



CONSULTING EARTH SCIENTISTS

ENVIRONMENTAL SITE ASSESSMENT:
LOT 22 ERSKINE PARK, TYRONE PL, ERSKINE PARK, NWS 2759
PREPARED FOR CSR LIMITED

Report ID: CES110514-CSR-AK
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ENVIRONMENTAL SITE ASSESSMENT

LOT 22 ERSKINE PARK

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1 INTRODUCTION

Consulting Earth Scientists (CES) were commissioned by CSR limited to conduct a site investigation and prepare an Environmental Site Assessment (ESA) report for the site Lot 22, Tyrone Place, Erskine Park 2759 (the site). The site is located to the west of Sydney CBD, in the local government area of Penrith Local Government. The site location can be seen on Figure 1. The ESA has been carried out with a view to future redevelopment of the site.

This report has been prepared in general accordance with the requirements specified for a Detailed Site Investigation as published by the department of Environment, Climate Change and Water (DECCW) incorporating the NSW Environment Protection Authority (EPA) in the *Contaminated Sites: Guidelines for Consultants Reporting on Contaminated Sites (NSW EPA, 1997)*.

2 OBJECTIVES AND SCOPE

The objectives of the ESA are as follows:

- Conduct a review of existing information;
- Conduct a site investigation to determine if there is contamination onsite;
- Perform a comprehensive soil sampling programme and testing;
- If contamination is identified assess whether the contamination represents a risk to human health or the environment considering the site's proposed use; and
- Outline recommended remediation options based on the results of the ESA.

To achieve these objectives the following scope of work was undertaken:

- Preparation of a Project Safety Plan (PSP), that identified foreseeable hazards associated with the site works and the measures to be employed to manage or remove the associated risk;
- Digging of 24 test pits using a mechanical excavator to a maximum depth of 5 m;
- Logging of test pits;
- Collection of 37 soil samples from test pits;
- Screening of soil samples by an experienced Environmental Scientist to select samples for laboratory analysis;
- Laboratory analysis of selected soil samples for heavy metals (As, Cd, Cr, Cu, Pb, Hg, Ni, Zn), hydrocarbon compounds (TRH, BTEX, PAH), pesticides (OCP/OPPs) Polychlorinated Biphenyls (PCBs) and Asbestos;
 - Submission of soil samples for laboratory analysis to a laboratory accredited by the National Association of Testing Authorities (NATA) for all tests described above;
 - Implementation of a quality control programme to ensure the integrity of data obtained;
 - Comparison of the results of chemical analyses from the soil and groundwater investigation to investigation levels published guidelines prepared or endorsed by the NSW DECCW, to assess the contamination status of the site and to assess possible risks to site occupants or the environment; and
 - Preparation of an ESA report.

3 SITE INFORMATION

3.1 SITE IDENTIFICATION

The site is located at Lot 22 Tyrone Place, Erskine park NWS 2759. The site is located in the local government area of Penrith City Council Local Government Area.

3.2 SITE DESCRIPTION

The site is approximately square shaped, and about 3.5 ha in area. The site was previously used as a stockpile facility for overburden material taken from the Erskine Park Quarry that operated next to the site (EES 2010). As a result the site contains a large residual stockpile that is currently being partly used as levelling material for Lot 21 which is situated to the east of the site.

3.3 SITE ZONING AND LAND USE

The site is currently zoned for commercial and industrial land use. It is currently vacant, having only been used for stockpiling of the overburden taken from Erskine Park Quarry.

3.4 SUMMARY OF SURROUNDING LAND USE

The surrounding land use at the time of the ESA consists of the following

- South: Erskine Park Landfill and Recycling Centre,
- North: Lenore Land an industrial area,
- East and west: industrial/commercial areas.

3.5 TOPOGRAPHY AND DRAINAGE

The centre of the site is the high point of the surrounding terrain. The stockpiled material is steeply sloping in places with slopes towards the site boundary in all directions from the centre of the site. There is an erosion and sediment control basin situated to the north west of the site, on the adjoining lot.

3.6 GEOLOGY

The Penrith 1:100000 Geological Series Sheet 9030 (NWS Department of Minerals and Energy, 1991) indicates that the site is underlain by Triassic Bringlelly Shale and Ashfield Shale. The bedrock is likely to be overlain by alluvial soils and fill material.

3.7 SOILS

The Penrith 1:100000 Soil Landscape Series Sheet 9030 (Soil Conservation Service of NSW, 1989) indicates that the natural soils underlying the site belong to the Blacktown soil landscape

group. These soils are found on undulating rises on Wianamatta and Hawkesbury Shale. Soils are shallow to moderately deep (< 100 cm) *Red and Brown Podzolic Soils (Dr3.21, Dr3.11, Db2.11)* on crests, upper slopes and well drained areas; deep (150 - 300 cm) *Yellow Podzolic Soils (Dy2.11, Dy3.11)* on lower slopes and areas of poor drainage. The limitations of this soil landscape group are moderate reactivity, low soil fertility and poor soil drainage.

Based on the existing information (reports EES (2010) and DLA (2012), both of which covered a larger area and included the adjoining lots), the site has been used as a stockpile for overburden material taken from the Erskine Park Quarry that operated to the south of the site (at the current location of the Erskine Park Landfill and Recycling Centre). As a result of this stockpile it is likely that there is a large amount of fill contained on the site. However this fill has been taken from the surrounding area and would most likely contain similar soil types mixed with waste materials from quarry operations (crushed rock etc). It is necessary to confirm the nature of materials onsite with an intrusive investigation.

3.8 ACID SULPHATE SOILS RISK

A review of the Acid Sulfate Soils Risk Maps and existing information (EES 2010 & DLA 2012) indicate that there are no known occurrences of Acid Sulfate Soils in or around the site area.

3.9 SITE HISTORY

A summary of the site history is derived from the review of historical aerial photographs and the historical title search is taken from the EES report (2010) and DLA report (2012).

Both reports state that the site was vacant and contained grassland prior to its use as a stockpile from the overburden from the Erskine Park Quarry which began between 1965 and 1970 and continued to between 1986 and 1994. After 1994 vegetation began to appear onsite and the site appeared to remain vacant until the current use of the stockpile as levelling material for Lot 21 to the east, which was in process at the time of the site investigations.

4 RESULTS OF PREVIOUS ASSESSMENT

Two previous preliminary environmental assessment reports were produced that included the site in their study area: *Preliminary Environmental Site Assessment 44 Tyrone Place Erskine Park NSW 2759* produced by DLA Environmental (DLA 2012) and *Classification of Erskine Park Quarry Overburden and the Potential Reuse of this Material On and Offsite* produced by Environmental Earth Sciences (EES 2010).

The EES report indicates that the stockpile present on the site is most likely to have been stockpiled and overburden material from the Erskine Park Quarry, and classified as virgin excavated natural material (VEMN). However, as some parts of the stockpile appeared to have been crushed or processed, the stockpile cannot be classed as VENM. The report also states that there is minimal risk to human health or the environment posed by the stockpiled material.

The DLA report, which also covered a larger area, contains results of a limited soil sampling programme, where soil samples from a small number of hand augered sampling points were analysed for Heavy Metals, TRH (total recoverable hydrocarbons), PAH (polycyclic aromatic hydrocarbons) compounds, BTEX (aromatic hydrocarbons) fractions, PCB (polychlorinated biphenyls), OPP (organophosphorous pesticides) and asbestos. The site history indicated minimal potential for contamination to exist as it was previously a vacant block and the analytical results indicated that the site contained no materials that could be harmful to human health or the environment. The report concludes that the site is suitable for the zoned land use of Industrial/Commercial uses.

5 CHARACTERISTICS OF CHEMICALS OF POTENTIAL CONCERN

The CoPC selected for the ESA on the site were selected based on experience and knowledge of the activities that were carried out on the site. The details and characteristics of the CoPC investigated are outlined below.

5.1.1 Heavy Metals

The metals typically analysed as contaminants in urban environments are arsenic, cadmium, chromium, copper, lead, nickel, zinc and mercury. They all generally tend to bind strongly to soil particles and will dissolve in water. Both mercury and zinc accumulate in animal tissue while the others will not. The mobility of all metals increases with increasing acidity.

5.1.2 Petroleum Hydrocarbons (TRH) and BTEX Compounds

Petroleum hydrocarbons and BTEX compounds are mostly associated with petroleum products. Petroleum hydrocarbons are analysed as TRH which are divided into C₆-C₉, C₁₀-C₁₄, C₁₅-C₂₈ and C₂₉-C₃₆ fractions based upon the number of carbon atoms within the compound. The C₆-C₉ fraction is considered to be the volatile fraction, with volatility decreasing and density increasing with the increasing number of carbon atoms. As a result, the C₆-C₉ fraction and BTEX are generally the most mobile and can volatilise, whereas the C₂₉-C₃₆ fraction is the least mobile.

5.1.3 Polycyclic Aromatic Hydrocarbons (PAH)

PAHs are essentially a by-product of incomplete combustion, either by natural or anthropogenic sources. Common sources are coal, soot, charcoal and bitumen. There are hundreds of PAHs in existence, but the common PAH analytical suite consists of the 16 USEPA priority PAHs which are listed in order of decreasing volatility, with naphthalene being the most volatile.

PAHs are very stable and persistent in the environment as well as being carcinogenic. Most PAHs adsorb strongly to soil particles, although some are capable of migrating into groundwater. They do not dissolve easily in water and are most likely to be associated with particulate matter.

5.1.4 Organochlorine and Organophosphorous Pesticides (OCPs/OPPs)

OCPs and OPPs are chlorine-based and phosphorous-based pesticides which are now generally banned from use in most parts of the world due to their environmental impact and bioaccumulative potential within fatty tissue. They are generally rapidly broken down by sunlight within about two days and adsorb strongly to soil.

5.1.5 Polychlorinated Biphenyls (PCB)

PCBs are chlorine-based, man-made compounds which are chemically stable, unreactive and have high electrical resistivity. They are commonly used in capacitors and transformers, hydraulic fluids, adhesives, plasticizers, heat transfer fluids, wax extenders, lubricants, cutting oils and flame retardants.

PCBs are fat soluble and bio-accumulate in the fatty tissue of terrestrial organisms and are biomagnified through the food chain. PCBs are transported through water and soil and occasionally through the air when waste materials containing PCBs are burned.

5.1.6 Asbestos Containing Materials (ACMs)

ACMs are man-made materials that contain asbestos. They include fibrous cement sheeting, fire retardants and lagging of piping and other structures.

Degradation of ACMs may result in the release of microscopic asbestos fibres, which can be harmful to human health and potentially result in lung diseases.

6 DATA QUALITY OBJECTIVES

The DQO process comprises a seven-step iterative planning approach. The process is used to define the type, quantity and quality of data needed to support decisions relating to the assessment of site contamination. It provides a systematic approach for defining the criteria that a data collection design should satisfy, including when, where and how to collect samples or measurements; determination of tolerable decision error rates; and the number of samples or measurements that should be collected.

Step 1 - State the Problem

The problem is the potential for the site to have contaminant levels in excess of those permissible for playing fields including secondary schools and which could impact upon receiving environments.

Step 2 - Identify the Decision Statement

Determine if there is any contamination at the site which would pose an unacceptable risk as defined by the NEPM (NEPC, 1999) or NSW EPA (1998) for the use of the site for industrial/commercial use or that would impact upon receiving environments.

Step 3 - Identify inputs to the decision

The following informational inputs are required to resolve the decision statement:

- The findings from the investigation to be undertaken at the site;
- Health Investigation Levels (HIL) as published in NEPC, 1999 Schedule B1;
- The Soil Investigation Levels (SILs) as published in NSW EPA *Guidelines for Assessing Service Station Sites* (1994) for TRH and BTEX assessment; and

Step 4 - Define the Boundaries of the Study

The boundary of the investigation comprises of Lot 22 Erskine Park, contained in the local government area of the City of Penrith. The site location is displayed in Figure 1.

Step 5 - Develop a Decision Rule

The purpose of this step is to define the parameter of interest, specify the action level and combine the outputs of the previous DQO steps into an “if...then...” decision rule that defines the conditions that would cause the decision maker to choose alternative actions.

The parameters of interest (or contaminants of concern) have been determined. The action level will be used to decide if the parameter represents an unacceptable risk industrial/commercial use

and/or the receiving environment. If the compound exceeds the action levels in soils, then this is deemed to present an unacceptable risk for the zoned land-use of industrial/commercial. The action level will be defined as the Site Assessment Criteria in Section 9.

Step 6 - Specify Acceptable Limits on Decision Errors

There are two types of errors:

- a) Deciding that the site is acceptable for Industrial and Commercial use and that there is a low risk to receiving environments when it actually is not. The consequence of this error may be unacceptable health risk for current and future users of the site.
- b) Deciding that the site is unacceptable for Industrial and Commercial use and that there is a risk to receiving environments when it is acceptable. The consequence of this error is that the client will pay for further investigation / remediation that are not necessary.

The more severe consequences are with decision error (a) since the risk of jeopardising human health outweighs the consequences of paying more for remediation.

Step 7 - Optimising the Design for Obtaining Data

The purpose of this step is to identify a resource-effective data collection design for generating data that are expected to satisfy the DQO's. The resource effective data collection design that is expected to satisfy the DQOs is described in detail in Section 8. To ensure the design satisfies the DQOs a comprehensive Quality Assurance and Quality Control Plan will be implemented as detailed in Section 8.

7 SAMPLING AND ANALYTICAL PROGRAMME

The following sampling and analytical programme was implemented as part of the ESA.

7.1 TEST PIT EXCAVATION

Fieldwork was undertaken on 29 and 30 March 2012 and was supervised by Mr Tristan Goodbody, an experienced environmental scientist, who directed excavations, nominated sampling and testing, and logged the encountered sub-surface conditions. A total of 24 test pits were excavated to an approximate depth of 5.5 m as this was the maximum depth obtainable using the mechanical excavator. Test pit logs can be found in Appendix A.

7.2 SOIL SAMPLING PROGRAMME

7.2.1 Sampling Pattern

To quantify the degree of possible contamination across the site, CES undertook a mixed judgemental and systematic sampling pattern where sampling points were selected at regular and even intervals. The location of the sample locations are provided as Figure 2.

7.2.2 Depth Intervals of Sampling

Each test pit was excavated to a maximum depth of 5.5 metres below ground level (mBGL). Representative, disturbed environmental samples were then collected at varying depths and when materials were encountered that the field environmental scientist determined should be sampled.

7.2.3 Method of Sampling Collection

Care was taken to ensure that representative samples were obtained from the depth required and that the integrity was maintained, particularly when dealing with potentially volatile and semi-volatile components. When collecting duplicates, samples to be analysed for volatiles were not mixed, rather they were placed directly into sample jars. Specific sampling procedures for each method of collection are provided below in the following sections.

Soil samples were collected directly from the excavator bucket. Care was taken when collecting samples to ensure the most representative sample of the targeted material was sampled. The soil was then transferred to the sample jar using new latex or nitrile gloves which were used for the collection of each sample.

7.2.4 Sample Containers

The soil sample jars comprise glass with a Teflon lined lid and were supplied by the primary laboratory. The jars were completely filled with soil, sealed, labelled with the job number, date, unique sampling point identification.

7.2.5 Method of Sample Storage and Handling

The full soil jars were immediately placed in a cool box in which ice had been added to keep the samples below a temperature of approximately 4°C. At the end of each day the samples in the cool box were transported to the primary laboratory.

7.2.6 Documentation

While on site, the supervising engineer/scientist filled out a copy of CES “sample register”, which documents:

- Time of sample collection;
- Weather;
- Unique sample identification number; and
- Sample location and depth.

All samples were classified in the field based on soil/fill characteristics and obvious signs of contamination such as discolouration or odour noted on a log. All samples, including QA samples, were transported to the primary and check laboratories under Chain-of Custody procedures and maintained in an ice-filled cooler. The COC forms detail the following information:

- Site identification;
- The sampler’s name;
- Nature of the sample;
- Collection time and date;
- Analyses to be performed;
- Sample preservation method;
- Departure time from site; and
- Dispatch courier(s).

During excavation, a test pit log was completed by a qualified environmental engineer/scientist. The log will record the following data:

- Sample number and depth;

- Soil classification, colour, consistency or density, and moisture content;
- Unusual characteristics such as odour and staining;
- Depth of excavation;

7.2.7 Reinstatement

Following completion of the test pits at each location, test pits were reinstated to surface levels using cuttings compacted with the excavator bucket.

7.3 ANALYTICAL PROGRAMME

7.3.1 Field Screening

Field screening was carried out on each soil sample collected, site conditions such as odour and staining were used as factors in determining what samples are selected for analysis.

7.3.2 Number of Samples for Analysis

Selected samples were submitted for analysis based on field screening results, odour, colour, the presence of unusual substances or liquids, etc and to provide adequate statistical coverage. The number of fill/soil samples to be analysed from the site are summarised in Table 2. A summary of the preservation, containers and maximum holding times for the samples is provided in Table 1.

7.3.3 Laboratory

CES engaged Envirolab Services Pty Ltd (Envirolab) as the primary laboratory and Australian Laboratory Services Pty Ltd (ALS) as the secondary or ‘check’ laboratory for all chemical testing. Both laboratories are NATA registered for the proposed chemical testing.

7.3.4 Analytical Methods

The soil/fill samples were analysed in accordance with ANZECC (1996) *Guidelines for the Laboratory Analysis of Contaminated Soils* using US EPA and APHA approved analytical methods as described in Table 2. The corresponding laboratory Practical Quantitation Limits for the respective samples are also summarised in Table 2.

7.3.5 Analytes

The choice of chemical analytes was determined based on knowledge of the history of the site and to provide information on baseline conditions. A summary of the proposed chemical analytes for the site is provided in Table 2.

8 QA/QC DATA EVALUATION

All soil samples were collected by experienced CES environmental scientists, under established CES protocols. CES personnel have been trained in sample collection and handling techniques outlined in Section 5.

For the purpose of assessing the quality of data presented in this report, CES collected and analysed various Quality Control (QC) samples (field QC samples), while the laboratory completed their own QC. The current section of this report is focused on the presentation of results of these QC samples and discussion of deviations from the Data Acceptance Criteria (DAC).

Additionally, in accordance with the NSW EPA (2006) *Contaminated Sites: Guidelines for the NSW Site Auditor Scheme (2nd Edition)*, Data Quality Indicators (Completeness, Comparability, Representativeness, Precision and Accuracy) have also been considered (where appropriate).

8.1 FIELD QA/QC

The results of the field QA/QC analysis and resulting data assessment is presented as Appendix B.

8.1.1 Blind Replicates

Two blind replicate samples were analysed for metals, TRH, BTEX, PAH, OCP, OPP and PCB, to assess the quality control during the field sampling programme. This equates to a frequency of 10.5 % which therefore conforms to the NSW EPA 1994 *Guidelines for Assessing Service Stations* and the Data Acceptance Criteria requirement of 10%. All the RPD's for the blind replicates conformed to the DAC.

8.1.2 Split Sample

Two split replicate samples were analysed for metals, TRH, BTEX, PAH, OCP, OPP and PCB, to assess the quality control during the field sampling programme. This equates to a frequency of 10.5 % which conforms to the NSW EPA 1994 *Guidelines for Assessing Service Stations* and the Data Acceptance Criteria requirement of 5%. The RPD's for split samples conformed to the DAC.

8.1.3 Trip Blanks

One trip blank was submitted to the laboratory for analysis. The concentrations of all parameters (TRH and BTEX) analysed in the trip blank sample were below the laboratory PQL and therefore conformed to the DAC.

8.1.4 Trip Spikes

One trip spike was submitted to the laboratory for analysis. The concentrations of all parameters (metals, TRH, BTEX, PAH, OCP, OPP and PCB) analysed in the trip spike sample were below the laboratory PQL and therefore conformed to the DAC with the exceptions of:

- Zinc where the level detected in the trip spike was 2mg kg^{-1} ; and
- Chromium where the level detected in the trip spike was 2mg kg^{-1} .

As these detections are only slightly above the laboratory PQL values CES considers that these outliers have had a negligible effect on the interpretation of the results.

8.2 LABORATORY QA/QC

Laboratory QA/QC data is presented in full in the laboratory certificates in Appendix B.

8.2.1 Laboratory Duplicates

Laboratory duplicate samples conformed to the DAC.

8.2.2 Laboratory Control Samples

Laboratory control samples conformed to the DAC.

8.2.3 Surrogates

Laboratory control samples conformed to the DAC.

8.2.4 Matrix Spikes

All matrix spike data conformed to DAC.

8.2.5 Method Blanks

All method blanks conformed to the DAC.

8.2.6 Sample Holding Times

All samples were extracted and analysed within the specified holding times.

8.2.7 Sample Condition

All samples were received by the analytical laboratories in correctly preserved and chilled containers with no reported breakages. Sample Receipt Notifications are presented with the laboratory reports in Appendix C.

8.3 DATA QUALITY INDICATORS (DQI)

8.3.1 Precision

The RPD's of the field and laboratory duplicates (blind and split replicates) and the recoveries for the laboratory prepared trip spikes conformed to the DAC, which indicated the sampling, laboratory and analytical precision was within acceptable limits and therefore provides confidence of limited variability and high reproducibility of the data set

8.3.2 Accuracy

Laboratory accuracy was assessed by the analysis of laboratory control samples and method blanks and percent recoveries of matrix spikes and surrogates.

The result of these laboratory control samples indicates the accuracy of the analytical results are acceptable and are likely to represent an accurate measure of the reported data.

8.3.3 Representativeness

CES consider the samples collected from the site to be representative of the materials being targeted as part of this investigation. CES staff ensured that samples collected were representative of the material observed in each borehole.

8.3.4 Completeness

All samples were collected and analysed in accordance with the SAQP. All other required QA/QC data, including both field and laboratory data as outlined in the SAQP is also provided and complete.

8.3.5 Comparability

Soil samples were collected by experienced CES environmental scientist in accordance with the SAQP using appropriate CES protocols and analysed in accordance with NATA accredited laboratory methods. The comparability of the data should be consistent as sampling protocols were employed throughout the duration of the fieldwork and analysis was undertaken by NATA registered laboratories using accredited analytical methods.

8.4 ASSESSMENT

The accuracy of the primary and secondary laboratory data are considered to be sufficient for the purposes of the investigation.

9 SITE ASSESSMENT CRITERIA

To address potential health impacts at the site, CES will compare the analytical testing results against a set of health and ecological based soil investigation levels to be referred to as Soil Investigation Levels (SIL) appropriate for the current land-use. That is, the SIL will be set at a level that provides confidence that contaminant concentrations below the SIL will not adversely affect human health or be phytotoxic to plants.

The site's current land-use is as a vacant Lot. It is zoned for industrial or commercial use. Therefore, CES has adopted the lower value from the following criteria:

- NEPC (1999) Health Investigation Levels recommended for exposure setting 'F' Commercial/Industrial: includes premises such as shops and offices as well as factories and industrial sites.
- With respect to hydrocarbons (TRH and BTEX), the NSW EPA (1994) Threshold Levels;
- There are no national or NSW DECCW endorsed guidelines for asbestos in soil relating to human health. The NSW Department of Environment and Climate Change, 2006 *Contaminated Sites: Guidelines for the NSW Site Auditor Scheme (2nd Edition)* states that Auditors must exercise their professional judgement when assessing whether a site is suitable for a specific use. The NSW DECCW states that the position of the Health Department is that there should be no asbestos in surface soil. A criteria of no asbestos in surface soil has been adopted for this assessment.

A summary of the adopted SIL is provided in Table 3.

10 RESULTS

Results of the ESA are presented below.

10.1 SOIL ANALYTICAL RESULTS

Analytical results for the soil samples collected at the site during the ESA are shown in Tables 4 and are summarised below. Laboratory certificates of analysis are presented in Appendix C.

10.1.1 Heavy Metals

A total of 20 samples from were submitted to the laboratory for metals analysis (As, Cd, Cr, Cu, Pb, Hg, Ni and Zn). The concentrations of heavy metals in samples are presented in Table 5. The concentrations of heavy metals were below the health-based SAC for all samples analysed.

10.1.2 Petroleum Hydrocarbons (TRH) and BTEX Compounds

A total of 20 samples were submitted to the laboratory for TRH C₆-C₃₆ and BTEX analysis. The concentrations of TRH and BTEX are presented in Table 4. Concentrations of TRH and BTEX in all samples analysed were below their respective threshold levels and laboratory PQLs.

10.1.3 Polycyclic Aromatic Hydrocarbons (PAHs)

A total of 20 samples were submitted to the laboratory for PAH analysis. The concentrations of benzo(a)pyrene and total PAHs in samples are presented in Table 4. Levels of PAH were below laboratory PQL for all samples analysed, with 3 exceptions where Phenanthrene was detected, but below the SAC.

10.1.4 Organochlorine and Organophosphorous Pesticides (OCPs/OPPs)

A total of 20 samples were submitted to the laboratory for OCP and OPP analysis. The concentrations of OCP and OPP are presented in Table 4. Concentrations of OCP and OPP in all samples analysed were below the health-based SAC and laboratory PQLs.

10.1.5 Polychlorinated Byphenyls (PCBs)

A total of 20 samples were submitted to the laboratory for PCBs analysis. The concentrations of PCBs are presented in Table 4. Concentrations of PCBs in all samples analysed were below the health-based SAC and laboratory PQLs.

10.1.6 Asbestos Containing Materials

A total of 20 samples were submitted to the laboratory for asbestos analysis. No asbestos was detected, therefore the asbestos results satisfy the SAC.

11 DISCUSSION

The following section provides a discussion of the main findings of the ESA, based on a review of existing information and the sampling and analysis undertaken at the site.

11.1 SITE HISTORY

From a review of previous reports the site was vacant grassland before being utilised as a stockpile location for the Erskine Park Quarry. In the time since the site's use as a stockpile it has remained vacant and began to be used as a source of material to be used as levelling material for Lot 21 to the east.

The site history did not indicate that potential sources of contamination were present on the site in the past.

11.2 CURRENT SITE CONDITIONS

Based on results of site investigations and relevant information the following is understood about the current condition of the site:

- The site contains a large stockpile of mixed VEMN and processed quarry material derived from the overburden and quarrying activities at the Erskine Park Quarry;
- The major component of the material encountered onsite is brown and grey sand with some fines with small to large rocks.
- Also encountered is red-brown clay with some sand;
- No undisturbed soils were encountered during site investigations;
- No groundwater was encountered during site investigations.

11.3 SOIL ANALYSIS

The results of the ESA soil analysis reported no contaminant compounds at concentrations exceeding the SAC (guidelines for industrial/commercial use)

12 CONCLUSIONS AND RECCOMENDATIONS

Qualitative and quantitative assessments of potential contaminants at the site conclude that the results of the sampling and analysis programme on the materials on the site indicated that the concentrations of heavy metals, TRH, BTEX compounds, PAHs, OCPs, OPPs, PCBs and Asbestos were less than the adopted site assessment criteria.

CES conclude that the site does not pose a risk to human health or the environment in its current condition.

13 LIMITATIONS

This report has been prepared for use by the client who commissioned the works in accordance with the project brief and based on information provided by the client. The advice contained in this report relates only to the current project and all results, conclusions and recommendations should be reviewed by a competent person with experience in environmental investigations before being used for any other purpose. Consulting Earth Scientists Pty Ltd (CES) accepts no liability for use or interpretation by any person or body other than the client. This report must not be reproduced except in full and must not be amended in any way without prior approval by the client and CES.

The extent of sampling and analysis of soils has been undertaken targeting areas of environmental concern, targeting specific soil strata from where contamination is considered most likely to occur based on knowledge of site history and visual inspection. This approach has been adopted in order to maximise the probability of identifying contaminants, however the approach may not identify contamination that occurs in unexpected locations or from unexpected sources.

Furthermore, soil conditions are variable resulting in the heterogeneous distribution of contaminants across the site. Contaminants have been investigated at discrete locations; however conditions between sample locations have been inferred based on estimated geological conditions, the nature and extent of investigated potential contaminants. The accuracy with which subsurface conditions have been characterised depends on the frequency of sampling, field and laboratory methods, the uniformity of the substrate and is therefore limited by the scope of works undertaken.

This report is based on targeted sampling and does not provide a complete assessment of the environmental status of the site and is limited to the scope defined therein. Should information become available regarding conditions at the site including previously unknown sources of contamination, CES reserves the right to review the report in the context of the additional information.

14 REFERENCES

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Geological Map

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Figures



0 60 120 240 360 480 600 Metres

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Title

Figure 1: Site Location

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Prepared By: M. Pickett	Checked By: T. Goodbody



Title
Figure 2: Site Layout and Test Pit Locations

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Tables

Table 1: Sample preservation, containers and maximum holding times - Soil

Parameter	Container	Preservation	Maximum holding time	Colour code
Acid digestible metals (As,Cd,Cu,Cr,Ni,Pb,Zn)	Glass with Teflon lid	Nil	6 months	Orange
Mercury	Glass with Teflon lid	Nil	28 days	Orange
TRH (C ₆ -C ₃₆)/BTEX	Glass with Teflon lid	4°C, zero headspace	14 days	Orange
OCP/OPPs	Glass with Teflon lid	4°C, zero headspace	14 days	Orange
PCBs	Glass with Teflon lid	4°C, zero headspace	14 days	Orange
PAHs	Glass with Teflon lid	4°C	14 days ¹	Orange

Table 2: Analytical schedule, parameters, PQLs and methods – Soil/Fill				
Parameter	Samples to be analysed	Unit	PQL	Method based on
TRH¹ in Soil				
C ₆ -C ₉ fraction	20	mg kg ⁻¹	25	USEPA 8015B
C ₁₀ -C ₁₄ fraction	20	mg kg ⁻¹	50	USEPA 8015B
C ₁₅ -C ₂₈ fraction	20	mg kg ⁻¹	100	USEPA 8015B
C ₂₉ -C ₃₆ fraction	20	mg kg ⁻¹	100	USEPA 8015B
Heavy Metals in Soil				
Total Arsenic	20	mg kg ⁻¹	4	USEPA 6010
Total Cadmium	20	mg kg ⁻¹	0.5	USEPA 6010
Total Chromium	20	mg kg ⁻¹	1	USEPA 6010
Total Copper	20	mg kg ⁻¹	1	USEPA 6010
Total Lead	20	mg kg ⁻¹	1	USEPA 6010
Total Manganese	20	mg kg ⁻¹	1	USEPA 6010
Total Mercury	20	mg kg ⁻¹	0.1	USEPA 6010
Total Nickel	20	mg kg ⁻¹	1	USEPA 6010
Total Zinc	20	mg kg ⁻¹	1	USEPA 6010
BTEX² in Soil				
Benzene	20	mg kg ⁻¹	0.5	USEPA 8021A
Toluene	20	mg kg ⁻¹	0.5	USEPA 8021A
Ethylbenzene	20	mg kg ⁻¹	1	USEPA 8021A
m&p-xylene	20	mg kg ⁻¹	2	USEPA 8021A
o-xylenes	20	mg kg ⁻¹	1	USEPA 8021A
Other Hydrocarbons in Soil				
PAHs ³	20	mg kg ⁻¹	0.05-0.2	USEPA 8270 SIM
OCPs ⁴	20	mg kg ⁻¹	0.1	USEPA 8270 SIM
OPPs ⁵	20	mg kg ⁻¹	0.1	USEPA 8270 SIM
PCBs ⁶	20	mg kg ⁻¹	0.1	USEPA 8270 SIM
Notes:				
¹ TRH-	-	Total Petroleum Hydrocarbons		
² BTEX	-	Benzene, Toluene, Ethylbenzene and Xylene		
³ PAH	-	Polycyclic Aromatic Hydrocarbon		
⁴ OCP	-	Organochlorine Pesticides		
⁵ OPP	-	Organophosphate Pesticides		
⁶ PCB	-	Polychlorinated Biphenyls		

Table 3: Assessment Criteria - Soil Investigation Levels	
Contaminant	Health Based Investigation Levels (NEHF F) (mg kg⁻¹)
Metals	
Total Arsenic	500
Total Cadmium	100
Total Chromium	500
Total Copper	5,000
Total Lead	1,500
Total Manganese	7,500
Total Mercury	75
Total Nickel	3,000
Total Zinc	35,000
TRH and BTEX	
TRH C ₆ -C ₉	65 ²
TRH C ₁₀ -C ₃₆	1000 ²
Benzene	1 ²
Toluene	130 ²
Ethylbenzene	3.1 ²
Total Xylene	14 ²
PAH, PCB and OCP	
Total PAH	20 ^{1,2}
Total PCB	50
Benzo (a) Pyrene	1 ^{1,2}
Aldrin/dieldrin	50
Chlorodane	250
DDT/DDD/DDE	1,000
Heptachlor	50
<small>Note 1: NEPC (1999) – Schedule (B1) Guideline on the Investigation Levels for Soil and Groundwater Note 2: NSW EPA (1994) Guidelines for Assessing Service Station Sites - Soil Investigation Levels</small>	

Table 4 Sample Description			
Sample ID	Test Pit	Depth	Description
290312-01-TG	TP01	0-1m	Heavy Clay Fill, Brown, Non compactable waste no odour QAQC
290312-02-TG	TP01	0-1m	Heavy Clay Fill, Brown, Non compactable waste no odour QAQC
290312-03-TG	TP01	0-1m	Heavy Clay Fill, Brown, Non compactable waste no odour QAQC
290312-04-TG	TP01	3-4m	Heavy Clay Fill, Black with Brown, Non compactable waste no odour
290312-05-TG	TP02	0-1m	Sandy clay, Dark brown no odour
290312-06-TG	TP02	3-4m	Sandy Clay, Dark Brown, Patches of pale grey clay no odour
290312-07-TG	TP03	4-5m	Light brown sandy clay, (medium to fine grained), small rocks no odour
290312-08-TG	TP04	1-2m	Grey clay with some sand and fractured rock no odour
290312-09-TG	TP04	4-5m	Sand, medium to fine grained, pale brown, Did not smell *Test for Aesbestos*
290312-10-TG	TP05	0-1m	Brown Clay with sand, waste and odour
290312-11-TG	TP05	4m	Pale brown sand with some clay no odour
290312-12-TG	TP06	2m	Pale grey/brown sand with clay, Grey, Red and Blue particles in sample no odour
290312-13-TG	TP07	4.5m	Red-brown clay with some sand no odour
290312-14-TG	TP08	3m	Clay with sand, stained black? Chemical odour
290312-15-TG	TP09	0-1m	Sandy clay, Dark brown no odour
290312-16-TG	TP09	5m	Sand with some clay, pale brown, some waste material no odour
290312-17-TG	TP10	5m	Sand with some clay, pale brown no odour
300312-01-TG	TP11	3-4m	Sand with some clay, brown, fine to medium grained no odour
300312-02-TG	TP12	3-4m	Sandy Clay, Brown no odour
300312-03-TG	TP13	0-1m	Clay with some sand, Red no odour
300312-04-TG	TP13	5m	Sand with some clay, pale brown, fine to medium grained no odour
300312-05-TG	TP14	5m	Grey sand, with some fines, Trip bland used no odour
300312-06-TG	TP15	5m	Sand with some fines, pale brown, no odour QAQC
300312-07-TG	TP15	5m	Sand with some fines, pale brown, no odour QAQC
300312-08-TG	TP15	5m	Sand with some fines, pale brown, no odour QAQC
300312-09-TG	TP16	5m	Sand with some clay, brown, fine to medium grained no odour
300312-10-TG	TP17	2m	Sand and clay, brown no odour
300312-11-TG	TP18	3.5m	Clay with some sand, brown, some red-brown clay also
300312-12-TG	TP20	0.5m	Sand with some clay, possible dark stain no odour
300312-13-TG	TP20	2m	Sand with some fines, Brown no odour
300312-14-TG	TP21	4.5m	Sand with some fines, dark brown - grey, no odour
300312-15-TG	TP22	0.7m	Red clay with some sand no odour
300312-16-TG	TP22	3m	Sand with some fines, black/grey no odour
300312-17-TG	TP23	0-1m	Red clay with some sand no odour
300312-18-TG	TP23	4m	Clay with sand, black/grey no odour
300312-19-TG	TP24	1m	Clay, green no odour
300312-20-TG	TP24	5m	Sandy Clay, Brown no odour