NC	NC	1000 - 7500 (3)
NH_3 (Ammonia)	0.14	NT	0.19	0.04	0.06	NT	0.01	0.5 (13)	0.9	NC
NO_3 (Nitrate)	<PQL	NT	<PQL	<PQL	<PQL	NT	0.05	50	0.7	NC

Notes:

Results expressed in mg/L unless otherwise stated

PQL - Practical Quantification Limits

(1) - Trigger Values for physical and chemical stressors for south-east Australia for Slightly Disturbed Ecosystems (Table 3.3.2)

(2) - For Freshwater Lakes and Reservoirs (Conservative)

(3) - Tolerance value of Clover (Conservative Value for Pastures)

(5) - Long Term Trigger Values (up to 100 yrs)

(6) - To minimse bioclogging of irrigation equipment

(7) - Trigger Values for assessing corrosiveness of water

(12) - Chromium (III)

(13) - Aesthetic Guideline Value

(14) - Arsenic (V) (conservative)

(15) - Mercury (Inorganic)

(16) - p-xylene (conservative)

NT - Not Tested

NC - No Criteria

NA - Not Applicable

Exceeds Anzecc 2000 Guidelines - Freshwaters

9 DISCUSSION OF RESULTS

A discussion of the analytical results (summarised in Section 8) for soils and surface waters are provided below.

9.1 Soil Inorganic Results

Fifteen soil/sediment samples were analysed for the following heavy metals – arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc. All concentrations of heavy metals were well below the health-based soil investigation levels for commercial/industrial land use (Ref 7).

Seven soil samples were tested for the presence of asbestos in soils. Asbestos fibres were not detected within the soil matrix of all samples analysed. One sample (100/FC) was collected from the fragments of fibrous cement scattered across the former "Heli Aust" workshop slab for asbestos identification. The sample analysed appeared to be representative in material type and appearance of the scattered fragments. The analytical result indicated that no asbestos was present in the fibrous cement fragment. One sample (108/FC) was collected from the fragments of fibrous cement observed in Pit 108 in the filling below 1.3 m. The analytical result indicated that chrysotile and amosite asbestos was present in the fibrous cement fragment.

Comparison of the heavy metal concentrations to the Waste Classification Guidelines (Table 1, Ref 9) indicates that inorganic chemical contaminant levels in the filling encountered in Pit 108 were low. Based on total contaminant chemical concentrations alone, the filling encountered in Pit 8 would be provisionally classifiable as "General Solid Waste", although given the presence of asbestos fragments the filling would need to be disposed of to a landfill licensed to accept "Asbestos Contaminated Waste". Comparison to the Waste Classification Guidelines (Ref 9) is only relevant when classifying materials for off-site disposal, and generally does not affect the soils suitability for the existing commercial/industrial land use.

9.2 Soil Organic Results

Fifteen soil samples were analysed for selected analytes including; TRH, BTEX, PAH, OCP, OPP, PCB, VOC and phenols.

All organic analytical results were below the health based soil investigation levels for a commercial/industrial land use (Ref 7) and the sensitive land use criteria for TRH and BTEX (Ref 8), with the exception of sample 102/0.1 (and replicate sample QA101) which reported TRH C_{10}-C_{36} concentrations of 29,710 mg/kg compared to threshold concentration of 1,000 mg/kg.

Further, it is noted that PAH, phenols, OCP, OPP and VOC concentrations were generally less than the laboratory practical quantification limits and, as such, less than the selected site assessment criteria level listed in Section 6. The exception was sediment sample 111Sed which reported detectable but low concentrations of PAH.

Comparison of the total concentrations to the Waste Classification Guidelines (Ref 9) indicates that all organic contaminant levels in the soils at the site were generally less than the "General Solid Waste" threshold values, although due to the presence of asbestos fragments in the filling in Pit 108 any filling material excavated from this area would be classified as "Asbestos Contaminated Waste". Furthermore, the TRH contaminated surface soils identified at Pit 102 would be provisionally classified as "Restricted Solid Waste", although excavation, stockpiling and further *ex situ* waste characterisation from the stockpile may reduce this classification.

Again, this testing is relevant when classifying materials for off-site disposal to a licensed landfill, and generally does not affect the soils suitability for the existing commercial/commercial industrial land use.

9.3 Surface Water Inorganic Results

Five surface water samples were analysed for selected analytes including; heavy metals - arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc and other water quality parameters such as pH, TDS, Ammonia and Nitrate.

All concentrations of heavy metals were below the trigger values for the protection of 95% of species in freshwaters (Ref 11). Further testing of water quality parameters indicated that surface waters on site were neutral to slightly acidic with low salinity (TDS) and nutrient (Ammonia & Nitrate) levels. The slightly acidic surface water at locations 111 and 113 are not considered significant.

9.4 Surface Water Organic Results

Four surface water samples were analysed for selected analytes including; TRH, BTEX and PAH. All concentrations of organic compounds were below the laboratory PQL and the trigger values for the protection of 95% of species in freshwaters (Ref 11).

10 CONCLUSIONS & RECOMMENDATIONS

DP has undertaken a Targeted Phase 2 Contamination Assessment (CA) of the site identified as the Warner Industrial Park, located at the corner of Hue Hue Road and Sparks Road, Warnervale NSW to assess the AEC recommended in the updated PCLA (Ref 1) for further assessment. The AEC identified at the site comprised:

- The "Heli Aust" helicopter operation on Lot 15 DP259530; and
- Potential run-on of contaminated materials from Buttonderry Landfill and its approaches on the NW corner of Lot 8 DP239704.

It is understood that the work was required to assess the suitability of the site, from a contamination perspective, for a proposed industrial land use.

The CA comprised a site inspection of the AEC and intrusive investigations (eight test pits, five sediment sampling locations and four surface water sampling locations) targeting the identified AEC.

DP completed a geotechnical investigation (Ref 3) at the site concurrently with the CA. Based on the observations and results the geotechnical investigation a number data gaps were identified that would require further assessment prior to or during redevelopment of the site. The data gaps identified included:

- Buried waste materials encountered in geotechnical Test Pit 6 (and Pit 6a).
- Significant quantity of filling placed in the south-eastern corner of Lot 5 in DP259531. The filling was understood to have been won from excavations in connection with the construction of the F3 freeway;
- Filling platforms, regraded areas and general rural activities surrounding a number of the existing or former residences/buildings; and

- Waste materials and small stockpiles of soil scattered in a number of locations throughout the site.

The issues (or data gaps) outlined above are commonly encountered on rural properties that are being redeveloped and can be readily addressed prior to or during redevelopment of the site. Based on the observations made these data gaps would not materially change the overall compatabilty of the site for the proposed industrial land use, although the data gaps should be further assessed and remediated (if required).

The following conclusions are provided with regard to the CA:

- Subsurface conditions encountered in the former "Heli Aust" operation area comprised filling ranging in thickness from 0.1 to greater than 1.7 m. The filling encountered appeared to have resulted from construction of a building platform for the workshop. The filling appeared to generally comprise a mix of site sourced silty clay and some possibly imported quarried sandstone. Notwithstanding this, Pit 108 encountered variable filling below a depth of 1.3 m comprising soils mixed with waste materials including fibrous cement fragments. The fibrous cement fragments in Pit 108 were later determined by laboratory testing to contain asbestos fibres. Sediment samples collected from the drainage alignments comprised a mix of clay, silt, sand and gravel mixed with some organic matter.
- No significant soil odours or elevated PID results were noted at any of the investigation locations with PID results ranging between 0.0 – 0.3 ppm, although surface staining was noted in the vicinity of Pit 102 adjacent to "fly tipped" drums labelled as turbine oil. With the exception of waste materials encountered in Pit 108, no significant signs of deleterious inclusions were noted in the filling. Minor inclusions observed included clay roof tile fragments at the ground surface in Pit 101 and a single piece of timber and metal in the filling at Pit 103.
- Groundwater seepage was not encountered in any of the CA pit locations, with the exception of Pit 108 where some seepage was encountered within the filling at a depth of 1.3 m. This seepage was thought to be related to the inclusions within the filling below 1.3 m and also the proximity of the pit to the nearby dam.
- Fifteen soil/sediment samples and five surface water samples were analysed for the identified selected potential contaminants of concern. A sample of the fibrous cement fragments scattered across the former "Heli Aust" workshop slab and a fragment present in Pit 108 was also tested for asbestos.

- With respect to the CA, soil/sediment chemical contaminant levels were generally low, with levels less than the health-based assessment criteria for commercial/industrial land use (Ref 7 & 8) with the exception of TRH $C_{10} – C_{36}$ concentration encountered in the surface soils at Pit 102 (sample ID 102/0.1). The pit was positioned adjacent to drums labelled as turbine oil and also corresponded to an area of surface staining. No asbestos was detected in any of the soil samples tested as well as in the fibrous cement building material fragment collected from the workshop slab area. The fibrous cement fragment (sample ID 108/FC) encountered in the filling in Pit 108 at a depth of 1.5 m was reported to contain asbestos fibres.
- The based on the contaminant levels encountered the filling in Pit 108 would be provisionally classified as a Special Waste ("Asbestos Contaminated Waste") but could be disposed of to a "General Solid Waste" Landfill that is also licensed to accept "Asbestos Contaminated Waste". The TRH contaminated surface soils identified at Pit 102 would be provisionally classified as "Restricted Solid Waste", although excavation, stockpiling (bioremediation) and further ex-situ waste characterisation may reduce this classification.
- Surface water monitoring results were all below trigger values for the protection of 95% of species in freshwaters (Ref 11), with the exception of marginal exceedances for pH at locations 111 and 113 (pH results of 6.4 and 5.8, respectively). These marginal exceedances are not considered to be significant and do not indicate that contaminants were migrating onto site as a results of run-on of contaminated materials from Buttonderry Landfill.

In summary, based on the conclusions of the PLCA (Ref 1) and the Target Phase 2 Contamination Assessment the "Warner Industrial Park" site is considered to be generally compatible with the proposed industrial land use on the proviso that the "data gaps" identified in Section 5 are further assessed and remediated (if required) and also the areas identified to be contaminated (i.e. Pit 102 & Pit 108) are remediated and validated.

It is recommended that the most appropriate time to undertake further assessment and/or remedial works would be immediately following the completion of demolition works of the buildings present within each of the lots, but prior to the commencement of any bulk earthwork activities. Notwithstanding this, it is recommended that prior to demolition works a detailed site walkover is undertaken to identify and demarcate the areas requiring further assessment and/or remediation and immediately following the demolition undertake the recommended remedial works.

11 LIMITATIONS OF THIS REPORT

DP have performed investigation and consulting services for this project in general accordance with current professional and industry standards for land contamination investigation. It should be noted that this assessment is not intended for geotechnical purposes and the targeted contamination assessment was limited to the scope of work outline in DP's proposal (Reference 2258D, dated 21 February 2008). Whilst every effort has been made to ensure a representative programme of field and laboratory sampling and testing, conditions different to those identified during these tasks may exist. Therefore DP, or any other reputable consultant, cannot 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 over time in response to variations in natural conditions, chemical reactions and other events, eg. 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, which 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 and groundwater quality are frequently being reviewed and concentrations of contaminants which are considered acceptable in the present may in the future be considered unacceptable.

This report and associated documentation and the information herein have been prepared solely for the use of Warnervale Business Park Pty Ltd and MM Consultants Pty Ltd and any reliance assumed by other parties on this report shall be at such parties own risk. Any ensuing liability resulting from use of the report by other parties cannot be transferred to DP.

DOUGLAS PARTNERS PTY LTD Reviewed by

Brent Kerry **Lindsay Rockett**
Environmental Engineer / Associate Senior Associate

References:

1. Coffey Geotechnics Pty Ltd, Wyong Employment Zone, Precincts 11, 13, 14 & Airport Supplier Park Halloran, *Update Preliminary Land Contamination Assessment and Acid Sulphate Soil Assessment,* GO01665/02-AC, 15 May 2006.
2. NSW EPA*, Contaminated Sites: Sampling Design Guidelines,* September 1995*.*
3. Douglas Partners Pty Ltd, *Report on Preliminary Geotechnical Investigation, Proposed Warnervale Industrial Park, Corner of Hue Hue Road & Sparks Road, Warnervale*, 41615.00, May 2008.
4. Australian Standard: *Guide to the Sampling and Investigation of Potentially Contaminated Soil, Part 1: Non-Volatile and Semi-Volatile Compounds* (AS 4482.1).
5. Managing Land Contamination, *Planning Guidelines SEPP 55 – Remediation of Land*, 1998.
6. NSW EPA, *Contaminated Sites: Guidelines for Consultants Reporting on Contaminated Sites*, November 1997.
7. NSW EPA, *Contaminated Sites: Guidelines for the Site Auditor Scheme*, April 2006.
8. NSW EPA, *Contaminated Sites: Guidelines for Assessing Service Station Sites*, December 1994.
9. NSW DECC, *Waste Classification Guidelines, Part 1: Classifying Waste*, April 2008.
10. National Environment Protection Council Service Corporation, *National Environment Protection (Assessment of Site Contamination) Measure*, December 1999*.*
11. Australian and New Zealand Environment and Conservation Council (ANZECC) *Australian Guidelines for Water Quality Monitoring and Reporting*, 2000.

APPENDIX A

NOTES RELATING TO THIS REPORT & DRAWINGS

Douglas Partners
Geotechnics · Environment · Groundwater

NOTES RELATING TO THIS REPORT

Introduction

These notes have been provided to amplify the geotechnical report in regard to classification methods, specialist field procedures and certain matters relating to the Discussion and Comments section. Not all, of course, are necessarily relevant to all reports.

Geotechnical reports are based on information gained from limited subsurface test boring and sampling, supplemented by knowledge of local geology and experience. For this reason, they must be regarded as interpretive rather than factual documents, limited to some extent by the scope of information on which they rely.

Description and Classification Methods

The methods of description and classification of soils and rocks used in this report are based on Australian Standard 1726, Geotechnical Site Investigations Code. In general, descriptions cover the following properties - strength or density, colour, structure, soil or rock type and inclusions.

Soil types are described according to the predominating particle size, qualified by the grading of other particles present (eg. sandy clay) on the following bases:

Soil Classification	Particle Size
Clay	less than 0.002 mm
Silt	0.002 to 0.06 mm
Sand	0.06 to 2.00 mm
Gravel	2.00 to 60.00 mm

Cohesive soils are classified on the basis of strength either by laboratory testing or engineering examination. The strength terms are defined as follows.

Classification	Undrained Shear Strength kPa
Very soft	less than 12
Soft	12—25
Firm	25—50
Stiff	50—100
Very stiff	100—200
Hard	Greater than 200

Non-cohesive soils are classified on the basis of relative density, generally from the results of standard penetration tests (SPT) or Dutch cone penetrometer tests (CPT) as below:

Relative Density	SPT "N" Value (blows/300 mm)	CPT Cone Value (q_c — MPa)
Very loose	less than 5	less than 2
Loose	5—10	2—5
Medium dense	10—30	5—15
Dense	30—50	15—25
Very dense	greater than 50	greater than 25

Rock types are classified by their geological names. Where relevant, further information regarding rock classification is given on the following sheet.

Sampling

Sampling is carried out during drilling to allow engineering examination (and laboratory testing where required) of the soil or rock.

Disturbed samples taken during drilling provide information on colour, type, inclusions and, depending upon the degree of disturbance, some information on strength and structure.

Undisturbed samples are taken by pushing a thin-walled sample tube into the soil and withdrawing with a sample of the soil in a relatively undisturbed state. Such samples yield information on structure and strength, and are necessary for laboratory determination of shear strength and compressibility. Undisturbed sampling is generally effective only in cohesive soils.

Details of the type and method of sampling are given in the report.

Drilling Methods.

The following is a brief summary of drilling methods currently adopted by the Company and some comments on their use and application.

Test Pits — these are excavated with a backhoe or a tracked excavator, allowing close examination of the in-situ soils if it is safe to descent into the pit. The depth of penetration is limited to about 3 m for a backhoe and up to 6 m for an excavator. A potential disadvantage is the disturbance caused by the excavation.

Large Diameter Auger (eg. Pengo) — the hole is advanced by a rotating plate or short spiral auger, generally 300 mm or larger in diameter. The cuttings are returned to the surface at intervals (generally of not more than 0.5 m) and are disturbed but usually unchanged in moisture content. Identification of soil strata is generally much more reliable than with continuous spiral flight augers, and is usually supplemented by occasional undisturbed tube sampling.

Continuous Sample Drilling — the hole is advanced by pushing a 100 mm diameter socket into the ground and withdrawing it at intervals to extrude the sample. This is the most reliable method of drilling in soils, since moisture content is unchanged and soil structure, strength, etc. is only marginally affected.

Continuous Spiral Flight Augers — the hole is advanced using 90—115 mm diameter continuous spiral flight augers which are withdrawn at intervals to allow

sampling or in-situ testing. This is a relatively economical means of drilling in clays and in sands above the water table. Samples are returned to the surface, or may be collected after withdrawal of the auger flights, but they are very disturbed and may be contaminated. Information from the drilling (as distinct from specific sampling by SPTs or undisturbed samples) is of relatively lower reliability, due to remoulding, contamination or softening of samples by ground water.

Non-core Rotary Drilling — the hole is advanced by a rotary bit, with water being pumped down the drill rods and returned up the annulus, carrying the drill cuttings. Only major changes in stratification can be determined from the cuttings, together with some information from 'feel' and rate of penetration.

Rotary Mud Drilling — similar to rotary drilling, but using drilling mud as a circulating fluid. The mud tends to mask the cuttings and reliable identification is again only possible from separate intact sampling (eg. from SPT).

Continuous Core Drilling — a continuous core sample is obtained using a diamond-tipped core barrel, usually 50 mm internal diameter. Provided full core recovery is achieved (which is not always possible in very weak rocks and granular soils), this technique provides a very reliable (but relatively expensive) method of investigation.

Standard Penetration Tests

Standard penetration tests (abbreviated as SPT) are used mainly in non-cohesive soils, but occasionally also in cohesive soils as a means of determining density or strength and also of obtaining a relatively undisturbed sample. The test procedure is described in Australian Standard 1289, "Methods of Testing Soils for Engineering Purposes" — Test 6.3.1.

The test is carried out in a borehole by driving a 50 mm diameter split sample tube under the impact of a 63 kg hammer with a free fall of 760 mm. It is normal for the tube to be driven in three successive 150 mm increments and the 'N' value is taken as the number of blows for the last 300 mm. In dense sands, very hard clays or weak rock, the full 450 mm penetration may not be practicable and the test is discontinued.

The test results are reported in the following form.

- In the case where full penetration is obtained with successive blow counts for each 150 mm of say 4, 6 and 7

  as 4, 6, 7
  N = 13

- In the case where the test is discontinued short of full penetration, say after 15 blows for the first 150 mm and 30 blows for the next 40 mm

  as 15, 30/40 mm.

The results of the tests can be related empirically to the engineering properties of the soil.

Occasionally, the test method is used to obtain samples in 50 mm diameter thin walled sample tubes in clays. In such circumstances, the test results are shown on the borelogs in brackets.

Cone Penetrometer Testing and Interpretation

Cone penetrometer testing (sometimes referred to as Dutch cone — abbreviated as CPT) described in this report has been carried out using an electrical friction cone penetrometer. The test is described in Australian Standard 1289, Test 6.4.1.

In the tests, a 35 mm diameter rod with a cone-tipped end is pushed continuously into the soil, the reaction being provided by a specially designed truck or rig which is fitted with an hydraulic ram system. Measurements are made of the end bearing resistance on the cone and the friction resistance on a separate 130 mm long sleeve, immediately behind the cone. Transducers in the tip of the assembly are connected by electrical wires passing through the centre of the push rods to an amplifier and recorder unit mounted on the control truck.

As penetration occurs (at a rate of approximately 20 mm per second) the information is plotted on a computer screen and at the end of the test is stored on the computer for later plotting of the results.

The information provided on the plotted results comprises: —

- Cone resistance — the actual end bearing force divided by the cross sectional area of the cone — expressed in MPa.
- Sleeve friction — the frictional force on the sleeve divided by the surface area — expressed in kPa.
- Friction ratio — the ratio of sleeve friction to cone resistance, expressed in percent.

There are two scales available for measurement of cone resistance. The lower scale (0—5 MPa) is used in very soft soils where increased sensitivity is required and is shown in the graphs as a dotted line. The main scale (0—50 MPa) is less sensitive and is shown as a full line.

The ratios of the sleeve friction to cone resistance will vary with the type of soil encountered, with higher relative friction in clays than in sands. Friction ratios of 1%—2% are commonly encountered in sands and very soft clays rising to 4%—10% in stiff clays.

In sands, the relationship between cone resistance and SPT value is commonly in the range:—

q_c (MPa) = (0.4 to 0.6) N (blows per 300 mm)

In clays, the relationship between undrained shear strength and cone resistance is commonly in the range:—

q_c = (12 to 18) c_u

Interpretation of CPT values can also be made to allow estimation of modulus or compressibility values to allow calculation of foundation settlements.

Inferred stratification as shown on the attached reports is assessed from the cone and friction traces and from experience and information from nearby boreholes, etc. This information is presented for general guidance, but must be regarded as being to some extent interpretive. The test method provides a continuous profile of engineering properties, and where precise information on

soil classification is required, direct drilling and sampling may be preferable.

Hand Penetrometers

Hand penetrometer tests are carried out by driving a rod into the ground with a falling weight hammer and measuring the blows for successive 150 mm increments of penetration. Normally, there is a depth limitation of 1.2 m but this may be extended in certain conditions by the use of extension rods.

Two relatively similar tests are used.

- Perth sand penetrometer — a 16 mm diameter flat-ended rod is driven with a 9 kg hammer, dropping 600 mm (AS 1289, Test 6.3.3). This test was developed for testing the density of sands (originating in Perth) and is mainly used in granular soils and filling.
- Cone penetrometer (sometimes known as the Scala Penetrometer) — a 16 mm rod with a 20 mm diameter cone end is driven with a 9 kg hammer dropping 510 mm (AS 1289, Test 6.3.2). The test was developed initially for pavement subgrade investigations, and published correlations of the test results with California bearing ratio have been published by various Road Authorities.

Laboratory Testing

Laboratory testing is carried out in accordance with Australian Standard 1289 "Methods of Testing Soil for Engineering Purposes". Details of the test procedure used are given on the individual report forms.

Bore Logs

The bore logs presented herein are an engineering and/or geological interpretation of the subsurface conditions, and their reliability will depend to some extent on frequency of sampling and the method of drilling. Ideally, continuous undisturbed sampling or core drilling will provide the most reliable assessment, but this is not always practicable, or possible to justify on economic grounds. In any case, the boreholes represent only a very small sample of the total subsurface profile.

Interpretation of the information and its application to design and construction should therefore take into account the spacing of boreholes, the frequency of sampling and the possibility of other than 'straight line' variations between the boreholes.

Ground Water

Where ground water levels are measured in boreholes, there are several potential problems;

- In low permeability soils, ground water although present, may enter the hole slowly or perhaps not at all during the time it is left open.
- A localised perched water table may lead to an erroneous indication of the true water table.
- Water table levels will vary from time to time with seasons or recent weather changes. They may not be the same at the time of construction as are indicated in the report.
- The use of water or mud as a drilling fluid will mask any ground water inflow. Water has to be blown out of the hole and drilling mud must first be washed out of the hole if water observations are to be made.

More reliable measurements can be made by installing standpipes which are read at intervals over several days, or perhaps weeks for low permeability soils. Piezometers, sealed in a particular stratum, may be advisable in low permeability soils or where there may be interference from a perched water table.

Engineering Reports

Engineering reports are prepared by qualified personnel and are based on the information obtained and on current engineering standards of interpretation and analysis. Where the report has been prepared for a specific design proposal (eg. a three storey building), the information and interpretation may not be relevant if the design proposal is changed (eg. to a twenty storey building). If this happens, the Company will be pleased to review the report and the sufficiency of the investigation work.

Every care is taken with the report as it relates to interpretation of subsurface condition, discussion of geotechnical aspects and recommendations or suggestions for design and construction. However, the Company cannot always anticipate or assume responsibility for:

- unexpected variations in ground conditions — the potential for this will depend partly on bore spacing and sampling frequency
- changes in policy or interpretation of policy by statutory authorities
- the actions of contractors responding to commercial pressures.

If these occur, the Company will be pleased to assist with investigation or advice to resolve the matter.

Site Anomalies

In the event that conditions encountered on site during construction appear to vary from those which were expected from the information contained in the report, the Company requests that it immediately be notified. Most problems are much more readily resolved when conditions are exposed than at some later stage, well after the event.

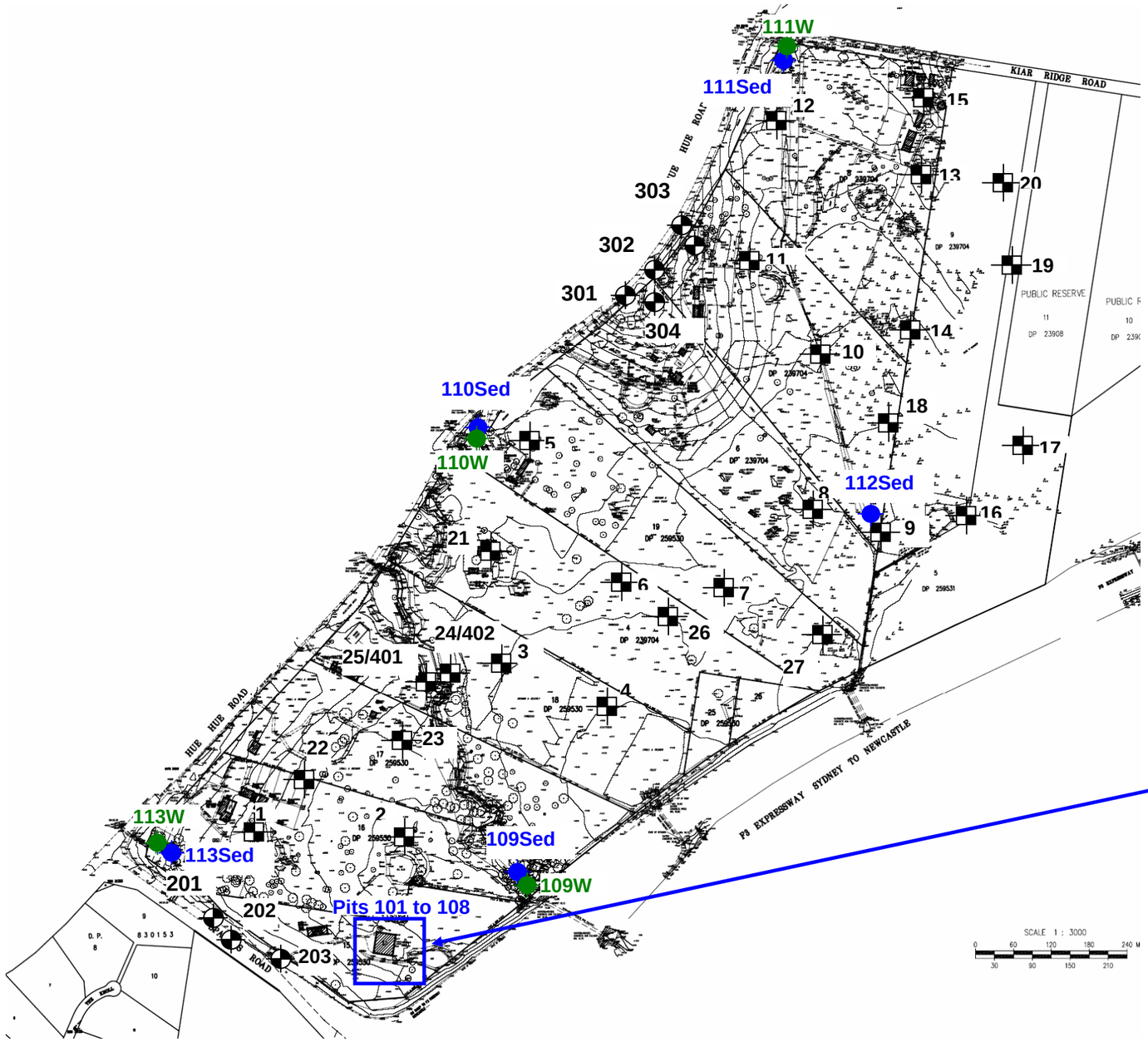
Reproduction of Information for Contractual Purposes

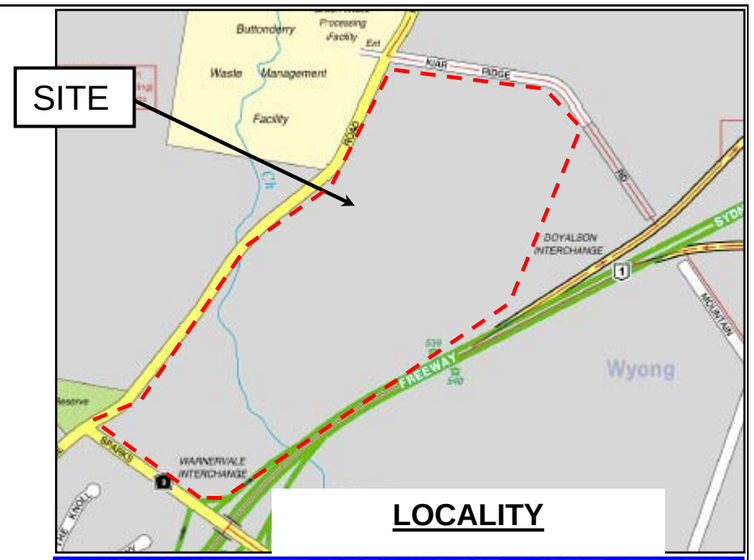
Attention is drawn to the document "Guidelines for the Provision of Geotechnical Information in Tender Documents", published by the Institution of Engineers,

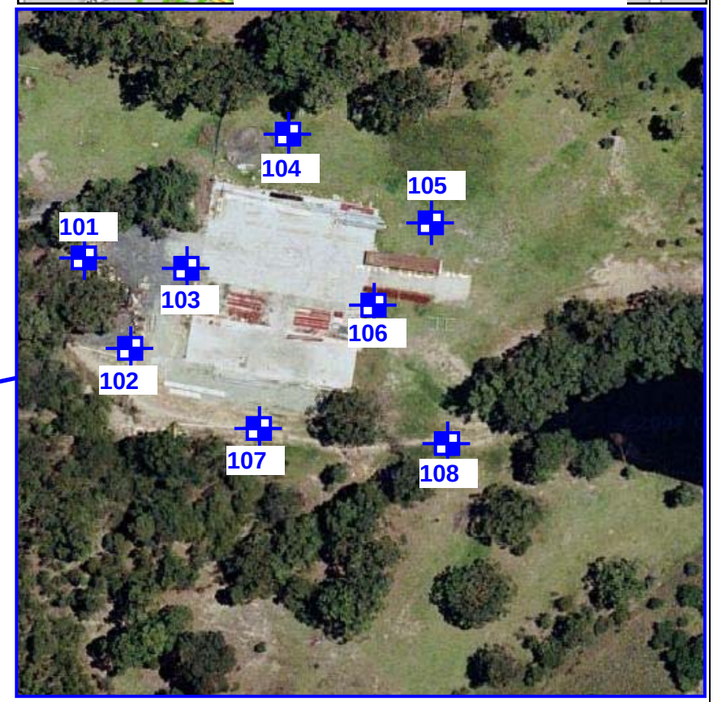
Australia. Where information obtained from this investigation is provided for tendering purposes, it is recommended that all information, including the written report and discussion, be made available. In circumstances where the discussion or comments section is not relevant to the contractual situation, it may be appropriate to prepare a specially edited document. The Company would be pleased to assist in this regard and/or to make additional report copies available for contract purposes at a nominal charge.

Site Inspection

The Company will always be pleased to provide engineering inspection services for geotechnical aspects of work to which this report is related. This could range from a site visit to confirm that conditions exposed are as expected, to full time engineering presence on site.







NOTES

1. Test locations are approximate only and are shown with reference to existing site features.
2. Drawing adapted from plan provided by Trehy Ingold Neate & Aerial Photograph sourced from Google Maps Web Site

LEGEND

- Approximate Geotechnical Test Bore Location
- Approximate Geotechnical Test Pit Location
- Approximate Contamination Test Pit Location
- Approximate Contamination Sediment Sampling Location
- Approximate Contamination Surface Water Sampling Location

Douglas Partners
Geotechnics · Environment · Groundwater

Sydney, Newcastle, Brisbane, Melbourne, Perth, Wyong, Singleton, Campbelltown, Townsville, Cairns, Darwin

TITLE: LOCATIONS OF TESTS
WARNER INDUSTRIAL PARK
CNR HUE HUE ROAD AND SPARKS ROAD, WARNERVALE

CLIENT: WARNER BUSINESS PARK PTY LTD

DRAWN BY: BJK	SCALE: 1:4000 @A3	PROJECT No: 41615.01	OFFICE: WYONG
APPROVED BY: KERRY		DATE: MAY 2008	DRAWING No: 1

Douglas Partners
Geotechnics · Environment · Groundwater

Sydney, Newcastle
Brisbane, Melbourne,
Perth, Wyong

Cairns, Campbelltown,
Darwin, Townsville

TITLE: Aerial Photo of Site (reproduced from Iplan)
Proposed Warner Industrial Park
Corner of Hue Hue Road and Sparks Road, Warnervale

CLIENT: Warner Business Park Pty Limited			OFFICE: Wyong
DRAWN BY: MPG	SCALE: NTS	PROJECT No: 41615.01	DRAWING No: 2
APPROVED BY:		DATE: May 2008	

APPENDIX B

TEST PIT LOGS & FIELD SAMPLE REGISTER

TEST PIT LOG

CLIENT: Warner Business Park Pty Ltd
PROJECT: Targeted Contamination Assessment
LOCATION: Cnr Hue Hue & Sparks Roads, Warnervale

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

PIT No: 101
PROJECT No: 41615.01
DATE: 25 Mar 08
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm)
	0.1	FILLING: Brown topsoils mixed with small gravels and clay roof tiles (fragments), moist		D/PID	0.1		PID = 0 ppm		
		SILT: Medium dense, light brown silt with trace rootlets, moist		D/PID	0.2		PID = 0 ppm		
	0.3	SILTY CLAY: Stiff grading to very stiff, grey mottled red brown, high plasticity, silty clay, M>Wp		D/PID/pp	0.5		PID = 0 ppm/pp = 120-160 kPa		
	1			D/PID/pp	1.0		PID = 0 ppm/pp = 160-180 kPa		1
				pp	1.5		pp = 180-230 kPa		
	1.55	SANDSTONE: extremely low strength, extremely weathered, light grey sandstone		D/PID	1.6		PID = 0 ppm		
	1.7	Pit discontinued at 1.7m. Refusal							
	2								2

RIG: 4 tonne excavator fitted with 450mmϕ bucket
LOGGED: Kerry

WATER OBSERVATIONS: No Free Groundwater Observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U,	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials: BK
Date: 5/08

Douglas Partners
Geotechnics · Environment · Groundwater

TEST PIT LOG

CLIENT: Warner Business Park Pty Ltd
PROJECT: Targeted Contamination Assessment
LOCATION: Cnr Hue Hue & Sparks Roads, Warnervale

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

PIT No: 102
PROJECT No: 41615.01
DATE: 25 Mar 08
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm)
	0.0	FILLING: Light grey gravelly sand filling, moist		D/P	D(QA1	00.1	PID = 0.3 ppm		
	0.2	SILTY CLAY: Stiff grading to very stiff, grey mottled red brown, high plasticity, silty clay, M>Wp		D/PID		0.3	PID = 0 ppm		
				pp		0.5	pp = 180-220 kPa		
		- ironstone gravels at 0.8m							
	1			D/PID/pp		1.0	PID = 0 ppm/pp = 200-220 kPa		1
				D/PID/pp		1.5	PID = 0 ppm/pp = 320-350 kPa		
	1.6	SILTY CLAY: Hard, light grey, medium to high plasticity, silty clay with red brown ironstone cobbles and gravels							
	1.75	Pit discontinued at 1.75m. Refusal							
	2								2

RIG: 4 tonne excavator fitted with 450mmϕ bucket

LOGGED: Kerry

WATER OBSERVATIONS: No Free Groundwater Observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U,	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials: BM
Date: 5/08

Douglas Partners
Geotechnics • Environment • Groundwater

TEST PIT LOG

CLIENT: Warner Business Park Pty Ltd
PROJECT: Targeted Contamination Assessment
LOCATION: Cnr Hue Hue & Sparks Roads, Warnervale

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

PIT No: 103
PROJECT No: 41615.01
DATE: 25 Mar 08
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm)
		FILLING: Apparently well compacted, gravel surface cover underlain by light yellow, grey, brown sandy clay with some gravel and silt (single piece of timber and metal)		D/PID	0.1		PID = 0 ppm		
				D/PID	0.5		PID = 0 ppm		
	0.55	SILTY CLAY: Stiff to very stiff, grey mottled red brown, high plasticity, silty clay, M>Wp							
	1			D/PID/pp	1.0		PID = 0 ppm/pp = 150-180 kPa		1
				pp	1.6		pp = 180-220 kPa		
	2 2.0	Pit discontinued at 2.0m. Near refusal		D/PID/pp	2.0		PID = 0 ppm/pp = 350-400 kPa		2

Dynamic Penetrometer Test (blows per mm): 5, 10, 15, 20

RIG: 4 tonne excavator fitted with 450mmϕ bucket
LOGGED: Kerry

WATER OBSERVATIONS: No Free Groundwater Observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials:
Date: 5/08

Douglas Partners
Geotechnics · Environment · Groundwater

TEST PIT LOG

CLIENT: Warner Business Park Pty Ltd
PROJECT: Targeted Contamination Assessment
LOCATION: Cnr Hue Hue & Sparks Roads, Warnervale

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

PIT No: 104
PROJECT No: 41615.01
DATE: 25 Mar 08
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm)
		FILLING: Grass cover underlain by mixture of apparently moderate to well compacted brown clayey silt and yellow, brown, grey silty clay with rootlets, M>Wp		D/PID	0.1		PID = 0 ppm		
				D/PID/pp	0.5		PID = 0 ppm/pp = 250-300 kPa		
				pp	0.7		pp = 250-300 kPa		
	0.9	CLAYEY SILT: Medium dense, dark grey brown clayey silt with rootlets							
1				D/PID	1.0		PID = 0 ppm		1
	1.4	SILTY CLAY: Stiff, grey mottled red brown, high plasticity, silty clay, M>Wp							
2	2.0	Pit discontinued at 2.0m. Limit of investigation		D/PID/pp	2.0		PID = 0 ppm/pp = 150-200 kPa		2

RIG: 4 tonne excavator fitted with 450mmϕ bucket

LOGGED: Kerry

WATER OBSERVATIONS: No Free Groundwater Observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U$_x$	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials: BK
Date: 5/08

Douglas Partners
Geotechnics • Environment • Groundwater

TEST PIT LOG

CLIENT: Warner Business Park Pty Ltd
PROJECT: Targeted Contamination Assessment
LOCATION: Cnr Hue Hue & Sparks Roads, Warnervale

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

PIT No: 105
PROJECT No: 41615.01
DATE: 25 Mar 08
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm)
		FILLING: Grass surface cover underlain by apparently moderately to well compacted, yellow, brown, grey sandy clay/clayey sand filling with sandstone gravels and cobbles, M~Wp		D/PID	0.1		PID = 0 ppm		
				D/PID	0.5		PID = 0 ppm		
1	1.0	SANDY SILT: Medium dense, grey brown, fine grained, sandy silt with trace rootlets and clay, moist		D/PID	1.1		PID = 0 ppm		1
	1.4	SANDY CLAY: Firm to stiff, brown and grey, low to medium plasticity, sandy clay with trace rootlets, M>Wp		D/PID/pp	1.5		PID = 0 ppm/pp = 80-120 kPa		
	1.8	SILTY CLAY: Stiff, red brown mottled grey, medium to high plasticity, silty clay, M>Wp							
2				D/PID/pp	2.0		PID = 0 ppm/pp = 150-200 kPa		2
	2.3	Pit discontinued at 2.3m. Limit of investigation							

RIG: 4 tonne excavator fitted with 450mmϕ bucket

LOGGED: Kerry

WATER OBSERVATIONS: No Free Groundwater Observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U,	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials: BK
Date: 5/08

Douglas Partners
Geotechnics · Environment · Groundwater

TEST PIT LOG

CLIENT: Warner Business Park Pty Ltd
PROJECT: Targeted Contamination Assessment
LOCATION: Cnr Hue Hue & Sparks Roads, Warnervale

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

PIT No: 106
PROJECT No: 41615.01
DATE: 25 Mar 08
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm)
	0.15	FILLING: Grass cover underlain by brown sandy silt with rootlets		D/PID	0.1		PID = 0 ppm		
		FILLING: Apparently moderately to well compacted, yellow, brown, grey sandy clay/clayey sand filling with sandstone gravels and cobbles, M~Wp		D/PID	0.5		PID = 0 ppm		
	1.3	SILTY CLAY: Stiff to very stiff, grey mottled red brown, high plasticity, silty clay, M>Wp		D/PID/pp	1.5		PID = 0 ppm/pp = 120-150 kPa		
				pp	2.0		pp = 140-180 kPa		
		- ironstone gravels at 2.4m							
	2.5	Pit discontinued at 2.5m. Limit of investigation		B/PID/pp	2.5		PID = 0 ppm/pp = 200-250 kPa		

RIG: 4 tonne excavator fitted with 450mm ϕ bucket

LOGGED: Kerry

WATER OBSERVATIONS: No Free Groundwater Observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials: RK
Date: 5/08

Douglas Partners
Geotechnics · Environment · Groundwater

TEST PIT LOG

CLIENT: Warner Business Park Pty Ltd
PROJECT: Targeted Contamination Assessment
LOCATION: Cnr Hue Hue & Sparks Roads, Warnervale

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

PIT No: 107
PROJECT No: 41615.01
DATE: 25 Mar 08
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
		FILLING: Light grey and brown gravelly sand mixed with clayey silt, moist		D/PID	0.1		PID = 0 ppm		
	0.15	SILTY CLAY: Stiff to very stiff, grey mottled red brown, high plasticity, silty clay, M>Wp		pp	0.2		pp = 180-200 kPa		
				D/PID	0.3		PID = 0 ppm		
				pp	0.6		pp = 200-250 kPa		
	1	- ironstone gravels and cobbles from 1.0m		D/PID/PP	1.0		pp = 350-400 kPa/ PID = 0.0 ppm		1
				D/PID	1.5		PID = 0 ppm		
	1.6	Pit discontinued at 1.6m. Refusal on extremely weathered sandstone							
	2								2

RIG: 4 tonne excavator fitted with 450mmϕ bucket

LOGGED: Kerry

WATER OBSERVATIONS: No Free Groundwater Observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U,	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials: BR
Date: 5/08

Douglas Partners
Geotechnics · Environment · Groundwater

TEST PIT LOG

CLIENT: Warner Business Park Pty Ltd
PROJECT: Targeted Contamination Assessment
LOCATION: Cnr Hue Hue & Sparks Roads, Warnervale

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

PIT No: 108
PROJECT No: 41615.01
DATE: 25 Mar 08
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm)
		FILLING: Grass cover underlain by brown, medium plasticity, silty sandy clay		D/PID	0.1		PID = 0 ppm		
	0.25	FILLING: Apparently moderate to well compacted, grey mottled red brown, high plasticity, silty clay, M>Wp		D/PID/pp	0.5		PID = 0 ppm/pp = 180-210 kPa		
	1			D/PID	1.0		PID = 0 ppm		1
	1.3	FILLING: Clayey silt mixed with waste materials including FC pipe, timber, rail ballast and plastic		D/PID	1.5		PID = 0 ppm		
	1.7	Pit discontinued at 1.7m. Refusal on hard object							
	2								2

Dynamic Penetrometer Test (blows per mm): 5, 10, 15, 20

RIG: 4 tonne excavator fitted with 450mmϕ bucket

LOGGED: Kerry

WATER OBSERVATIONS: Groundwater Seepage inflow at 1.3m

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials: BM
Date: 5/08

Douglas Partners
Geotechnics · Environment · Groundwater

Douglas Partners
Geotechnics · Environment · Groundwater

RECORD OF SAMPLES

CLIENT Warner Business Park Pty Ltd
PROJECT Contamination Assessment
LOCATION Warnervale

DATE: 2/4/08
PROJECT NO: 41615.01

Sample No	Sample Location	Sample/Material Description	Container Type	TOPIC Headspace (ppm)
109 W	Collected	QAW1 - Flowing - See Photo	Bottles	
109 Sed		As 111	Jar + Bag	0.0
110 W		Flowing - See Photo	Bottles	
110 Sed		As 111	Jar + Bag	0.2
111 W		Not Flowing - but Ponded	Bottles	
111 Sed	↓	Brown clay silt with fine gravel	Jar + Bag	0.2
112 W	Not Collected	Dry No Sample Collected	Bottles	
112 Sed	Collected	Brown silty Clay with rootlets	Jar + Bag	0.1
113 W	"	Not Flowing but Ponded	Bottles	
113 Sed	"	As 11 with gravel No organic matter	Jar + Bag	0.0
RB101		Rinsate		
100 FC		From Heli Shed Slab	Bag	

PID #1 Calibrated prior to use
25/3/08 & 2/4/08
by Bburns

APPENDIX C

ANALYTICAL LABORATORY RESULTS

10 April 2008 **TEST REPORT**

Douglas Partners Pty Ltd
Unit D, 7 Donaldson Street
WYONG NORTH
NSW 2259

Your Reference: 41615.01, Warnervale (Soils)
Report Number: 59959

Attention: Brent Kerry

Dear Brent
The following samples were received from you on the date indicated.

Samples: Qty.	16 Soils & 2 Fibro Cements
Date of Receipt of Samples:	34/0/8
Date of Receipt of Instructions:	3/4/08
Date Preliminary Report Emailed:	Not Issued

These samples were analysed in accordance with your written instructions.
A copy of the instructions is attached with the analytical report.

The results and associated quality control are contained in the following pages of this report. Unless otherwise stated, solid samples are expressed on a dry weight basis (moisture has been supplied for your information only), air and liquid samples as received.

Should you have any queries regarding this report please contact the undersigned.

Yours faithfully
SGS ENVIRONMENTAL SERVICES

Ly Kim Ha
Senior Organic Chemist

Edward Ibrahim
Laboratory Services Manager

SGS Australia Pty Ltd
ABN 44 000 964 278
Environmental Services Unit 16, 33 Maddox Street, Alexandria Australia
t (02) 8594 0400 f (02) 8594 0499
www.au.sgs.com
Member of the SGS Group

VOCs in soil full list Our Reference: Your Reference Sample Type Date Sampled	UNITS ---------- ----------	59959-1 101/0.1 Soil 25/03/2008	59959-2 102/0.1 Soil 25/03/2008	59959-8 106/0.1 Soil 25/03/2008	59959-9 107/0.1 Soil 25/03/2008	59959-11 108/1.5 Soil 25/03/2008
Date extracted		4/04/2008	4/04/2008	4/04/2008	4/04/2008	4/04/2008
Date analysed		5/04/2008	5/04/2008	5/04/2008	5/04/2008	5/04/2008
Dichlorodifluoromethane	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
Chloromethane	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
Vinyl Chloride	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
Bromomethane	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
Chloroethane	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
Trichlorofluoromethane	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
1,1-Dichloroethene	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
trans-1,2-Dichloroethene	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
1,1-Dichloroethane	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
cis-1,2-Dichloroethene	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
Bromochloromethane	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
Chloroform	mg/kg	<10	<10	<10	<10	<10
2,2-Dichloropropane	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
1,2-Dichloroethane	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
1,1,1-Trichloroethane	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
1,1-Dichloropropene	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
Carbon tetrachloride	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
Dibromomethane	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
1,2-Dichloropropane	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
Trichloroethene	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
Bromodichloromethane	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
trans-1,3-Dicloropropene	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
cis-1,3-Dichloropropene	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
1,1,2-Trichloroethane	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
1,3-Dichloropropane	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
Dibromochloromethane	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
1,2-Dibromoethane	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
Tetrachloroethene	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
1,1,1,2-Tetrachloroethane	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
Chlorobenzene	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
Bromoform	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
Styrene	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
1,1,2,2-Tetrachloroethane	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
1,2,3-Trichloropropane	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
Isopropylbenzene	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
Bromobenzene	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
n-Propylbenzene	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50

VOCs in soil full list Our Reference: Your Reference Sample Type Date Sampled	UNITS ---------- ----------	59959-1 101/0.1 Soil 25/03/2008	59959-2 102/0.1 Soil 25/03/2008	59959-8 106/0.1 Soil 25/03/2008	59959-9 107/0.1 Soil 25/03/2008	59959-11 108/1.5 Soil 25/03/2008
2-Chlorotoluene	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
4-Chlorotoluene	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
1,3,5-Trimethylbenzene	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
tert-Butylbenzene	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
1,2,4-Trimethylbenzene	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
1,3-Dichlorobenzene	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
sec-Butylbenzene	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
1,4-Dichlorobenzene	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
p-Isopropyltoluene	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
1,2-Dichlorobenzene	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
n-Butylbenzene	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
1,2-Dibromo-3-chloropropane	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
1,2,4-Trichlorobenzene	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
Naphthalene	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
Hexachlorobutadiene	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
1,2,3-Trichlorobenzene	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50
Dibromofluoromethane	% Recovery	93	90	92	89	92
1,2-Dichloroethane-d4	% recovery	105	105	106	103	105
Toluene-*d8 Surrogate 2*	% recovery	101	100	102	100	100
4-Bromofluorobenzene *Surrogate 3*	% recovery	91	87	89	90	91

TRH/BTEX in Soil Our Reference: Your Reference Sample Type Date Sampled	UNITS ---------- ----------	59959-1 101/0.1 Soil 25/03/2008	59959-2 102/0.1 Soil 25/03/2008	59959-3 QA101 Soil 25/03/2008	59959-5 103/0.1 Soil 25/03/2008	59959-6 104/0.1 Soil 25/03/2008
Date Extracted (TRH C6-C9 PT)		4/04/2008	4/04/2008	4/04/2008	4/04/2008	4/04/2008
Date Analysed (TRH C6-C9 PT)		7/04/2008	7/04/2008	7/04/2008	7/04/2008	7/04/2008
TRH C_6 - C_9 P&T	mg/kg	<20	<20	<20	<20	<20
Date Extracted (TRH C10-C36)		8/04/2008	8/04/2008	8/04/2008	8/04/2008	8/04/2008
Date Analysed (TRH C10-C36)		8/04/2008	8/04/2008	8/04/2008	8/04/2008	8/04/2008
TRH C_{10} - C_{14}	mg/kg	<20	310	310	<20	<20
TRH C_{15} - C_{28}	mg/kg	<50	28,000	23,000	<50	<50
TRH C_{29} - C_{36}	mg/kg	<50	1,400	1,100	<50	<50
Date Extracted (BTEX)		4/04/2008	4/04/2008	4/04/2008	4/04/2008	4/04/2008
Date Analysed (BTEX)		7/04/2008	7/04/2008	7/04/2008	7/04/2008	7/04/2008
Benzene	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Toluene	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Total Xylenes	mg/kg	<1.5	<1.5	<1.5	<1.5	<1.5
BTEX Surrogate (%)	%	102	98	98	101	95

TRH/BTEX in Soil Our Reference: Your Reference Sample Type Date Sampled	UNITS ---------- ----------	59959-7 105/0.1 Soil 25/03/2008	59959-8 106/0.1 Soil 25/03/2008	59959-9 107/0.1 Soil 25/03/2008	59959-10 108/0.1 Soil 25/03/2008	59959-11 108/1.5 Soil 25/03/2008
Date Extracted (TRH C6-C9 PT)		4/04/2008	4/04/2008	4/04/2008	4/04/2008	4/04/2008
Date Analysed (TRH C6-C9 PT)		7/04/2008	7/04/2008	7/04/2008	7/04/2008	7/04/2008
TRH C_6 - C_9 P&T	mg/kg	<20	<20	<20	<20	<20
Date Extracted (TRH C10-C36)		8/04/2008	8/04/2008	8/04/2008	8/04/2008	8/04/2008
Date Analysed (TRH C10-C36)		8/04/2008	8/04/2008	8/04/2008	8/04/2008	8/04/2008
TRH C_{10} - C_{14}	mg/kg	<20	<20	<20	<20	<20
TRH C_{15} - C_{28}	mg/kg	<50	<50	<50	<50	<50
TRH C_{29} - C_{36}	mg/kg	<50	<50	<50	<50	<50
Date Extracted (BTEX)		4/04/2008	4/04/2008	4/04/2008	4/04/2008	4/04/2008
Date Analysed (BTEX)		7/04/2008	7/04/2008	7/04/2008	7/04/2008	7/04/2008
Benzene	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Toluene	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Total Xylenes	mg/kg	<1.5	<1.5	<1.5	<1.5	<1.5
BTEX Surrogate (%)	%	96	89	98	91	93

TRH/BTEX in Soil Our Reference: Your Reference Sample Type Date Sampled	UNITS ---------- ----------	59959-13 109Sed Soil 25/03/2008	59959-14 110Sed Soil 25/03/2008	59959-15 111Sed Soil 25/03/2008	59959-16 112Sed Soil 25/03/2008	59959-17 113Sed Soil 25/03/2008
Date Extracted (TRH C6-C9 PT)		4/04/2008	4/04/2008	4/04/2008	4/04/2008	4/04/2008
Date Analysed (TRH C6-C9 PT)		7/04/2008	7/04/2008	7/04/2008	7/04/2008	7/04/2008
TRH C_6 - C_9 P&T	mg/kg	<20	<20	<20	<20	<20
Date Extracted (TRH C10-C36)		8/04/2008	8/04/2008	8/04/2008	8/04/2008	8/04/2008
Date Analysed (TRH C10-C36)		8/04/2008	8/04/2008	8/04/2008	8/04/2008	8/04/2008
TRH C_{10} - C_{14}	mg/kg	<20	<20	<20	<20	<20
TRH C_{15} - C_{28}	mg/kg	<50	<50	<50	<50	<50
TRH C_{29} - C_{36}	mg/kg	<50	<50	<50	<50	<50
Date Extracted (BTEX)		4/04/2008	4/04/2008	4/04/2008	4/04/2008	4/04/2008
Date Analysed (BTEX)		7/04/2008	7/04/2008	7/04/2008	7/04/2008	7/04/2008
Benzene	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Toluene	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Total Xylenes	mg/kg	<1.5	<1.5	<1.5	<1.5	<1.5
BTEX Surrogate (%)	%	91	80	89	90	85

PAHs in Soil Our Reference: Your Reference Sample Type Date Sampled	UNITS ---------- ----------	59959-1 101/0.1 Soil 25/03/2008	59959-2 102/0.1 Soil 25/03/2008	59959-5 103/0.1 Soil 25/03/2008	59959-6 104/0.1 Soil 25/03/2008	59959-7 105/0.1 Soil 25/03/2008
Date Extracted		8/04/2008	8/04/2008	8/04/2008	8/04/2008	8/04/2008
Date Analysed		8/04/2008	8/04/2008	8/04/2008	8/04/2008	8/04/2008
Naphthalene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fluorene	mg/kg	<0.2	<0.1	<0.1	<0.1	<0.1
Phenanthrene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Anthracene	mg/kg	<0.1	<0.4	<0.1	<0.1	<0.1
Fluoranthene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Pyrene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo[*a*]anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Chrysene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo[*b,k*]fluoranthene	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Benzo[*a*]pyrene	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Indeno[*123-cd*]pyrene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Dibenzo[*ah*]anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo[*ghi*]perylene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Total PAHs	mg/kg	<1.65	<1.85	<1.55	<1.55	<1.55
Nitrobenzene-d5	%	106	104	101	100	105
2-Fluorobiphenyl	%	112	96	108	103	109
p -Terphenyl-*d14*	%	120	100	109	110	106

PAHs in Soil Our Reference: Your Reference Sample Type Date Sampled	UNITS ---------- ----------	59959-8 106/0.1 Soil 25/03/2008	59959-9 107/0.1 Soil 25/03/2008	59959-10 108/0.1 Soil 25/03/2008	59959-11 108/1.5 Soil 25/03/2008	59959-13 109Sed Soil 25/03/2008
Date Extracted		8/04/2008	8/04/2008	8/04/2008	8/04/2008	8/04/2008
Date Analysed		8/04/2008	8/04/2008	8/04/2008	8/04/2008	8/04/2008
Naphthalene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fluorene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Phenanthrene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fluoranthene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Pyrene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo[*a*]anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Chrysene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo[*b,k*]fluoranthene	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Benzo[*a*]pyrene	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Indeno[*123-cd*]pyrene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Dibenzo[*ah*]anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo[*ghi*]perylene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Total PAHs	mg/kg	<1.55	<1.55	<1.55	<1.55	<1.55
Nitrobenzene-d5	%	91	104	101	100	82
2-Fluorobiphenyl	%	99	105	104	100	98
p -Terphenyl-*d14*	%	108	108	107	107	107

PAHs in Soil Our Reference: Your Reference Sample Type Date Sampled	UNITS ---------- ----------	59959-14 110Sed Soil 25/03/2008	59959-15 111Sed Soil 25/03/2008	59959-16 112Sed Soil 25/03/2008	59959-17 113Sed Soil 25/03/2008
Date Extracted		8/04/2008	8/04/2008	8/04/2008	8/04/2008
Date Analysed		8/04/2008	8/04/2008	8/04/2008	8/04/2008
Naphthalene	mg/kg	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	mg/kg	<0.1	<0.1	<0.1	<0.1
Acenaphthene	mg/kg	<0.1	<0.1	<0.1	<0.1
Fluorene	mg/kg	<0.1	<0.1	<0.1	<0.1
Phenanthrene	mg/kg	<0.1	<0.1	<0.1	<0.1
Anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1
Fluoranthene	mg/kg	<0.1	0.2	<0.1	<0.1
Pyrene	mg/kg	<0.1	0.2	<0.1	<0.1
Benzo[*a*]anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1
Chrysene	mg/kg	<0.1	<0.1	<0.1	<0.1
Benzo[*b,k*]fluoranthene	mg/kg	<0.2	0.2	<0.2	<0.2
Benzo[*a*]pyrene	mg/kg	<0.05	0.11	<0.05	<0.05
Indeno[*123-cd*]pyrene	mg/kg	<0.1	0.1	<0.1	<0.1
Dibenzo[*ah*]anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1
Benzo[*ghi*]perylene	mg/kg	<0.1	0.1	<0.1	<0.1
Total PAHs	mg/kg	<1.55	<1.81	<1.55	<1.55
Nitrobenzene-d5	%	94	93	114	97
2-Fluorobiphenyl	%	88	103	106	103
p -Terphenyl-*d14*	%	110	110	111	107

OC Pesticides in Soil Our Reference: Your Reference Sample Type Date Sampled	UNITS ---------- ----------	59959-7 105/0.1 Soil 25/03/2008	59959-8 106/0.1 Soil 25/03/2008	59959-9 107/0.1 Soil 25/03/2008	59959-11 108/1.5 Soil 25/03/2008	59959-13 109Sed Soil 25/03/2008
Date Extracted		8/04/2008	8/04/2008	8/04/2008	8/04/2008	8/04/2008
Date Analysed		8/04/2008	8/04/2008	8/04/2008	8/04/2008	8/04/2008
HCB	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
alpha-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
gamma-BHC (Lindane)	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Heptachlor	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aldrin	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
beta-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
delta-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Heptachlor Epoxide	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
o,p-DDE	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
alpha-Endosulfan	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
trans-Chlordane	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
cis-Chlordane	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
trans-Nonachlor	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
p,p-DDE	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Dieldrin	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endrin	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
o,p-DDD	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
o,p-DDT	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
beta-Endosulfan	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
p,p-DDD	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
p,p-DDT	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endosulfan Sulphate	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endrin Aldehyde	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Methoxychlor	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endrin Ketone	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
2,4,5,6-Tetrachloro-m-xylene *(Surrogate*	%	107	106	103	105	119

OC Pesticides in Soil Our Reference: Your Reference Sample Type Date Sampled	UNITS ---------- ----------	59959-14 110Sed Soil 25/03/2008	59959-15 111Sed Soil 25/03/2008	59959-16 112Sed Soil 25/03/2008	59959-17 113Sed Soil 25/03/2008
Date Extracted		8/04/2008	8/04/2008	8/04/2008	8/04/2008
Date Analysed		8/04/2008	8/04/2008	8/04/2008	8/04/2008
HCB	mg/kg	<0.1	<0.1	<0.1	<0.1
alpha-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1
gamma-BHC (Lindane)	mg/kg	<0.1	<0.1	<0.1	<0.1
Heptachlor	mg/kg	<0.1	<0.1	<0.1	<0.1
Aldrin	mg/kg	<0.1	<0.1	<0.1	<0.1
beta-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1
delta-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1
Heptachlor Epoxide	mg/kg	<0.1	<0.1	<0.1	<0.1
o,p-DDE	mg/kg	<0.1	<0.1	<0.1	<0.1
alpha-Endosulfan	mg/kg	<0.1	<0.1	<0.1	<0.1
trans-Chlordane	mg/kg	<0.1	<0.1	<0.1	<0.1
cis-Chlordane	mg/kg	<0.1	<0.1	<0.1	<0.1
trans-Nonachlor	mg/kg	<0.1	<0.1	<0.1	<0.1
p,p-DDE	mg/kg	<0.1	<0.1	<0.1	<0.1
Dieldrin	mg/kg	<0.1	<0.1	<0.1	<0.1
Endrin	mg/kg	<0.1	<0.1	<0.1	<0.1
o,p-DDD	mg/kg	<0.1	<0.1	<0.1	<0.1
o,p-DDT	mg/kg	<0.1	<0.1	<0.1	<0.1
beta-Endosulfan	mg/kg	<0.1	<0.1	<0.1	<0.1
p,p-DDD	mg/kg	<0.1	<0.1	<0.1	<0.1
p,p-DDT	mg/kg	<0.1	<0.1	<0.1	<0.1
Endosulfan Sulphate	mg/kg	<0.1	<0.1	<0.1	<0.1
Endrin Aldehyde	mg/kg	<0.1	<0.1	<0.1	<0.1
Methoxychlor	mg/kg	<0.1	<0.1	<0.1	<0.1
Endrin Ketone	mg/kg	<0.1	<0.1	<0.1	<0.1
2,4,5,6-Tetrachloro-m-xylene *(Surrogate*	%	118	111	117	109

OP Pesticides in Soil						
Our Reference:	UNITS	59959-7	59959-8	59959-9	59959-11	59959-13
Your Reference	----------	105/0.1	106/0.1	107/0.1	108/1.5	109Sed
Sample Type	----------	Soil	Soil	Soil	Soil	Soil
Date Sampled		25/03/2008	25/03/2008	25/03/2008	25/03/2008	25/03/2008
Date Extracted		8/04/2008	8/04/2008	8/04/2008	8/04/2008	8/04/2008
Date Analysed		8/04/2008	8/04/2008	8/04/2008	8/04/2008	8/04/2008
Chlorpyrifos	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fenitrothion	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Bromofos Ethyl	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Ethion	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
OP_Surrogate 1	%	107	106	103	105	119

OP Pesticides in Soil					
Our Reference:	UNITS	59959-14	59959-15	59959-16	59959-17
Your Reference	----------	110Sed	111Sed	112Sed	113Sed
Sample Type	----------	Soil	Soil	Soil	Soil
Date Sampled		25/03/2008	25/03/2008	25/03/2008	25/03/2008
Date Extracted		8/04/2008	8/04/2008	8/04/2008	8/04/2008
Date Analysed		8/04/2008	8/04/2008	8/04/2008	8/04/2008
Chlorpyrifos	mg/kg	<0.1	<0.1	<0.1	<0.1
Fenitrothion	mg/kg	<0.1	<0.1	<0.1	<0.1
Bromofos Ethyl	mg/kg	<0.1	<0.1	<0.1	<0.1
Ethion	mg/kg	<0.1	<0.1	<0.1	<0.1
OP_Surrogate 1	%	118	111	117	109

PCBs in Soil Our Reference: Your Reference Sample Type Date Sampled	UNITS ---------- ----------	59959-7 105/0.1 Soil 25/03/2008	59959-8 106/0.1 Soil 25/03/2008	59959-9 107/0.1 Soil 25/03/2008	59959-11 108/1.5 Soil 25/03/2008	59959-13 109Sed Soil 25/03/2008
Date Extracted		8/04/2008	8/04/2008	8/04/2008	8/04/2008	8/04/2008
Date Analysed		8/04/2008	8/04/2008	8/04/2008	8/04/2008	8/04/2008
Arochlor 1016	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Arochlor 1221	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Arochlor 1232	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Arochlor 1242	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Arochlor 1248	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Arochlor 1254	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Arochlor 1260	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Arochlor 1262	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Arochlor 1268	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Total Positive PCB	mg/kg	<0.90	<0.90	<0.90	<0.90	<0.90
PCB_Surrogate 1	%	107	106	103	105	119

PCBs in Soil Our Reference: Your Reference Sample Type Date Sampled	UNITS ---------- ----------	59959-14 110Sed Soil 25/03/2008	59959-15 111Sed Soil 25/03/2008	59959-16 112Sed Soil 25/03/2008	59959-17 113Sed Soil 25/03/2008
Date Extracted		8/04/2008	8/04/2008	8/04/2008	8/04/2008
Date Analysed		8/04/2008	8/04/2008	8/04/2008	8/04/2008
Arochlor 1016	mg/kg	<0.1	<0.1	<0.1	<0.1
Arochlor 1221	mg/kg	<0.1	<0.1	<0.1	<0.1
Arochlor 1232	mg/kg	<0.1	<0.1	<0.1	<0.1
Arochlor 1242	mg/kg	<0.1	<0.1	<0.1	<0.1
Arochlor 1248	mg/kg	<0.1	<0.1	<0.1	<0.1
Arochlor 1254	mg/kg	<0.1	<0.1	<0.1	<0.1
Arochlor 1260	mg/kg	<0.1	<0.1	<0.1	<0.1
Arochlor 1262	mg/kg	<0.1	<0.1	<0.1	<0.1
Arochlor 1268	mg/kg	<0.1	<0.1	<0.1	<0.1
Total Positive PCB	mg/kg	<0.90	<0.90	<0.90	<0.90
PCB_Surrogate 1	%	118	111	117	109

Total Phenolics in Soil						
Our Reference:	UNITS	59959-1	59959-2	59959-5	59959-8	59959-11
Your Reference	----------	101/0.1	102/0.1	103/0.1	106/0.1	108/1.5
Sample Type	----------	Soil	Soil	Soil	Soil	Soil
Date Sampled		25/03/2008	25/03/2008	25/03/2008	25/03/2008	25/03/2008
Date Extracted (Phenols)		4/04/2008	4/04/2008	4/04/2008	4/04/2008	4/04/2008
Date Analysed (Phenols)		4/04/2008	4/04/2008	4/04/2008	4/04/2008	4/04/2008
Total Phenolics (as Phenol)	mg/kg	<0.1	0.3	<0.1	<0.1	<0.1

Acid Extractable Metals in Soil						
Our Reference:	UNITS	59959-1	59959-2	59959-3	59959-5	59959-6
Your Reference	----------	101/0.1	102/0.1	QA101	103/0.1	104/0.1
Sample Type	----------	Soil	Soil	Soil	Soil	Soil
Date Sampled		25/03/2008	25/03/2008	25/03/2008	25/03/2008	25/03/2008
Date Extracted (Metals)		7/04/2008	7/04/2008	7/04/2008	7/04/2008	7/04/2008
Date Analysed (Metals)		7/04/2008	7/04/2008	7/04/2008	7/04/2008	7/04/2008
Arsenic	mg/kg	<3	4	3	<3	4
Cadmium	mg/kg	2.7	1.5	1.4	2.5	<0.3
Chromium	mg/kg	16	9.1	9.1	12	9.7
Copper	mg/kg	49	15	16	14	4.2
Lead	mg/kg	25	11	11	44	11
Nickel	mg/kg	77	12	13	16	4.1
Zinc	mg/kg	100	56	62	37	30
Date Extracted (Mercury)		4/04/2008	4/04/2008	4/04/2008	4/04/2008	4/04/2008
Date Analysed (Mercury)		4/04/2008	4/04/2008	4/04/2008	4/04/2008	4/04/2008
Mercury	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05

Acid Extractable Metals in Soil						
Our Reference:	UNITS	59959-7	59959-8	59959-9	59959-10	59959-11
Your Reference	----------	105/0.1	106/0.1	107/0.1	108/0.1	108/1.5
Sample Type	----------	Soil	Soil	Soil	Soil	Soil
Date Sampled		25/03/2008	25/03/2008	25/03/2008	25/03/2008	25/03/2008
Date Extracted (Metals)		7/04/2008	7/04/2008	7/04/2008	7/04/2008	7/04/2008
Date Analysed (Metals)		7/04/2008	7/04/2008	7/04/2008	7/04/2008	7/04/2008
Arsenic	mg/kg	<3	9	<3	5	7
Cadmium	mg/kg	<0.3	0.8	0.4	<0.3	0.4
Chromium	mg/kg	2.7	16	17	6.5	15
Copper	mg/kg	5.5	10	13	1.2	16
Lead	mg/kg	10	15	7	8	17
Nickel	mg/kg	1.3	3.2	14	1.1	2.7
Zinc	mg/kg	16	14	50	5.2	27
Date Extracted (Mercury)		4/04/2008	4/04/2008	4/04/2008	4/04/2008	4/04/2008
Date Analysed (Mercury)		4/04/2008	4/04/2008	4/04/2008	4/04/2008	4/04/2008
Mercury	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05

Acid Extractable Metals in Soil Our Reference: Your Reference Sample Type Date Sampled	UNITS ---------- ----------	59959-13 109Sed Soil 25/03/2008	59959-14 110Sed Soil 25/03/2008	59959-15 111Sed Soil 25/03/2008	59959-16 112Sed Soil 25/03/2008	59959-17 113Sed Soil 25/03/2008
Date Extracted (Metals)		7/04/2008	7/04/2008	7/04/2008	7/04/2008	7/04/2008
Date Analysed (Metals)		7/04/2008	7/04/2008	7/04/2008	7/04/2008	7/04/2008
Arsenic	mg/kg	6	6	6	4	5
Cadmium	mg/kg	0.5	0.5	<0.3	<0.3	<0.3
Chromium	mg/kg	11	11	13	13	16
Copper	mg/kg	13	14	11	5.3	3.9
Lead	mg/kg	12	16	28	16	9.8
Nickel	mg/kg	10	12	9.0	6.4	4.7
Zinc	mg/kg	65	80	66	24	15
Date Extracted (Mercury)		4/04/2008	4/04/2008	4/04/2008	4/04/2008	4/04/2008
Date Analysed (Mercury)		4/04/2008	4/04/2008	4/04/2008	4/04/2008	4/04/2008
Mercury	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05

Asbestos ID in soil						
Our Reference:	UNITS	59959-1	59959-5	59959-10	59959-11	59959-14
Your Reference	----------	101/0.1	103/0.1	108/0.1	108/1.5	110Sed
Sample Type	----------	Soil	Soil	Soil	Soil	Soil
Date Sampled		25/03/2008	25/03/2008	25/03/2008	25/03/2008	25/03/2008
Date Analysed		9/04/2008	9/04/2008	9/04/2008	9/04/2008	9/04/2008
Sample Description		30g soil,rocks	30g soil,sand,rocks	30g soil,sand,rocks	30g soil,sand,rocks	30g soil,plant matter,clay
Asbestos ID in soil	-	No asbestos detected	No asbestos detected	No asbestos detected	No asbestos detected	No asbestos detected

Asbestos ID in soil			
Our Reference:	UNITS	59959-15	59959-17
Your Reference	----------	111Sed	113Sed
Sample Type	----------	Soil	Soil
Date Sampled		25/03/2008	25/03/2008
Date Analysed		9/04/2008	9/04/2008
Sample Description		30g clay,sand,	30g clay,sand
Asbestos ID in soil	-	No asbestos detected	No asbestos detected

Asbestos ID in materials			
Our Reference:	UNITS	59959-12	59959-23
Your Reference	----------	108/FC	100/FC
Sample Type	----------	Fibro Cement	Fibro Cement
Date Sampled		25/03/2008	25/03/2008
Date Analysed		9/04/2008	9/04/2008
Sample Description		90x70x10mm cement sheet fragment	40x25x3 mm cement sheet fragment
Asbestos ID in materials	-	Chrysotile asbestos detected Amosite asbestos detected	No asbestos detected

Moisture						
Our Reference:	UNITS	59959-1	59959-2	59959-3	59959-5	59959-6
Your Reference	----------	101/0.1	102/0.1	QA101	103/0.1	104/0.1
Sample Type	----------	Soil	Soil	Soil	Soil	Soil
Date Sampled		25/03/2008	25/03/2008	25/03/2008	25/03/2008	25/03/2008
Date Analysed (moisture)		4/04/2008	4/04/2008	4/04/2008	4/04/2008	4/04/2008
Moisture	%	11	10	11	12	19

Moisture						
Our Reference:	UNITS	59959-7	59959-8	59959-9	59959-10	59959-11
Your Reference	----------	105/0.1	106/0.1	107/0.1	108/0.1	108/1.5
Sample Type	----------	Soil	Soil	Soil	Soil	Soil
Date Sampled		25/03/2008	25/03/2008	25/03/2008	25/03/2008	25/03/2008
Date Analysed (moisture)		4/04/2008	4/04/2008	4/04/2008	4/04/2008	4/04/2008
Moisture	%	11	20	10	14	22

Moisture						
Our Reference:	UNITS	59959-13	59959-14	59959-15	59959-16	59959-17
Your Reference	----------	109Sed	110Sed	111Sed	112Sed	113Sed
Sample Type	----------	Soil	Soil	Soil	Soil	Soil
Date Sampled		25/03/2008	25/03/2008	25/03/2008	25/03/2008	25/03/2008
Date Analysed (moisture)		4/04/2008	4/04/2008	4/04/2008	4/04/2008	4/04/2008
Moisture	%	62	55	21	19	24

Method ID	Methodology Summary
SEO-019	VOCs by P&T GC/MS- Determination of Volatile Organic Compounds by Purge and Trap then Gas Chromatography / Mass spectrometry following extraction with methanol for soils. Waters are introduced directly on the purge and trap.
SEO-017	BTEX/TRH C6-C9 - Determination by Purge and Trap Gas Chromatography with Flame Ionisation Detection (FID) and Photo Ionisation Detection (PID). The surrogate spike used is aaa-trifluorotoluene.
SEO-020	TRH - Determination of Total Recoverable Hydrocarbons by gas chromatography following extraction with DCM/Acetone for solids and DCM for liquids.
SEO-018	BTEX - Determination by purge and trap/ Gas Chromatography with MS Detection.
SEO-030	PAHs by GC/MS - Determination of Polynuclear Aromatic Hydrocarbons (PAH's) by Gas Chromatography / Mass Spectrometry following extraction with dichloromethane or dichloromethane/acetone. The surrogate spike used is p-Terphenyl-d14.
SEO-005	OC/OP/PCB - Determination of a suite of Organchlorine Pesticides, Chlorinated Organo-phosphorus Pesticides and Polychlorinated Biphenyls (PCB's) by sonication extraction using dichloromethane for waters or acetone / hexane for soils followed by Gas Chromatographic separation with Electron Capture Detection (GC/ECD). The surrogate spike used is 2,4,5,6-Tetrachloro-m-xylene.
SEI-066	Phenols - Determined by colourimetric method using Discrete Analyser, following steam distillation of the sample.
SEM-010	Metals - Determination of various metals by ICP-OES following appropriate sample preparation or digestion process.
SEM-005	Mercury - Determination of Mercury by Cold Vapour Generation Atomic Absorption Spectroscopy.
AN602	Qualitative identification of asbestos type fibres in bulk using Polarised Light Microscopy and Dispersion Staining Techniques. Accreditation does not cover the identification of Synthetic Mineral Fibre.
AN002	Preparation of soils, sediments and sludges undergo analysis by either air drying, compositing, subsampling and 1:5 soil water extraction where required. Moisture content is determined by drying the sample at 105 ± 5°C.

QUALITY CONTROL VOCs in soil full list	UNITS	LOR	METHOD	Blank	Duplicate Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Matrix Spike % Recovery Duplicate + %RPD
Date extracted				04/04/08	[NT]	[NT]	59959-1	04/04/08%
Date analysed				05/04/08	[NT]	[NT]	59959-1	05/04/08%
Dichlorodifluoromethane	mg/kg	0.5	SEO-019	<0.50	[NT]	[NT]	[NR]	[NR]
Chloromethane	mg/kg	0.5	SEO-019	<0.50	[NT]	[NT]	[NR]	[NR]
Vinyl Chloride	mg/kg	0.50	SEO-019	<0.50	[NT]	[NT]	[NR]	[NR]
Bromomethane	mg/kg	0.5	SEO-019	<0.50	[NT]	[NT]	[NR]	[NR]
Chloroethane	mg/kg	0.5	SEO-019	<0.50	[NT]	[NT]	[NR]	[NR]
Trichlorofluoromethane	mg/kg	0.5	SEO-019	<0.50	[NT]	[NT]	[NR]	[NR]
1,1-Dichloroethene	mg/kg	0.5	SEO-019	<0.50	[NT]	[NT]	59959-1	90%
trans-1,2-Dichloroethene	mg/kg	0.5	SEO-019	<0.50	[NT]	[NT]	[NR]	[NR]
1,1-Dichloroethane	mg/kg	0.5	SEO-019	<0.50	[NT]	[NT]	[NR]	[NR]
cis-1,2-Dichloroethene	mg/kg	0.5	SEO-019	<0.50	[NT]	[NT]	[NR]	[NR]
Bromochloromethane	mg/kg	0.5	SEO-019	<0.50	[NT]	[NT]	[NR]	[NR]
Chloroform	mg/kg	10	SEO-019	<10	[NT]	[NT]	59959-1	90%
2,2-Dichloropropane	mg/kg	0.5	SEO-019	<0.50	[NT]	[NT]	[NR]	[NR]
1,2-Dichloroethane	mg/kg	0.5	SEO-019	<0.50	[NT]	[NT]	59959-1	88%
1,1,1-Trichloroethane	mg/kg	0.5	SEO-019	<0.50	[NT]	[NT]	[NR]	[NR]
1,1-Dichloropropene	mg/kg	0.5	SEO-019	<0.50	[NT]	[NT]	[NR]	[NR]
Carbon tetrachloride	mg/kg	0.5	SEO-019	<0.50	[NT]	[NT]	[NR]	[NR]
Dibromomethane	mg/kg	0.5	SEO-019	<0.50	[NT]	[NT]	[NR]	[NR]
1,2-Dichloropropane	mg/kg	0.5	SEO-019	<0.50	[NT]	[NT]	[NR]	[NR]
Trichloroethene	mg/kg	0.5	SEO-019	<0.50	[NT]	[NT]	59959-1	90%
Bromodichloromethane	mg/kg	0.5	SEO-019	<0.50	[NT]	[NT]	[NR]	[NR]
trans-1,3-Dicloropropene	mg/kg	0.5	SEO-019	<0.50	[NT]	[NT]	[NR]	[NR]
cis-1,3-Dichloropropene	mg/kg	0.5	SEO-019	<0.50	[NT]	[NT]	[NR]	[NR]
1,1,2-Trichloroethane	mg/kg	0.5	SEO-019	<0.50	[NT]	[NT]	[NR]	[NR]
1,3-Dichloropropane	mg/kg	0.5	SEO-019	<0.50	[NT]	[NT]	[NR]	[NR]
Dibromochloromethane	mg/kg	0.5	SEO-019	<0.50	[NT]	[NT]	[NR]	[NR]
1,2-Dibromoethane	mg/kg	0.5	SEO-019	<0.50	[NT]	[NT]	[NR]	[NR]
Tetrachloroethene	mg/kg	0.5	SEO-019	<0.50	[NT]	[NT]	[NR]	[NR]
1,1,1,2-Tetrachloroethane	mg/kg	0.5	SEO-019	<0.50	[NT]	[NT]	[NR]	[NR]
Chlorobenzene	mg/kg	0.5	SEO-019	<0.50	[NT]	[NT]	59959-1	97%
Bromoform	mg/kg	0.5	SEO-019	<0.50	[NT]	[NT]	[NR]	[NR]
Styrene	mg/kg	0.5	SEO-019	<0.50	[NT]	[NT]	[NR]	[NR]
1,1,2,2-Tetrachloroethane	mg/kg	0.5	SEO-019	<0.50	[NT]	[NT]	[NR]	[NR]

QUALITY CONTROL VOCs in soil full list	UNITS	LOR	METHOD	Blank	Duplicate Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Matrix Spike % Recovery Duplicate + %RPD
1,2,3-Trichloropropane	mg/kg	0.5	SEO-019	<0.50	[NT]	[NT]	[NR]	[NR]
Isopropylbenzene	mg/kg	0.5	SEO-019	<0.50	[NT]	[NT]	[NR]	[NR]
Bromobenzene	mg/kg	0.5	SEO-019	<0.50	[NT]	[NT]	[NR]	[NR]
n-Propylbenzene	mg/kg	0.5	SEO-019	<0.50	[NT]	[NT]	[NR]	[NR]
2-Chlorotoluene	mg/kg	0.5	SEO-019	<0.50	[NT]	[NT]	[NR]	[NR]
4-Chlorotoluene	mg/kg	0.5	SEO-019	<0.50	[NT]	[NT]	[NR]	[NR]
1,3,5-Trimethylbenzene	mg/kg	0.5	SEO-019	<0.50	[NT]	[NT]	[NR]	[NR]
tert-Butylbenzene	mg/kg	0.5	SEO-019	<0.50	[NT]	[NT]	[NR]	[NR]
1,2,4-Trimethylbenzene	mg/kg	0.5	SEO-019	<0.50	[NT]	[NT]	[NR]	[NR]
1,3-Dichlorobenzene	mg/kg	0.5	SEO-019	<0.50	[NT]	[NT]	[NR]	[NR]
sec-Butylbenzene	mg/kg	0.5	SEO-019	<0.50	[NT]	[NT]	[NR]	[NR]
1,4-Dichlorobenzene	mg/kg	0.5	SEO-019	<0.50	[NT]	[NT]	[NR]	[NR]
p-Isopropyltoluene	mg/kg	0.5	SEO-019	<0.50	[NT]	[NT]	[NR]	[NR]
1,2-Dichlorobenzene	mg/kg	0.5	SEO-019	<0.50	[NT]	[NT]	[NR]	[NR]
n-Butylbenzene	mg/kg	0.5	SEO-019	<0.50	[NT]	[NT]	[NR]	[NR]
1,2-Dibromo-3-chloropropane	mg/kg	0.5	SEO-019	<0.50	[NT]	[NT]	[NR]	[NR]
1,2,4-Trichlorobenzene	mg/kg	0.5	SEO-019	<0.50	[NT]	[NT]	[NR]	[NR]
Naphthalene	mg/kg	0.5	SEO-019	<0.50	[NT]	[NT]	[NR]	[NR]
Hexachlorobutadiene	mg/kg	0.5	SEO-019	<0.50	[NT]	[NT]	[NR]	[NR]
1,2,3-Trichlorobenzene	mg/kg	0.5	SEO-019	<0.50	[NT]	[NT]	[NR]	[NR]
Dibromofluoromethane	% Recovery	0	SEO-019	94	[NT]	[NT]	59959-1	97%
1,2-Dichloroethane-d4	% recovery	0	SEO-019	100	[NT]	[NT]	59959-1	98%
Toluene-*d8 Surrogate* 2	% recovery	0	SEO-019	101	[NT]	[NT]	59959-1	100%
4-Bromofluorobenzene *Surrogate 3*	% recovery	0	SEO-019	96	[NT]	[NT]	59959-1	89%

QUALITY CONTROL TRH/BTEX in Soil	UNITS	LOR	METHOD	Blank	Duplicate Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Matrix Spike % Recovery Duplicate + %RPD
Date Extracted (TRH C6-C9 PT)				04/04/08	59959-6	4/04/2008 || 4/04/2008	LCS	04/04/08%
Date Analysed (TRH C6-C9 PT)				07/04/08	59959-6	7/04/2008 || 7/04/2008	LCS	07/04/08%
TRH C_6 - C_9 P&T	mg/kg	20	SEO-017	<20	59959-6	<20 || <20	LCS	105%
Date Extracted (TRH C10-C36)				08/04/08	59959-6	8/04/2008 || [N/T]	LCS	08/04/08%
Date Analysed (TRH C10-C36)				08/04/08	59959-6	8/04/2008 || [N/T]	LCS	08/04/08%
TRH C_{10} - C_{14}	mg/kg	20	SEO-020	<20	59959-6	<20 || [N/T]	LCS	83%
TRH C_{15} - C_{28}	mg/kg	50	SEO-020	<50	59959-6	<50 || [N/T]	LCS	82%
TRH C_{29} - C_{36}	mg/kg	50	SEO-020	<50	59959-6	<50 || [N/T]	LCS	86%
Date Extracted (BTEX)				04/04/08	59959-6	4/04/2008 || 4/04/2008	LCS	04/04/08%
Date Analysed (BTEX)				07/04/08	59959-6	7/04/2008 || 7/04/2008	LCS	07/04/08%
Benzene	mg/kg	0.5	SEO-018	<0.5	59959-6	<0.5 || <0.5	LCS	80%
Toluene	mg/kg	0.5	SEO-018	<0.5	59959-6	<0.5 || <0.5	LCS	92%
Ethylbenzene	mg/kg	0.5	SEO-018	<0.5	59959-6	<0.5 || <0.5	LCS	92%
Total Xylenes	mg/kg	1.5	SEO-018	<1.5	59959-6	<1.5 || <1.5	LCS	93%
BTEX Surrogate (%)	%	0	SEO-018	99	59959-6	95 || 94 || RPD: 1	LCS	101%

QUALITY CONTROL PAHs in Soil	UNITS	LOR	METHOD	Blank	Duplicate Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Matrix Spike % Recovery Duplicate + %RPD
Date Extracted				08/04/08	59959-1	8/04/2008 || 8/04/2008	59959-6	08/04/08%
Date Analysed				08/04/08	59959-1	8/04/2008 || 8/04/2008	59959-6	08/04/08%
Naphthalene	mg/kg	0.1	SEO-030	<0.1	59959-1	<0.1 || <0.1	59959-6	91%
Acenaphthylene	mg/kg	0.1	SEO-030	<0.1	59959-1	<0.1 || <0.1	59959-6	81%
Acenaphthene	mg/kg	0.1	SEO-030	<0.1	59959-1	<0.1 || <0.1	59959-6	102%
Fluorene	mg/kg	0.1	SEO-030	<0.1	59959-1	<0.2 || <0.2	[NR]	[NR]
Phenanthrene	mg/kg	0.1	SEO-030	<0.1	59959-1	<0.1 || <0.1	59959-6	93%
Anthracene	mg/kg	0.1	SEO-030	<0.1	59959-1	<0.1 || <0.1	59959-6	98%
Fluoranthene	mg/kg	0.1	SEO-030	<0.1	59959-1	<0.1 || <0.1	59959-6	91%
Pyrene	mg/kg	0.1	SEO-030	<0.1	59959-1	<0.1 || <0.1	59959-6	91%
Benzo[*a*]anthracene	mg/kg	0.1	SEO-030	<0.1	59959-1	<0.1 || <0.1	[NR]	[NR]
Chrysene	mg/kg	0.1	SEO-030	<0.1	59959-1	<0.1 || <0.1	[NR]	[NR]
Benzo[*b,k*]fluoranthene	mg/kg	0.2	SEO-030	<0.2	59959-1	<0.2 || <0.2	[NR]	[NR]
Benzo[*a*]pyrene	mg/kg	0.05	SEO-030	<0.05	59959-1	<0.05 || <0.05	59959-6	93%
Indeno[*123-cd*]pyrene	mg/kg	0.1	SEO-030	<0.1	59959-1	<0.1 || <0.1	[NR]	[NR]
Dibenzo[*ah*]anthracene	mg/kg	0.1	SEO-030	<0.1	59959-1	<0.1 || <0.1	[NR]	[NR]
Benzo[*ghi*]perylene	mg/kg	0.1	SEO-030	<0.1	59959-1	<0.1 || <0.1	[NR]	[NR]
Total PAHs	mg/kg	1.55	SEO-030	<1.55	59959-1	<1.65 || <1.65	[NR]	[NR]
Nitrobenzene-d5	%	0	SEO-030	72	59959-1	106 || 107 || RPD: 1	59959-6	106%
2-Fluorobiphenyl	%	0	SEO-030	101	59959-1	112 || 112 || RPD: 0	59959-6	108%
p -Terphenyl-*d*14	%	0	SEO-030	109	59959-1	120 || 106 || RPD: 12	59959-6	105%

QUALITY CONTROL OC Pesticides in Soil	UNITS	LOR	METHOD	Blank	Duplicate Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Matrix Spike % Recovery Duplicate + %RPD
Date Extracted				08/04/08	59959-7	8/04/2008 || 8/04/2008	59959-8	08/04/08%
Date Analysed				08/04/08	59959-7	8/04/2008 || 8/04/2008	59959-8	08/04/08%
HCB	mg/kg	0.1	SEO-005	<0.1	59959-7	<0.1 || <0.1	[NR]	[NR]
alpha-BHC	mg/kg	0.1	SEO-005	<0.1	59959-7	<0.1 || <0.1	[NR]	[NR]
gamma-BHC (Lindane)	mg/kg	0.1	SEO-005	<0.1	59959-7	<0.1 || <0.1	[NR]	[NR]
Heptachlor	mg/kg	0.1	SEO-005	<0.1	59959-7	<0.1 || <0.1	59959-8	72%
Aldrin	mg/kg	0.1	SEO-005	<0.1	59959-7	<0.1 || <0.1	59959-8	70%
beta-BHC	mg/kg	0.1	SEO-005	<0.1	59959-7	<0.1 || <0.1	[NR]	[NR]
delta-BHC	mg/kg	0.1	SEO-005	<0.1	59959-7	<0.1 || <0.1	59959-8	64%
Heptachlor Epoxide	mg/kg	0.1	SEO-005	<0.1	59959-7	<0.1 || <0.1	[NR]	[NR]
o,p-DDE	mg/kg	0.1	SEO-005	<0.1	59959-7	<0.1 || <0.1	[NR]	[NR]
alpha-Endosulfan	mg/kg	0.1	SEO-005	<0.1	59959-7	<0.1 || <0.1	[NR]	[NR]
trans-Chlordane	mg/kg	0.1	SEO-005	<0.1	59959-7	<0.1 || <0.1	[NR]	[NR]
cis-Chlordane	mg/kg	0.1	SEO-005	<0.1	59959-7	<0.1 || <0.1	[NR]	[NR]
trans-Nonachlor	mg/kg	0.1	SEO-005	<0.1	59959-7	<0.1 || <0.1	[NR]	[NR]
p,p-DDE	mg/kg	0.1	SEO-005	<0.1	59959-7	<0.1 || <0.1	[NR]	[NR]
Dieldrin	mg/kg	0.1	SEO-005	<0.1	59959-7	<0.1 || <0.1	59959-8	68%
Endrin	mg/kg	0.1	SEO-005	<0.1	59959-7	<0.1 || <0.1	59959-8	69%
o,p-DDD	mg/kg	0.1	SEO-005	<0.1	59959-7	<0.1 || <0.1	[NR]	[NR]
o,p-DDT	mg/kg	0.1	SEO-005	<0.1	59959-7	<0.1 || <0.1	[NR]	[NR]
beta-Endosulfan	mg/kg	0.1	SEO-005	<0.1	59959-7	<0.1 || <0.1	[NR]	[NR]
p,p-DDD	mg/kg	0.1	SEO-005	<0.1	59959-7	<0.1 || <0.1	[NR]	[NR]
p,p-DDT	mg/kg	0.1	SEO-005	<0.1	59959-7	<0.1 || <0.1	59959-8	66%
Endosulfan Sulphate	mg/kg	0.1	SEO-005	<0.1	59959-7	<0.1 || <0.1	[NR]	[NR]
Endrin Aldehyde	mg/kg	0.1	SEO-005	<0.1	59959-7	<0.1 || <0.1	[NR]	[NR]
Methoxychlor	mg/kg	0.1	SEO-005	<0.1	59959-7	<0.1 || <0.1	[NR]	[NR]
Endrin Ketone	mg/kg	0.1	SEO-005	<0.1	59959-7	<0.1 || <0.1	[NR]	[NR]
2,4,5,6-Tetrachloro-m-xylene *(Surrogate*	%	0	SEO-005	103	59959-7	107 || 106 || RPD: 1	59959-8	111%

QUALITY CONTROL OP Pesticides in Soil	UNITS	LOR	METHOD	Blank	Duplicate Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Matrix Spike % Recovery Duplicate + %RPD
Date Extracted				08/04/08	59959-7	8/04/2008 || 8/04/2008	59959-8	08/04/08%
Date Analysed				08/04/08	59959-7	8/04/2008 || 8/04/2008	59959-8	08/04/08%
Chlorpyrifos	mg/kg	0.1	SEO-005	<0.1	59959-7	<0.1 || <0.1	59959-8	71%
Fenitrothion	mg/kg	0.1	SEO-005	<0.1	59959-7	<0.1 || <0.1	[NR]	[NR]
Bromofos Ethyl	mg/kg	0.1	SEO-005	<0.1	59959-7	<0.1 || <0.1	[NR]	[NR]
Ethion	mg/kg	0.1	SEO-005	<0.1	59959-7	<0.1 || <0.1	[NR]	[NR]
OP_Surrogate 1	%	0	SEO-005	103	59959-7	107 || 106 || RPD: 1	59959-8	111%
QUALITY CONTROL PCBs in Soil	UNITS	LOR	METHOD	Blank	Duplicate Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Matrix Spike % Recovery Duplicate + %RPD
Date Extracted				08/04/08	59959-7	8/04/2008 || 8/04/2008	LCS	08/04/08%
Date Analysed				08/04/08	59959-7	8/04/2008 || 8/04/2008	LCS	08/04/08%
Arochlor 1016	mg/kg	0.1	SEO-005	<0.1	59959-7	<0.1 || <0.1	[NR]	[NR]
Arochlor 1221	mg/kg	0.1	SEO-005	<0.1	59959-7	<0.1 || <0.1	[NR]	[NR]
Arochlor 1232	mg/kg	0.1	SEO-005	<0.1	59959-7	<0.1 || <0.1	[NR]	[NR]
Arochlor 1242	mg/kg	0.1	SEO-005	<0.1	59959-7	<0.1 || <0.1	[NR]	[NR]
Arochlor 1248	mg/kg	0.1	SEO-005	<0.1	59959-7	<0.1 || <0.1	[NR]	[NR]
Arochlor 1254	mg/kg	0.1	SEO-005	<0.1	59959-7	<0.1 || <0.1	[NR]	[NR]
Arochlor 1260	mg/kg	0.1	SEO-005	<0.1	59959-7	<0.1 || <0.1	LCS	115%
Arochlor 1262	mg/kg	0.1	SEO-005	<0.1	59959-7	<0.1 || <0.1	[NR]	[NR]
Arochlor 1268	mg/kg	0.1	SEO-005	<0.1	59959-7	<0.1 || <0.1	[NR]	[NR]
Total Positive PCB	mg/kg	0.9	SEO-005	<0.90	59959-7	<0.90 || <0.90	[NR]	[NR]
PCB_Surrogate 1	%	0	SEO-005	103	59959-7	107 || 106 || RPD: 1	LCS	99%

QUALITY CONTROL **Total Phenolics in Soil**	**UNITS**	**LOR**	**METHOD**	**Blank**	**Duplicate Sm#**	**Duplicate** **Base + Duplicate + %RPD**	**Spike Sm#**	**Matrix Spike % Recovery** **Duplicate + %RPD**
Date Extracted (Phenols)				4/04/2008	[NT]	[NT]	LCS	4/04/2008%
Date Analysed (Phenols)				4/04/2008	[NT]	[NT]	LCS	4/04/2008%
Total Phenolics (as Phenol)	mg/kg	0.1	SEI-066	<0.1	[NT]	[NT]	LCS	92%
QUALITY CONTROL Acid Extractable Metals in Soil	UNITS	LOR	METHOD	Blank	Duplicate Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Matrix Spike % Recovery Duplicate + %RPD
Date Extracted (Metals)				07/04/08	59959-1	7/04/2008 || 7/04/2008	59959-2	07/04/08%
Date Analysed (Metals)				07/04/08	59959-1	7/04/2008 || 7/04/2008	59959-2	07/04/08%
Arsenic	mg/kg	3	SEM-010	<3	59959-1	<3 || <3	59959-2	98%
Cadmium	mg/kg	0.3	SEM-010	<0.3	59959-1	2.7 || 2.8 || RPD: 4	59959-2	98%
Chromium	mg/kg	0.3	SEM-010	<0.3	59959-1	16 || 13 || RPD: 21	59959-2	90%
Copper	mg/kg	0.5	SEM-010	<0.5	59959-1	49 || 41 || RPD: 18	59959-2	97%
Lead	mg/kg	1	SEM-010	<1	59959-1	25 || 28 || RPD: 11	59959-2	91%
Nickel	mg/kg	0.5	SEM-010	<0.5	59959-1	77 || 62 || RPD: 22	59959-2	91%
Zinc	mg/kg	0.5	SEM-010	<0.5	59959-1	100 || 100 || RPD: 0	59959-2	90%
Date Extracted (Mercury)				04/04/08	59959-1	4/04/2008 || 4/04/2008	59959-2	04/04/08%
Date Analysed (Mercury)				04/04/08	59959-1	4/04/2008 || 4/04/2008	59959-2	04/04/08%
Mercury	mg/kg	0.05	SEM-005	<0.05	59959-1	<0.05 || <0.05	59959-2	92%

QUALITY CONTROL Asbestos ID in soil	**UNITS**	**LOR**	**METHOD**	**Blank**
Date Analysed				[NT]
QUALITY CONTROL Asbestos ID in materials	UNITS	LOR	METHOD	Blank
Date Analysed				[NT]
QUALITY CONTROL Hold sample-**NO test** required	UNITS	LOR	METHOD	Blank
Sample on HOLD				[NT]
QUALITY CONTROL Moisture	UNITS	LOR	METHOD	Blank
Date Analysed (moisture)				04/04/08
Moisture	%	1	AN002	<1

QUALITY CONTROL TRH/BTEX in Soil	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD
Date Extracted (TRH C6-C9 PT)		59959-17	4/04/2008 || 4/04/2008
Date Analysed (TRH C6-C9 PT)		59959-17	7/04/2008 || 7/04/2008
TRH C_6 - C_9 P&T	mg/kg	59959-17	<20 || <20
Date Extracted (TRH C10-C36)		59959-17	8/04/2008 || [N/T]
Date Analysed (TRH C10-C36)		59959-17	8/04/2008 || [N/T]
TRH C_{10} - C_{14}	mg/kg	59959-17	<20 || [N/T]
TRH C_{15} - C_{28}	mg/kg	59959-17	<50 || [N/T]
TRH C_{29} - C_{36}	mg/kg	59959-17	<50 || [N/T]
Date Extracted (BTEX)		59959-17	4/04/2008 || 4/04/2008
Date Analysed (BTEX)		59959-17	7/04/2008 || 7/04/2008
Benzene	mg/kg	59959-17	<0.5 || <0.5
Toluene	mg/kg	59959-17	<0.5 || <0.5
Ethylbenzene	mg/kg	59959-17	<0.5 || <0.5
Total Xylenes	mg/kg	59959-17	<1.5 || <1.5
BTEX Surrogate (%)	%	59959-17	85 || 87 || RPD: 2

QUALITY CONTROL PAHs in Soil	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD
Date Extracted		59959-11	8/04/2008 || 8/04/2008
Date Analysed		59959-11	8/04/2008 || 8/04/2008
Naphthalene	mg/kg	59959-11	<0.1 || <0.1
Acenaphthylene	mg/kg	59959-11	<0.1 || <0.1
Acenaphthene	mg/kg	59959-11	<0.1 || <0.1
Fluorene	mg/kg	59959-11	<0.1 || <0.1
Phenanthrene	mg/kg	59959-11	<0.1 || <0.1
Anthracene	mg/kg	59959-11	<0.1 || <0.1
Fluoranthene	mg/kg	59959-11	<0.1 || <0.1
Pyrene	mg/kg	59959-11	<0.1 || <0.1
Benzo[*a*]anthracene	mg/kg	59959-11	<0.1 || <0.1
Chrysene	mg/kg	59959-11	<0.1 || <0.1
Benzo[*b,k*]fluoranthene	mg/kg	59959-11	<0.2 || <0.2
Benzo[*a*]pyrene	mg/kg	59959-11	<0.05 || <0.05
Indeno[*123-cd*]pyrene	mg/kg	59959-11	<0.1 || <0.1
Dibenzo[*ah*]anthracene	mg/kg	59959-11	<0.1 || <0.1
Benzo[*ghi*]perylene	mg/kg	59959-11	<0.1 || <0.1
Total PAHs	mg/kg	59959-11	<1.55 || <1.55
Nitrobenzene-d5	%	59959-11	100 || 103 || RPD: 3
2-Fluorobiphenyl	%	59959-11	100 || 103 || RPD: 3
p -Terphenyl-*d14*	%	59959-11	107 || 109 || RPD: 2

QUALITY CONTROL Acid Extractable Metals in Soil	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD
Date Extracted (Metals)		59959-13	7/04/2008 || 7/04/2008
Date Analysed (Metals)		59959-13	7/04/2008 || 7/04/2008
Arsenic	mg/kg	59959-13	6 || 4 || RPD: 40
Cadmium	mg/kg	59959-13	0.5 || <0.3
Chromium	mg/kg	59959-13	11 || 11 || RPD: 0
Copper	mg/kg	59959-13	13 || 11 || RPD: 17
Lead	mg/kg	59959-13	12 || 11 || RPD: 9
Nickel	mg/kg	59959-13	10 || 8.2 || RPD: 20
Zinc	mg/kg	59959-13	65 || 50 || RPD: 26
Date Extracted (Mercury)		59959-13	4/04/2008 || 4/04/2008
Date Analysed (Mercury)		59959-13	4/04/2008 || 4/04/2008
Mercury	mg/kg	59959-13	<0.05 || <0.05
QUALITY CONTROL TRH/BTEX in Soil	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD
Date Extracted (TRH C6-C9 PT)		59959-1	4/04/2008 || [N/T]
Date Analysed (TRH C6-C9 PT)		59959-1	7/04/2008 || [N/T]
TRH C_6 - C_9 P&T	mg/kg	59959-1	<20 || [N/T]
Date Extracted (TRH C10-C36)		59959-1	8/04/2008 || 8/04/2008
Date Analysed (TRH C10-C36)		59959-1	8/04/2008 || 8/04/2008
TRH C_{10} - C_{14}	mg/kg	59959-1	<20 || <20
TRH C_{15} - C_{28}	mg/kg	59959-1	<50 || <50
TRH C_{29} - C_{36}	mg/kg	59959-1	<50 || <50
Date Extracted (BTEX)		59959-1	4/04/2008 || [N/T]
Date Analysed (BTEX)		59959-1	7/04/2008 || [N/T]
Benzene	mg/kg	59959-1	<0.5 || [N/T]
Toluene	mg/kg	59959-1	<0.5 || [N/T]
Ethylbenzene	mg/kg	59959-1	<0.5 || [N/T]
Total Xylenes	mg/kg	59959-1	<1.5 || [N/T]
BTEX Surrogate (%)	%	59959-1	102 || [N/T]

QUALITY CONTROL TRH/BTEX in Soil	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD
Date Extracted (TRH C6-C9 PT)		59959-11	4/04/2008 || [N/T]
Date Analysed (TRH C6-C9 PT)		59959-11	7/04/2008 || [N/T]
TRH C_6 - C_9 P&T	mg/kg	59959-11	<20 || [N/T]
Date Extracted (TRH C10-C36)		59959-11	8/04/2008 || 8/04/2008
Date Analysed (TRH C10-C36)		59959-11	8/04/2008 || 8/04/2008
TRH C_{10} - C_{14}	mg/kg	59959-11	<20 || <20
TRH C_{15} - C_{28}	mg/kg	59959-11	<50 || <50
TRH C_{29} - C_{36}	mg/kg	59959-11	<50 || <50
Date Extracted (BTEX)		59959-11	4/04/2008 || [N/T]
Date Analysed (BTEX)		59959-11	7/04/2008 || [N/T]
Benzene	mg/kg	59959-11	<0.5 || [N/T]
Toluene	mg/kg	59959-11	<0.5 || [N/T]
Ethylbenzene	mg/kg	59959-11	<0.5 || [N/T]
Total Xylenes	mg/kg	59959-11	<1.5 || [N/T]
BTEX Surrogate (%)	%	59959-11	93 || [N/T]

Result Codes

[INS]	:	Insufficient Sample for this test	[RPD]	:	Relative Percentage Difference
[NR]	:	Not Requested	*	:	Not part of NATA Accreditation
[NT]	:	Not tested	[N/A]	:	Not Applicable

Report Comments

Sampled by the client

Even after disintegration it can be very difficult, or impossible, to detect the presence of asbestos in some asbestos-containing bulk materials using polarised light microscopy.
This is due to the low grade or small length or diameter of asbestos fibres present in the material, or to the fact that very fine fibres have been distributed intimately throughout the materials.

No respirable fibres detected using trace analysis technique.
Sub Sample taken from the Jar/Bag supplied by client for Asbestos analysis at the clients request.
Asbestos analysed by Approved Identifier Edward Ibrahim.

The PAHs LOR for sample numbers 1, 1D, and 2 has been raised due to sample matrix interference.
Date Organics extraction commenced: 04/04/08
NATA Corporate Accreditation No. 2562, Site No 4354
Note: Test results are not corrected for recovery (excluding Dioxins/Furans* and PAH in XAD and PUF).

Quality Control Protocol

Method Blank: An analyte free matrix to which all reagents are added in the same volume or proportions as used in sample processing. The method blank should be carried through the complete sample preparation and analytical procedure. A method blank is prepared every 20 samples.
Duplicate: A separate portion of a sample being analysed that is treated the same as the other samples in the batch. One duplicate is processed at least every 10 samples.
Surrogate Spike: An organic compound which is similar to the target analyte(s) in chemical composition and behavior in the analytical process, but which is not normally found in environmental samples. Surrogates are added to samples before extraction to monitor extraction efficiency and percent recovery in each sample.
Internal Standard: Added to all samples requiring analysis for organics (where relevant) or metals by ICP after the extraction/digestion process; the compounds/elements serve to give a standard of retention time and/or response, which is invariant from run-to-run with the instruments.
Laboratory Control Sample: A known matrix spiked with compound(s) representative of the target analytes. It is used to document laboratory performance. When the results of the matrix spike analysis indicates a potential problem due to the sample matrix itself, the LCS results are used to verify that the laboratory can perform the analysis in a clean matrix.
Matrix Spike: An aliquot of sample spiked with a known concentration of target analyte(s). The spiking occurs prior to sample preparation and analysis. A matrix spike is used to document the bias of a method in a given sample matrix.

Quality Acceptance Criteria

Unless otherwise specified in the test method, the following general acceptance criteria apply:

Method Blanks:	<LOR
Duplicates:	<5 x LOR: No RPD criteria applied.
	>5 x LOR: 0-30% RPD is accepted.
LCS's:	Determined by Control Charts.
	Where control charts have not been developed, the Matrix Spikes criteria apply.
Matrix Spikes:	70-130% recovery is accepted for metals / inorganics.
	60-140% is accepted for organics.
Surrogates:	60-130% recovery is accepted for BTEX.
	70-130% recovery is accepted for other organics.

S0413-44 - WOO4

Douglas Partners
Geotechnics • Environment • Groundwater

CHAIN OF CUSTODY DESPATCH SHEET

Project Name: Warnervale
Project No: 41615.01
DP Contact Person: Brent Kerry
Prior Storage: esky / fridge / shelved (circle)

To: SGS Environmental Services
Unit 16, 33 Maddox Street
ALEXANDRIA NSW 2015

Attention: Alex Stenta 8594 0400

Attn:

Sample ID	Sample Type S-soil W-water	Lab ID	Analytes: Package #3	VOC		Phenols	Asbestos	TRH/BTEX	HM	Package #4	Hold						Notes
101/0.1	S	1	X	X		X	X										Samples collected by BJK 25/3/08
102/0.1		2	X	X		X											
QA101		3						X	X								
102/0.3		4									X						
103/0.1		5	X			X	X										
104/0.1		6	X														
105/0.1		7								X							
106/0.1		8		X		X				X							
107/0.1		9		X						X							
108/0.1		10	X				X										
108/1.5	↓	11		X		X	X			X							
108/FC	FC	12					X										
PQL (S)	mg/kg																
PQL (W)	mg/L																

Received 3/4/08 @ 1:30 am/pm
By
Time
Samples Intact Yes/no
Esky/Cooler Pack Yes/no
Comments: 59959

PQL = practical quantitation limit, *As per Laboratory Method Detection Limit

Date relinquished: 3/4/08
Total number of samples in container:
Results required by: Normal Turnaround
Bottom

SAMPLES RECEIVED
Please sign and date to acknowledge receipt of samples and return by fax

Signature:
Date: 3/4/8 Lab Ref: 59959

Send results to:
Douglas Partners Pty Ltd
Address: Unit P 7 Donaldson Street
Wyong North NSW 2259

Fax: 4351 1410

SVOC = PAH, OC, OP & PCB

Douglas Partners
Geotechnics • Environment • Groundwater

CHAIN OF CUSTODY DESPATCH SHEET

Project Name: Warnervale
Project No: 41615.01
DP Contact Person: Brent Kerry
Prior Storage: esky / fridge / shelved (circle)

To:
SGS Environmental Services
Unit 16, 33 Maddox Street
ALEXANDRIA NSW 2015
Attention: Alex Stenta 8594 0400

Attn:

Sample ID	Sample Type S-soil W-water	Lab ID	Analytes: Package #4	Asbestos	Package #3	pH	TDS	Ammonia	Nitrate	HM	TRH/BTEX						Notes
109Sed	S	13	X														Collected by BJK 25/3/08
110Sed		14	X	X													
111Sed		15	X	X													
112Sed		16	X														
113Sed		17	X	X													
109W	W	18			X	X	X	X	X								Collected 2/4/08
110W		19			X	X	X	X	X								
111W		20			X	X	X	X	X								
113W		21			X	X	X	X	X								
QAW1		22								X							
100/FC	FC	23		X													25/3/08
RB101	W	24								X	X						25/3/08
PQL (S)	mg/kg																
PQL (W)	mg/L																

PQL = practical quantitation limit, *As per Laboratory Method Detection Limit

Date relinquished: 3/4/08
Total number of samples in container:
Results required by: Normal Turnaround

SAMPLES RECEIVED
Please sign and date to acknowledge receipt of samples and return by fax

Signature: Emily
Date: 7/4/08 Lab Ref: 59959

Send results to:
Douglas Partners Pty Ltd
Address: Unit D 7 Donaldson Street
Wyong North NSW 2259
Fax: 4351 1410

14 April 2008 **TEST REPORT**

Douglas Partners Pty Ltd
Unit D, 7 Donaldson Street
WYONG NORTH
NSW 2259

Your Reference: 41615.01, Warnervale (Waters)
Report Number: 59959A

Attention: Brent Kerry

Dear Brent
The following samples were received from you on the date indicated.

Samples: Qty.	6 Waters
Date of Receipt of Samples:	34/0/8 & 4/4/08
Date of Receipt of Instructions:	3/4/08
Date Preliminary Report Emailed:	Not Issued

These samples were analysed in accordance with your written instructions.
A copy of the instructions is attached with the analytical report.

The results and associated quality control are contained in the following pages of this report. Unless otherwise stated, solid samples are expressed on a dry weight basis (moisture has been supplied for your information only), air and liquid samples as received.

Should you have any queries regarding this report please contact the undersigned.

Yours faithfully
SGS ENVIRONMENTAL SERVICES

Ly Kim Ha
Senior Organic Chemist

Edward Ibrahim
Laboratory Services Manager

SGS Australia Pty Ltd
ABN 44 000 964 278
Environmental Services Unit 16, 33 Maddox Street, Alexandria Australia
t (02) 8594 0400 f (02) 8594 0499
www.au.sgs.com
Member of the SGS Group

BTEX in Water (µg/L) Our Reference: Your Reference Sample Type Date Sampled	UNITS ---------- ----------	59959A-18 109W Water 2/04/2008	59959A-19 110W Water 2/04/2008	59959A-20 111W Water 2/04/2008	59959A-21 113W Water 2/04/2008	59959A-24 RB101 Water 25/03/2008
Date Extracted (BTEX)		7/04/2008	7/04/2008	7/04/2008	7/04/2008	7/04/2008
Date Analysed (BTEX)		7/04/2008	7/04/2008	7/04/2008	7/04/2008	7/04/2008
Benzene	µg/L	<1	<1	<1	<1	<1
Toluene	µg/L	<1	<1	<1	<1	<1
Ethylbenzene	µg/L	<1	<1	<1	<1	<1
Total Xylenes	µg/L	<3	<3	<3	<3	<3
Surrogate	%	116	112	116	112	112

TRH in water with C6-C9 by P/T Our Reference: Your Reference Sample Type Date Sampled	UNITS ---------- ----------	59959A-18 109W Water 2/04/2008	59959A-19 110W Water 2/04/2008	59959A-20 111W Water 2/04/2008	59959A-21 113W Water 2/04/2008	59959A-24 RB101 Water 25/03/2008
Date Extracted (TRH C6-C9 PT)		7/04/2008	7/04/2008	7/04/2008	7/04/2008	7/04/2008
Date Analysed (TRH C6-C9 PT)		7/04/2008	7/04/2008	7/04/2008	7/04/2008	7/04/2008
TRH C_6 - C_9 P&T in µg/L	µg/L	<40	<40	<40	<40	<40
Date Extracted (TRH C10-C36)		7/04/2008	7/04/2008	7/04/2008	7/04/2008	7/04/2008
Date Analysed (TRH C10-C36)		7/04/2008	7/04/2008	7/04/2008	7/04/2008	7/04/2008
TRH C_{10} - C_{14}	ug/L	<100	<100	<100	<100	<100
TRH C_{15} - C_{28}	ug/L	<200	<200	<200	<200	<200
TRH C_{29} - C_{36}	µg/L	<200	<200	<200	<200	<200

PAHs in Water Our Reference: Your Reference Sample Type Date Sampled	UNITS ---------- ----------	59959A-18 109W Water 2/04/2008	59959A-19 110W Water 2/04/2008	59959A-20 111W Water 2/04/2008	59959A-21 113W Water 2/04/2008
Date Extracted		7/04/2008	7/04/2008	7/04/2008	7/04/2008
Date Analysed		7/04/2008	7/04/2008	7/04/2008	7/04/2008
Naphthalene	µg/L	<0.5	<0.5	<0.5	<0.5
Acenaphthylene	µg/L	<0.5	<0.5	<0.5	<0.5
Acenaphthene	µg/L	<0.5	<0.5	<0.5	<0.5
Fluorene	µg/L	<0.5	<0.5	<0.5	<0.5
Phenanthrene	µg/L	<0.5	<0.5	<0.5	<0.5
Anthracene	µg/L	<0.5	<0.5	<0.5	<0.5
Fluoranthene	µg/L	<0.5	<0.5	<0.5	<0.5
Pyrene	µg/L	<0.5	<0.5	<0.5	<0.5
Benzo[*a*]anthracene	µg/L	<0.5	<0.5	<0.5	<0.5
Chrysene	µg/L	<0.5	<0.5	<0.5	<0.5
Benzo*[b,k]*fluoranthene	µg/L	<1.0	<1.0	<1.0	<1.0
Benzo[*a*]pyrene	µg/L	<0.5	<0.5	<0.5	<0.5
Indeno[*123-cd*]pyrene	µg/L	<0.5	<0.5	<0.5	<0.5
Dibenzo[*ah*]anthracene	µg/L	<0.5	<0.5	<0.5	<0.5
Benzo[*ghi*]perylene	µg/L	<0.5	<0.5	<0.5	<0.5
Total PAHs	µg/L	<8.0	<8.0	<8.0	<8.0
Nitrobenzene-d5	%	115	98	66	29
2-Fluorobiphenyl	%	115	96	61	28
p -Terphenyl-*d14*	%	126	123	73	45

Inorganics Our Reference: Your Reference Sample Type Date Sampled	UNITS ---------- ----------	59959A-18 109W Water 2/04/2008	59959A-19 110W Water 2/04/2008	59959A-20 111W Water 2/04/2008	59959A-21 113W Water 2/04/2008
Date Extracted (pH)		7/04/2008	7/04/2008	3/04/2008	3/04/2008
Date Analysed (pH)		7/04/2008	7/04/2008	3/04/2008	3/04/2008
pH	pH Units	7.0	7.2	6.4	5.8
Date Extracted (TDS)		11/04/2008	11/04/2008	11/04/2008	11/04/2008
Date Analysed (TDS)		11/04/2008	11/04/2008	11/04/2008	11/04/2008
Total Dissolved Solids	mg/L	300	170	170	600
Date Extracted (Ammonia)		11/04/2008	11/04/2008	10/04/2008	10/04/2008
Date Analysed (Ammonia)		11/04/2008	11/04/2008	10/04/2008	10/04/2008
Ammonia as N	mg/L	0.14	0.19	0.04	0.06
Date Extracted		9/04/2008	9/04/2008	9/04/2008	9/04/2008
Date Analysed		9/04/2008	9/04/2008	9/04/2008	9/04/2008
Nitrate as N	mg/L	<0.05	<0.05	<0.05	<0.05

Trace HM (ICP-MS)-Dissolved Our Reference: Your Reference Sample Type Date Sampled	UNITS ---------- ----------	59959A-18 109W Water 2/04/2008	59959A-19 110W Water 2/04/2008	59959A-20 111W Water 2/04/2008	59959A-21 113W Water 2/04/2008	59959A-22 QAW1 Water 2/04/2008
Date Extracted (Metals-ICPMS)		9/04/2008	9/04/2008	9/04/2008	9/04/2008	9/04/2008
Date Analysed (Metals-ICPMS)		9/04/2008	9/04/2008	9/04/2008	9/04/2008	9/04/2008
Arsenic	µg/L	<1.0	<1.0	1.0	<1.0	1.0
Cadmium	µg/L	<0.10	<0.10	<0.10	<0.10	<0.10
Chromium	µg/L	<1.0	<1.0	<1.0	<1.0	<1.0
Copper	µg/L	<1.0	<1.0	<1.0	2.6	<1.0
Lead	µg/L	<1.0	<1.0	<1.0	1.8	<1.0
Nickel	µg/L	3.0	3.5	3.3	1.2	3.7
Zinc	µg/L	2.5	1.1	3.9	4.7	2.3

Trace HM (ICP-MS)-Dissolved Our Reference: Your Reference Sample Type Date Sampled	UNITS ---------- ----------	59959A-24 RB101 Water 25/03/2008
Date Extracted (Metals-ICPMS)		9/04/2008
Date Analysed (Metals-ICPMS)		9/04/2008
Arsenic	µg/L	<1.0
Cadmium	µg/L	<0.10
Chromium	µg/L	<1.0
Copper	µg/L	<1.0
Lead	µg/L	<1.0
Nickel	µg/L	<1.0
Zinc	µg/L	4.5

Mercury Cold Vapor/Hg Analyser Our Reference: Your Reference Sample Type Date Sampled	UNITS ---------- ----------	59959A-18 109W Water 2/04/2008	59959A-19 110W Water 2/04/2008	59959A-20 111W Water 2/04/2008	59959A-21 113W Water 2/04/2008	59959A-22 QAW1 Water 2/04/2008
Date Extracted (Mercury)		7/04/2008	7/04/2008	4/04/2008	4/04/2008	4/04/2008
Date Analysed (Mercury)		7/04/2008	7/04/2008	4/04/2008	4/04/2008	4/04/2008
Mercury (Dissolved)	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005

Mercury Cold Vapor/Hg Analyser Our Reference: Your Reference Sample Type Date Sampled	UNITS ---------- ----------	59959A-24 RB101 Water 25/03/2008
Date Extracted (Mercury)		4/04/2008
Date Analysed (Mercury)		4/04/2008
Mercury (Dissolved)	mg/L	<0.0005

Method ID	Methodology Summary
SEO-018	BTEX - Determination by purge and trap/ Gas Chromatography with MS Detection.
SEO-017	BTEX/TRH C6-C9 - Determination by Purge and Trap Gas Chromatography with Flame Ionisation Detection (FID) and Photo Ionisation Detection (PID). The surrogate spike used is aaa-trifluorotoluene.
SEO-020	TRH - Determination of Total Recoverable Hydrocarbons by gas chromatography following extraction with DCM/Acetone for solids and DCM for liquids.
SEO-030	PAHs by GC/MS - Determination of Polynuclear Aromatic Hydrocarbons (PAH's) by Gas Chromatography / Mass Spectrometry following extraction with dichloromethane or dichloromethane/acetone. The surrogate spike used is p-Terphenyl-d14.
AN101	pH - Measured using pH meter and electrode in accordance with APHA 20th ED, 4500-H+.
SEI-017	Total Dissolved Solids - determined gravimetrically by drying the sample, in accordance with APHA 20th ED, 2540-C.
SEI-037	Ammonia - Determined by colourimetric method using Discrete Analyser
SEI-038	Anions - a range of Anions are determined by Ion Chromatography, in accordance with APHA 20th ED, 4110-B.
SEP-015	Water sample is digested with Nitric Acid at 105^{o}C for total metals analysed by ICPMS.
AN318	Determination of elements at trace levels in waters by ICP-MS. Method based on USEPA 6020A
SEM-005	Mercury - Determination of Mercury by Cold Vapour Generation Atomic Absorption Spectroscopy.

QUALITY CONTROL BTEX in Water (µg/L)	UNITS	LOR	METHOD	Blank	Duplicate Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Matrix Spike % Recovery Duplicate + %RPD
Date Extracted (BTEX)				07/04/08	[NT]	[NT]	LCS	07/04/08%
Date Analysed (BTEX)				07/04/08	[NT]	[NT]	LCS	07/04/08%
Benzene	µg/L	1	SEO-018	<1	[NT]	[NT]	LCS	101%
Toluene	µg/L	1	SEO-018	<1	[NT]	[NT]	LCS	102%
Ethylbenzene	µg/L	1	SEO-018	<1	[NT]	[NT]	LCS	102%
Total Xylenes	µg/L	3	SEO-018	<3	[NT]	[NT]	LCS	101%
Surrogate	%	0	SEO-018	108	[NT]	[NT]	LCS	78%
QUALITY CONTROL TRH in water with C6-C9 by P/T	UNITS	LOR	METHOD	Blank	Duplicate Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Matrix Spike % Recovery Duplicate + %RPD
Date Extracted (TRH C6-C9 PT)				07/04/08	[NT]	[NT]	LCS	07/04/08%
Date Analysed (TRH C6-C9 PT)				07/04/08	[NT]	[NT]	LCS	07/04/08%
TRH C_6 - C_9 P&T in µg/L	µg/L	40	SEO-017	<40	[NT]	[NT]	LCS	105%
Date Extracted (TRH C10-C36)				07/04/08	[NT]	[NT]	LCS	07/04/08%
Date Analysed (TRH C10-C36)				07/04/08	[NT]	[NT]	LCS	07/04/08%
TRH C_{10} - C_{14}	ug/L	100	SEO-020	<100	[NT]	[NT]	LCS	116%
TRH C_{15} - C_{28}	ug/L	200	SEO-020	<200	[NT]	[NT]	LCS	117%
TRH C_{29} - C_{36}	µg/L	200	SEO-020	<200	[NT]	[NT]	LCS	118%
QUALITY CONTROL PAHs in Water	UNITS	LOR	METHOD	Blank	Duplicate Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Matrix Spike % Recovery Duplicate + %RPD
Date Extracted				07/04/08	[NT]	[NT]	LCS	07/04/08%
Date Analysed				07/04/08	[NT]	[NT]	LCS	07/04/08%
Naphthalene	µg/L	0.5	SEO-030	<0.5	[NT]	[NT]	LCS	72%
Acenaphthylene	µg/L	0.5	SEO-030	<0.5	[NT]	[NT]	LCS	68%
Acenaphthene	µg/L	0.5	SEO-030	<0.5	[NT]	[NT]	LCS	84%
Fluorene	µg/L	0.5	SEO-030	<0.5	[NT]	[NT]	[NR]	[NR]
Phenanthrene	µg/L	0.5	SEO-030	<0.5	[NT]	[NT]	LCS	72%
Anthracene	µg/L	0.5	SEO-030	<0.5	[NT]	[NT]	LCS	75%
Fluoranthene	µg/L	0.5	SEO-030	<0.5	[NT]	[NT]	LCS	70%
Pyrene	µg/L	0.5	SEO-030	<0.5	[NT]	[NT]	LCS	72%
Benzo[a]anthracene	µg/L	0.5	SEO-030	<0.5	[NT]	[NT]	[NR]	[NR]
Chrysene	µg/L	0.5	SEO-030	<0.5	[NT]	[NT]	[NR]	[NR]

QUALITY CONTROL **PAHs in Water**	**UNITS**	**LOR**	**METHOD**	**Blank**	**Duplicate Sm#**	**Duplicate** **Base + Duplicate + %RPD**	**Spike Sm#**	**Matrix Spike % Recovery** **Duplicate + %RPD**
Benzo[*b,k*]fluoranthene	µg/L	1.0	SEO-030	<1.0	[NT]	[NT]	[NR]	[NR]
Benzo[*a*]pyrene	µg/L	0.5	SEO-030	<0.5	[NT]	[NT]	LCS	70%
Indeno[*123-cd*]pyrene	µg/L	0.5	SEO-030	<0.5	[NT]	[NT]	[NR]	[NR]
Dibenzo[*ah*]anthracene	µg/L	0.5	SEO-030	<0.5	[NT]	[NT]	[NR]	[NR]
Benzo[*ghi*]perylene	µg/L	0.5	SEO-030	<0.5	[NT]	[NT]	[NR]	[NR]
Total PAHs	µg/L	8.0		<8.0	[NT]	[NT]	[NR]	[NR]
Nitrobenzene-d5	%	0	SEO-030	100	[NT]	[NT]	LCS	77%
2-Fluorobiphenyl	%	0	SEO-030	98	[NT]	[NT]	LCS	77%
p -Terphenyl-*d*14	%	0	SEO-030	109	[NT]	[NT]	LCS	94%
QUALITY CONTROL Inorganics	UNITS	LOR	METHOD	Blank	Duplicate Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Matrix Spike % Recovery Duplicate + %RPD
Date Extracted (pH)				[NT]	59959A-18	7/04/2008 || [N/T]	[NR]	[NR]
Date Analysed (pH)				[NT]	59959A-18	7/04/2008 || [N/T]	[NR]	[NR]
pH	pH Units	0	AN101	[NT]	59959A-18	7.0 || [N/T]	[NR]	[NR]
Date Extracted (TDS)				11/04/2008	59959A-18	11/04/2008 || 11/04/2008	[NR]	[NR]
Date Analysed (TDS)				11/04/2008	59959A-18	11/04/2008 || 11/04/2008	[NR]	[NR]
Total Dissolved Solids	mg/L	5	SEI-017	<5	59959A-18	300 || 330 || RPD: 10	[NR]	[NR]
Ammonia as N	mg/L	0.01	SEI-037	<0.01	59959A-18	0.14 || [N/T]	[NR]	[NR]
Date Extracted				9/04/2008	59959A-18	9/04/2008 || 9/04/2008	59959A-19	09/04/08%
Date Analysed				9/04/2008	59959A-18	9/04/2008 || 9/04/2008	59959A-19	09/04/08%
Nitrate as N	mg/L	0.05	SEI-038	<0.05	59959A-18	<0.05 || <0.05	59959A-19	107%

QUALITY CONTROL Trace HM (ICP-MS)-Dissolved	UNITS	LOR	METHOD	Blank	Duplicate Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Matrix Spike % Recovery Duplicate + %RPD
Date Extracted (Metals-ICPMS)			SEP-015	09/04/08	[NT]	[NT]	LCS	09/04/08%
Date Analysed (Metals-ICPMS)			SEP-015	09/04/08	[NT]	[NT]	LCS	09/04/08%
Arsenic	µg/L	1	AN318	<1.0	[NT]	[NT]	LCS	94%
Cadmium	µg/L	0.1	AN318	<0.10	[NT]	[NT]	LCS	92%
Chromium	µg/L	1	AN318	<1.0	[NT]	[NT]	LCS	87%
Copper	µg/L	1	AN318	<1.0	[NT]	[NT]	LCS	104%
Lead	µg/L	1	AN318	<1.0	[NT]	[NT]	LCS	99%
Nickel	µg/L	1	AN318	<1.0	[NT]	[NT]	LCS	117%
Zinc	µg/L	1	AN318	<1.0	[NT]	[NT]	LCS	96%
QUALITY CONTROL Mercury Cold Vapor/Hg Analyser	UNITS	LOR	METHOD	Blank	Duplicate Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Matrix Spike % Recovery Duplicate + %RPD
Date Extracted (Mercury)				04/04/08	[NT]	[NT]	LCS	04/04/08%
Date Analysed (Mercury)				04/04/08	[NT]	[NT]	LCS	04/04/08%
Mercury (Dissolved)	mg/L	0.0005	SEM-005	<0.0005	[NT]	[NT]	LCS	102%

QUALITY CONTROL Inorganics	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD
Date Extracted (pH)		59959A-21	3/04/2008 || 3/04/2008
Date Analysed (pH)		59959A-21	3/04/2008 || 3/04/2008
pH	pH Units	59959A-21	5.8 || 5.8 || RPD: 0
Date Extracted (TDS)		59959A-21	11/04/2008 || 11/04/2008
Date Analysed (TDS)		59959A-21	11/04/2008 || 11/04/2008
Total Dissolved Solids	mg/L	59959A-21	600 || [N/T]
Ammonia as N	mg/L	59959A-21	0.06 || [N/T]
Date Extracted		59959A-21	9/04/2008 || [N/T]
Date Analysed		59959A-21	9/04/2008 || [N/T]
Nitrate as N	mg/L	59959A-21	<0.05 || [N/T]

Result Codes

[INS]	:	Insufficient Sample for this test	[RPD]	:	Relative Percentage Difference
[NR]	:	Not Requested	*	:	Not part of NATA Accreditation
[NT]	:	Not tested	[N/A]	:	Not Applicable

Report Comments

PAH-# 21 Surrogate not recovered within acceptance criteria due to the sample matrix.

TDS: Dried residue from sample 20 and 21 is consistent with organic content causing TDS\Conductivity ratio to fail.
Date Organics extraction commenced: 07/04/08
NATA Corporate Accreditation No. 2562, Site No 4354
Note: Test results are not corrected for recovery (excluding Dioxins/Furans* and PAH in XAD and PUF).
This document is issued, on the Client's behalf, by the Company under its General Conditions of Service available on request and accessible at http://www.sgs.com/terms_and_conditions.htm. The Client's attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein.

Any other holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents.

Quality Control Protocol

Method Blank: An analyte free matrix to which all reagents are added in the same volume or proportions as used in sample processing. The method blank should be carried through the complete sample preparation and analytical procedure. A method blank is prepared every 20 samples.
Duplicate: A separate portion of a sample being analysed that is treated the same as the other samples in the batch. One duplicate is processed at least every 10 samples.
Surrogate Spike: An organic compound which is similar to the target analyte(s) in chemical composition and behavior in the analytical process, but which is not normally found in environmental samples. Surrogates are added to samples before extraction to monitor extraction efficiency and percent recovery in each sample.
Internal Standard: Added to all samples requiring analysis for organics (where relevant) or metals by ICP after the extraction/digestion process; the compounds/elements serve to give a standard of retention time and/or response, which is invariant from run-to-run with the instruments.
Laboratory Control Sample: A known matrix spiked with compound(s) representative of the target analytes. It is used to document laboratory performance. When the results of the matrix spike analysis indicates a potential problem due to the sample matrix itself, the LCS results are used to verify that the laboratory can perform the analysis in a clean matrix.
Matrix Spike: An aliquot of sample spiked with a known concentration of target analyte(s). The spiking occurs prior to sample preparation and analysis. A matrix spike is used to document the bias of a method in a given sample matrix.

Quality Acceptance Criteria

Unless otherwise specified in the test method, the following general acceptance criteria apply:

Method Blanks:	<LOR
Duplicates:	<5 x LOR: No RPD criteria applied.
	>5 x LOR: 0-30% RPD is accepted.
LCS's:	Determined by Control Charts.
	Where control charts have not been developed, the Matrix Spikes criteria apply.
Matrix Spikes:	70-130% recovery is accepted for metals / inorganics.
	60-140% is accepted for organics.
Surrogates:	60-130% recovery is accepted for BTEX.
	70-130% recovery is accepted for other organics.

S0213-44 - WOM

Douglas Partners
Geotechnics • Environment • Groundwater

CHAIN OF CUSTODY DESPATCH SHEET

Project Name: Warnervale
Project No: 41615.01
DP Contact Person: Brent Kerry
Prior Storage: esky / fridge / shelved (circle)

To: SGS Environmental Services
Unit 16, 33 Maddox Street
ALEXANDRIA NSW 2015
Attention: Alex Stenta 8594 0400
Attn:

Sample ID	Sample Type S-soil W-water	Lab ID	Analytes: Package #3	VOC		Phenols	Asbestos	TRH/BTEX	LHM	Package #4	Hold							Notes
101/0.1	S	1	X	X		X	X											Samples collected by BJK 25/3/08
102/0.1		2	X	X		X												
QA101		3						X	X									
102/0.3		4									X							
103/0.1		5	X			X	X											
104/0.1		6	X															
105/0.1		7								X								
106/0.1		8		X		X				X								
107/0.1		9		X						X								
108/0.1		10	X				X											
108/1.5	↓	11		X		X	X			X								
108/FC	FC	12					X											
PQL (S)	mg/kg																	
PQL (W)	mg/L																	

Received 3/4/08
By
Time 1:30 am/pm
Samples Intact yes/no
Cooler Pack yes/no
Comments: SG 9959A

PQL = practical quantitation limit, *As per Laboratory Method Detection Limit

Date relinquished: 3/4/08
Total number of samples in container:
Results required by: Normal Turnaround
BK

SAMPLES RECEIVED
Please sign and date to acknowledge receipt of samples and return by fax

Signature:
Date: 3/4/8 Lab Ref: 59959

Send results to:
Douglas Partners Pty Ltd
Address: Unit D 7 Donaldson Street
Wyong North NSW 2259
Fax: 4351 1410

SVOC = PAH, OC, OP & PCB

Douglas Partners
Geotechnics • Environment • Groundwater

CHAIN OF CUSTODY DESPATCH SHEET

Project Name: Warnervale
Project No: 41615.01
DP Contact Person: Brent Kerry
Prior Storage: esky / fridge / shelved (circle)

To: SGS Environmental Services
Unit 16, 33 Maddox Street
ALEXANDRIA NSW 2015
Attention: Alex Stenta 8594 0400
Attn:

Sample ID	Sample Type S-soil W-water	Lab ID	Analytes: Package #4	Asbestos	Package #3	pH	TDS	Ammonia	Nitrate	HM	TRH/BTEX						Notes
109Sed	S	13	X														Collected by BJK 25/3/08
110Sed		14	X	X													
111Sed		15	X	X													
112Sed		16	X														
113Sed		17	X	X													
109W	W	18			X	X	X	X	X								Collected 2/4/08
110W		19			X	X	X	X	X								
111W		20			X	X	X	X	X								
113W		21			X	X	X	X	X								
QAW1		22								X							
100/FC	FC	23		X													25/3/08
RB101	W	24								X	X						25/3/08
PQL (S)	mg/kg																
PQL (W)	mg/L																

PQL = practical quantitation limit, *As per Laboratory Method Detection Limit

Date relinquished: 3/4/08
Total number of samples in container:
Results required by: Normal Turnaround
Brent

SAMPLES RECEIVED
Please sign and date to acknowledge receipt of samples and return by fax
Signature: Emily
Date: 7/4/08 Lab Ref: 54959

Send results to:
Douglas Partners Pty Ltd
Address: Unit D 7 Donaldson Street
Wyong North NSW 2259
Fax: 4351 1410

APPENDIX D

QA/QC PROCEDURES & RESULTS

APPENDIX D

QUALITY ASSURANCE/QUALITY CONTROL FOR SOIL & SURFACE WATER SAMPLING

.....

Quality Assurance (QA) was maintained by:

- compliance with a Project Quality Plan written for the objectives of the study;
- using qualified engineers to undertake the field supervision and sampling;
- following the DP operating procedures for sampling, field testing and decontamination as presented in Table D1;
- using NATA accredited laboratories for sample testing, that generally utilise standard laboratory methods of the US EPA, the APHA and NSW EPA.

Table D1: Field Procedures

Abbreviation	Procedure Name
FPM LOG	Logging
FPM DECONT	Decontamination of Personnel and Equipment
FPM ENVID	Sample Identification, Handling, Transport and Storage of Contaminated Samples
FPM PIDETC	Operation of Field Analysers
FPM WATSAMP	Water Sampling
FPM ENVSAMP	Sampling of Contaminated Soils

(from Douglas Partners Field Procedures Manual)

Quality Control (QC) of the laboratory programme was achieved by the following means:

- field replicate - a specific sample was split in the field, placed in separate containers and labelled with different sample numbers, and sent to the laboratory for analysis;
- field equipment rinsate - a rinsate water sample was taken and sent to the laboratory at the completion of sampling to ensure decontamination of sampling equipment was adequate;
- method blanks - the laboratory ran reagent blanks to confirm the equipment and standards used were uncontaminated;
- laboratory duplicates - the laboratory split samples internally and conducted tests on separate extracts;
- laboratory spikes - samples were spiked by the laboratory with a known concentration of contaminants and subsequently tested for percent recovery.

Discussion

A. Check Replicate

The Relative Percent Difference (RPD) between duplicate results is used as a measure of laboratory reproducibility and is given by the following:-

$$\text{RPD} = \frac{\text{ABS (Duplicate result 1} - \text{Duplicate result 2)}}{\text{(Duplicate result 1} + \text{Duplicate result 2)} / 2} \text{ x } 100$$

The RPD can have a value between 0% and 200%. An RPD data quality objective of up to 50% is generally considered to be acceptable for organic analysis, and 35% for inorganics (i.e. Metals).

A summary of the results of the soil replicate QA/QC testing is provided in Table D2.

TABLE D2 - RESULTS OF QUALITY CONTROL ANALYSIS

Analyte		102/0.1	QA101	RPD (%)	109W	QAW1	RPD (%)
Metals	As	4	3	29	<PQL	0.001	N/A
	Cd	1.5	1.4	7	<0.1	<0.1	N/A
	Cr	9.1	9.1	0	<PQL	<PQL	N/A
	Cu	15	16	6	<PQL	<PQL	N/A
	Pb	11	11	0	<PQL	<PQL	N/A
	Hg	<PQL	<PQL	N/A	<PQL	<PQL	N/A
	Ni	12	13	8	0.003	0.0037	21
	Zn	56	62	10	0.0025	0.0023	8
TRH	C_6 - C_9	<PQL	<PQL	N/A	NT	NT	N/A
	C_{10} - C_{14}	310	310	0	NT	NT	N/A
	C_{15} - C_{28}	28000	23000	20	NT	NT	N/A
	C_{29} - C_{36}	1400	1100	24	NT	NT	N/A
BTEX	Benzene	<PQL	<PQL	N/A	NT	NT	N/A
	Toluene	<PQL	<PQL	N/A	NT	NT	N/A
	Ethyl Benzene	<PQL	<PQL	N/A	NT	NT	N/A
	Xylene	<PQL	<PQL	N/A	NT	NT	N/A

RPDs for the soil and surface water field replicates ranged from 0% to 29%, with results within the acceptable limits. The results of replicate analysis are therefore generally considered acceptable.

B. Field Rinsate Blank

As part of field investigations, one equipment rinsate sample was collected to check on the adequacy of decontamination procedures used during the soil sampling program. Sample RB101 was collected on 25 February 2008 during test pitting activities. The soil sampling field rinsate sample was tested for a suite of heavy metals and petroleum hydrocarbons (TRH & BTEX). Identical decontamination procedures were used during the collection of sediment samples on 2 April 2008. Sampling of the surface water was undertaken sampling directly into the laboratory supplied container and gloves were changed prior to collection of each sample.

A full copy of the analytical results is attached in Appendix E. The analytical results for the rinsate samples were all less than PQL, with the exception of the zinc. The detectable zinc concentrations in the rinsate may theoretically have marginally affected the quality of the metal concentrations reported, although given that the detectable levels were generally orders of magnitude less than the soil results and they were also below the adopted trigger values, it is considered that the detected metal levels in the rinsate sample would not have materially affected the assessment outcome.

C. Sample Handling and Holding Times

A review of the laboratory reports and chain of custody forms associated with the CA indicates the following:

- Samples were received chilled and in good order;
- Samples received were appropriately preserved for all tests;
- VOC/SVOC samples were received in Teflon sealed containers;
- Volatile samples were received with zero headspace; and
- Samples were received within recommended holding times.

D. Laboratory Method Blanks

A reagent blank is prepared and analysed at the beginning of every analytical run, following calibration of the analytical apparatus. Results for reagent blanks for soil analyses showed concentrations of all analytes to be below laboratory PQL limits. Results are included in the laboratory reports attached in Appendix C.

E. Laboratory Duplicates

The average RPD for individual contaminants ranged from 0% to 40%, with results within the acceptable limits. The results are therefore considered to be acceptable.

F. Laboratory Spikes

Recoveries in the order of 70% to 130% are generally considered to be acceptable. The average percent recovery for individual contaminants ranged from 64% to 117% which is generally within the quality control objectives. A few recoveries for PAH and OCP were marginally above the acceptable limits. All PAH and OCP results were however generally below the laboratory PQL and as such are considered acceptable.

G. Laboratory Surrogate Recovery

This sample is prepared by adding a known amount of surrogate, which behaves similarly to the analyte, prior to analysis of each sample. The recovery result indicates the proportion of the known concentration of the surrogate detected during analysis. Surrogate recoveries were found to be generally within the SGS acceptance limits, indicating that the extraction was effectively and appropriately completed.

CONCLUSIONS

In summary, while some exceedences above the acceptance criteria were found for laboratory replicates, the fact that the majority of exceedences occurred for metals with small concentrations, the results are considered acceptable.

The accuracy and precision of the soil testing procedures, as inferred by the QA/QC data is generally considered to be of sufficient standard to allow the data reported to be used to interpret site contamination conditions.

Table D3 summarises data quality indicators (DQIs).

Table D3 - Data Quality Indicators

DQO	Achievement Evaluation Procedure
Documentation completeness	Completion of field and laboratory chain of custody documentation, completion of test pit logs.
Data completeness	Sampling rationale and analysis of appropriate determinants based on site history and on-site observations.
Data comparability	Use of NATA certified laboratory, use of consistent sampling technique.
Precision and accuracy for sampling and analysis	Achievement of 30-50% RPD for replicate analysis, acceptable levels for laboratory QC criteria.