

Carr - Catherine

From: Dataworks
Subject: FW: Final sampling plan
Attachments: 214358_REP_004B.PDF

From: David Walker [<mailto:dwalker@geolyse.com>]
Sent: Wednesday, 27 January 2016 12:43 PM
To: Hudson - Wade
Subject: Final sampling plan

Hi Wade

As discussed, find the final sampling plan attached.

Our client has authorised the sampling associated with the plan this morning and we are expecting the sampling to be completed within the next 2 weeks (although pushing for sooner). Any commentary on the sampling locations or methodology would be appreciated.

Also, as discussed, the intention is to lodge the demolition DA as soon as possible so any comments you have on the draft would be appreciated.

cheers

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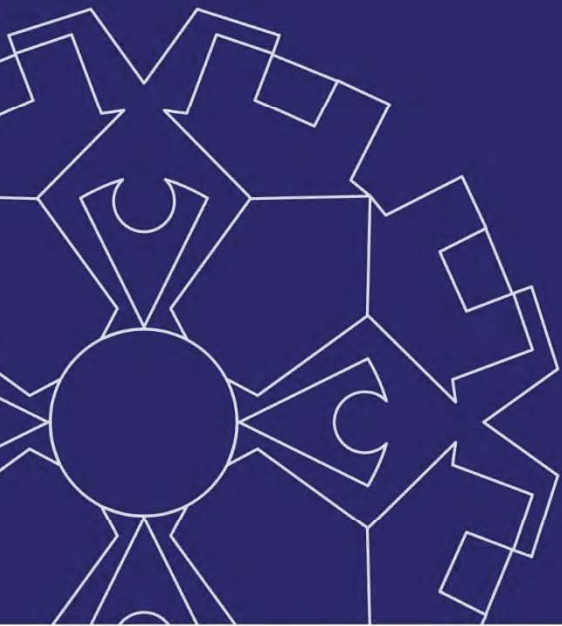
GEOLYSE

**SAMPLING PLAN
FORMER GUNNEDAH ABATTOIR**

QUIA ROAD, GUNNEDAH

**PREPARED FOR
IRONBARK ENERGY PTY LTD**

JANUARY 2016



• Civil, Environmental & Structural Engineering • Surveying • Environmental • Planning • Architecture

SAMPLING PLAN

FORMER GUNNEDAH ABATTOIR

QUIA ROAD, GUNNEDAH

PREPARED FOR:
IRONBARK ENERGY PTY LTD

JANUARY 2016



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Geolyse Pty Ltd and the authors responsible for the preparation and compilation of this report declare that we do not have, nor expect to have a beneficial interest in the study area of this project and will not benefit from any of the recommendations outlined in this report.

The preparation of this report has been in accordance with the project brief provided by the client and has relied upon the information, data and results provided or collected from the sources and under the conditions outlined in the report.

All information contained within this report is prepared for the exclusive use of Ironbark Energy Pty Ltd to accompany this report for the land described herein and are not to be used for any other purpose or by any other person or entity. No reliance should be placed on the information contained in this report for any purposes apart from those stated therein.

Geolyse Pty Ltd accepts no responsibility for any loss, damage suffered or inconveniences arising from, any person or entity using the plans or information in this study for purposes other than those stated above.

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Introduction

This sampling plan has been prepared by Geolyse Pty Ltd (Geolyse) to define field investigations and sampling to be carried out for the Phase 2 detailed site investigation (P2 DSI) to collect environmental samples for the purpose of site characterisation and assessment of land use suitability for future redevelopment of the site located on the corner of Quia and Blackjack Roads, Gunnedah NSW. It is noted that the site as described in this sampling plan includes the portion of land subject to Development Application (DA) 2015/062, as well as the former abattoir facility intended to be subject to a future DA.

Field investigations for the P2 DSI sampling are consistent with the policies and guidelines endorsed by the NSW Environment Protection Authority (EPA) as detailed in *Contaminated Sites: Guidelines for Consultants Reporting on Contaminated Sites* (NSW Office of Environment and Heritage, 2011, specifically the National Environment Protection Council (NEPC) *National Environment Protection (Assessment of Site Contamination) Measure*, 1999 (amended 2013) and the NSW Environment Protection Authority publication *Contaminated Sites – Sampling Design Guidelines* (1995). The area to be assessed and subject to this sampling plan is shown on **Figure 1**.

This sampling plan is specific to environmental conditions at the site. It does not include a scope of work for sampling of building materials and structures to assess for the presence of hazardous materials, which has previously been assessed as described in New Environment (2005) *Asbestos Survey Report, Former Gunnedah Abattoir, Quia Road, Gunnedah* (ref: 6499\01\ASR).

1.1 OBJECTIVES

The objective of the sampling plan is to document investigation methodology such that sufficient data can be collected to assess the vertical and lateral extent of potential contamination at the site from past and present operations. The data collected will allow conclusions to be drawn on the suitability of the land for its intended uses based on the potential risk posed by contamination to sensitive onsite and offsite human and ecological receptors.

For the purposes of this sampling plan, the definition of a P2 DSI is adopted from a 'Stage 2 – Detailed Site Investigation' (*Guidelines for Consultants Reporting on Contaminated Sites*, NSW Office of Environment and Heritage, 2000) and defined as an assessment undertaken to provide comprehensive information relating to the type, extent and level of contamination at the site, by assessing:

- contaminant dispersal in air, surface water, groundwater, soil and/or dust
- potential impacts to soil, water, sediment and/or biota
- the adequacy and completeness of all information available to be used in making decisions on remediation.

1.2 SITE AREAS

For the purposes of this sampling plan, the site has been divided into the following precincts, as shown on **Figure 1**:

- Zone 1: Former Abattoir – Developed Areas
- Zone 2: Former Abattoir – External Areas
- Zone 3: Undeveloped Open Space
- Zone 4: Dump

Site Contamination Status

Previous investigations at the site have included collecting samples from 127 locations across the entire site (and some off-site locations) and analysis for asbestos (New Environment, 2006), and from 19 additional locations targeting areas where potential for soil contamination was considered to be greatest. Additionally, visual inspection of the former abattoir area indicated the presence of fibre cement sheeting fragments suspected of containing asbestos.

Analytical results of three (3) soil samples collected from areas of the site not targeted for comprehensive sampling, i.e. areas historically used for pasture and/or cropping, are considered to be generally representative of the entire area, based on the land use being spatially consistent across this area.

2.1 PREVIOUS ENVIRONMENTAL INVESTIGATIONS

Environmental investigations assessing potential soil contamination have previously been undertaken at the site as follows:

- New Environment, 2006, Preliminary Assessment of Potential Off-Site Asbestos Migration, Former Gunnedah Abattoir Site, 131 Quia Road, Gunnedah, NSW, 2380
- Environ, 2007, Preliminary contamination assessment, Gunnedah abattoir, corner of Quia Road and Black Jack Road, NSW for North West Projects (NSW) Pty Ltd
- SLR Consulting Australia Pty Ltd, 2011, Airborne Asbestos Monitoring and Site Inspection Building Area, The Former Gunnedah Abattoir Site 131 Quia Road, Gunnedah, NSW 2380

2.2 SOIL CONTAMINATION FINDINGS

Specific findings relating to soil contamination documented in these investigations are summarised below:

- Chrysotile and amosite asbestos bundles were identified at sampling locations 17 (east of north eastern corner of buildings, adjacent to Quia Road), 41 (north eastern corner of Site, adjacent to Quia Road), 50 (north eastern portion of Site) and 127 (offsite location to north west of abattoir buildings area) (New Environment, 2006);
- Air monitoring was undertaken at 12 locations across the Site. Asbestos was not detected above the laboratory detection limit (<0.01 fibres/mL) at any location (New Environment, 2006);
- A site inspection and airborne asbestos monitoring was conducted in the building area of the former abattoir site. The likelihood of the migration of airborne asbestos to the environment external to the Building Area was considered to be low and did not appear to indicate an unacceptable level of public health risks. Ground surfaces were covered with the sporadic presence of fibre cement sheeting fragments suspected of containing asbestos (SLR Consulting Australia, 2011);
- Abattoir related operations have extended across the majority of the site through cattle holding areas, settling dams and the dump. Abattoir operations may have included a number of potentially contaminating activities associated with animal waste disposal, pest management, animal hide treatment, ash generation from the boiler and petroleum storage (Environ, 2007);
- Low level OCPs were detected at two locations (former Skin Sheds & fill near former transformer) at concentrations well below the respective protection of human health based criteria for industrial / commercial use. It is considered unlikely that widespread gross OCP or other pesticide related contamination is present at the Site (Environ, 2007);
- Odorous and stained soils were encountered from the surface to 3 m depth in test pit TP15 which was excavated to the north east of the boiler room (possible former AST location) and south of

the former store. It was considered that the material did not meet aesthetic criteria and further remediation works may be required (Environ, 2007);

- Ash from the onsite boiler may contain PAHs at significantly varying concentrations, which are most likely below applicable criteria for commercial/industrial use (Environ, 2007);
- Total coliforms were detected in a near surface sample and deeper sample (2.7 m) collected from the south western most former settling pond. The levels of total coliforms detected in near surface sample were above the assessment criteria and it is considered that total coliforms may be present at relatively elevated concentrations in near surface soils within other settling ponds (Environ, 2007);
- The potential for bacterial contamination to be present at concentrations which may provide an impediment to proposed development is low, however areas of the site where this potential is greatest include the vicinity of the former settling ponds, the dump, the former 'Save All Plant' and the immediate vicinity of the subsurface waste distribution infrastructure (Environ, 2007);

2.3 GROUNDWATER ASSESSMENT

The following assessment of the risk of groundwater contamination is an excerpt from Environ (2007):

It is considered unlikely that groundwater at the Site would have been subject to significant contamination for the following reasons:

- *No contamination has been identified which is considered to potentially pose a significant risk of impact to groundwater if the contamination were to migrate vertically;*
- *The vertical migration of contamination is likely to be limited due to the nature of the high plasticity and presumably low permeability clays encountered at the Site;*
- *At present, groundwater is unlikely to occur at depths <3 m below ground surface, and in conjunction with the low permeability clays if significant contamination were present the potential for vertical migration of contamination is low.*

It is noted that groundwater in the immediate vicinity of the former settling ponds (if present) may have historically been subject to bacterial related contamination. Investigation of groundwater in the vicinity of the former settling ponds may be appropriate in the future.

Upon inspection of the site, Geolyse considers that potential for impacts to groundwater associated with the dump area, Zone 4, requires additional assessment. Proposed methodology for assessment of groundwater impacts is discussed further in **Section 4.3**.

Assessment Criteria

3.1 HUMAN HEALTH

3.1.1 HEALTH INVESTIGATION LEVELS

The Amended ASC NEPM (NEPC, 2013) provides a framework for the use of investigation and screening levels. The framework is applicable for assessing human health risk via all relevant pathways of exposure and covers a broad range of metals and organic substances. Different levels are provided for a variety of exposure settings.

The NEPM HILs have been developed to be protective of human health. Based on the future land use for the site proposed as industrial, concentrations of contaminants in the soil are to be compared against the commercial / industrial 'HIL D' land use HILs.

3.1.2 HEALTH SCREENING LEVELS

The Amended ASC NEPM (NEPC, 2013) presents health screening levels (HSLs) for petroleum compounds. HSLs are relevant to various land use settings for residential, recreational open space, and commercial / industrial land use and reflect the risk posed by vapour.

Based on the future land uses for the site, concentrations of contaminants in soil and groundwater are to be compared against the commercial / industrial 'HSL D' land use HSLs.

3.1.3 ASBESTOS IN SOILS

The amended ASC NEPM (NEPC, 2013) provides Health Screening Levels (HSLs) for bonded, friable and all forms of asbestos in soil. The HSLs were adopted from the *WA Guidelines for the Assessment, Remediation and Management of Asbestos – Contaminated Sites in Western Australia* (WA Department of Health, 2009).

Asbestos in soil HSLs for the site will include commercial / industrial 'HSL D'.

The NEPM HSL for friable asbestos, including fibrous asbestos (FA) and asbestos fines (AF), can be lower than the LOR of the analytical method under some circumstances. The analytical LOR for friable asbestos (FA and AF) should be adopted as an assessment criterion for asbestos in soil provided a weight of evidence approach is taken and the following items are considered:

- The presence of free fibres (e.g. respirable) by qualitative trace analysis is assessed
- Surface soils (at the immediate sample location and across the site generally) are free of visible forms of asbestos (e.g. fragments of fibrous cement sheeting)
- The concentration of bonded asbestos containing material (ACM) is less than the HSL.

3.1.4 DRINKING WATER GUIDELINES

The Amended ASC NEPM (NEPC, 2013) adopts the National Health and Medical Research Council and National Resource Management Ministerial Council, Australia (NHMRC & NRMCC) 2011 *National water quality management strategy, Australian drinking water guidelines*. These guidelines provide guideline concentrations for organic and inorganic chemicals in drinking water for the protection human health.

Concentrations of contaminants in surface water and groundwater are to be compared against these guidelines.

3.2 ECOLOGICAL ASSESSMENT

3.2.1 ECOLOGICAL INVESTIGATION LEVELS

The Amended ASC NEPM (NEPC, 2013) provides ecological investigation levels (EILs) for selected metals and organic substances and are applicable for assessing risk to terrestrial ecosystems. EILs depend on specific soil physicochemical properties and land use scenarios and generally apply to the top two metres of soil, taking into account depth of contamination, soil texture, background levels, and age of the impacts.

Based on the current and future land uses for the site, concentrations of contaminants in the soil are to be compared against the 'commercial and industrial' land use EILs.

3.2.2 ECOLOGICAL SCREENING LEVELS

The Amended ASC NEPM (NEPC, 2013) provides ecological screening levels (ESLs) to be protective of environmental concerns by establishing the reasonable maximum exposure from site sources for a range of petroleum hydrocarbon compounds and TRH fractions commonly encountered on contaminated sites and are applicable for assessing risk to terrestrial ecosystems. ESLs broadly apply to coarse and fine-grained soils and various land uses. They are generally applied to the top two metres of soil.

Based on the current and future land uses for the site, concentrations of contaminants in the soil are to be compared against the 'commercial and industrial' land use ESLs.

3.2.3 PROTECTION OF AQUATIC ECOSYSTEMS

The Amended ASC NEPM (NEPC, 2013) adopts the Australian and New Zealand Conservation Council & Agriculture and Resource Management Council of Australia and New Zealand (ANZECC & ARMCANZ) 2000 National water quality management strategy. Australian and New Zealand guidelines for fresh and marine water quality. These guidelines provide trigger values for organic and inorganic chemicals for the protection of marine and freshwater ecosystems.

Based on the expected receiving waters for groundwater and surface water at the site, concentrations of contaminants in groundwater and surface water are to be compared against freshwater water trigger values.

3.2.4 SEDIMENT QUALITY GUIDELINES

The Amended ASC NEPM (NEPC, 2013) refers to Interim Sediment Quality Guidelines (ISQGs), provided in ANZECC & ARMCANZ, 2000. These guidelines provide low and high level trigger values for organic and inorganic chemicals for the protection of aquatic ecosystems.

Based on the proposed land use of existing surface water bodies at the site, concentrations of contaminants in sediments are to be compared against low level trigger values. Where LORs exceed the ISQG then further evaluation of risk should be considered in the context of the site use and toxicant.

3.3 AESTHETICS

The aesthetic criteria requires that soils should not be discoloured, malodorous (including when dug over or wet) or of abnormal consistency, and the natural state of the soil should be considered.

3.4 WASTE

If required, consideration of preliminary waste classification data, relevant to potential remediation activities requiring offsite disposal of material, should be in accordance with the NSW EPA *Waste Classification Guidelines* (2014).

Sampling Plan and Methodology

4.1 SOIL INVESTIGATION

4.1.1 SOIL SAMPLING DENSITY

The sampling design is based on a combined targeted / judgemental and systematic approach in an attempt to 'close' the data gap between and below spatial areas previously characterised. The soil sampling locations are shown on **Figure 1**, while the soil sampling densities for each zone are shown in **Table 4.1**:

Table 4.1 – Proposed Sampling Program

Investigation Zone	Area (ha.)	No. Soil Sample Locations (Historic)	No. Soil Sample Locations (Proposed)	Final Soil Sampling Density (no. samples / ha.)
Zone 1	3.9	6	24	7.69
Zone 2	7.7	6	20	3.38
Zone 3	129.6	7	38	0.35
Zone 4	1.8	0	5	2.78
TOTAL	143.0	19	87	0.74

The final soil sampling densities calculated in the above table may be compared to 'equivalent sampling density (points/hectare)', *Table A – Minimum Sampling Points Required for Site Characterisation Based on Detecting Circular Hotspots by Using a Systematic Sampling Pattern*, provided in the NSW EPA *Sampling Design Guidelines* (NSW EPA, 1995).

Whilst it is acknowledged the final soil sampling densities are lower than the minimum sampling densities provided in 'Table A' (NSW EPA, 1995), based on the site history, findings of previous investigations (refer to **Section 2.2**), and the intended future uses of the site (industrial) the final soil sampling densities are considered to be appropriate in achieving the objectives identified in **Section 1.1** of this sampling plan.

4.1.2 TARGETED SOIL SAMPLING LOCATIONS

Areas where soil impacts have been identified to warrant further investigation are limited to the former transformer location (Zone 1), the former Skin Sheds (Zone 2), and the dump area (Zone 4). Aesthetic impacts associated with the former boiler (Zone 1) have also been identified. Impacts identified in these areas (Environ, 2006) require delineation.

At these locations, excluding the dump area within Zone 4 (discussed below), test-pits are to be progressed at 5 and 10 metre intervals to the north, south, east and west of the original sampling locations where impacts were identified, as shown of **Figure 2**. Samples are to be collected from the former transformer and Skin Shed areas at depths corresponding to the original samples (0.05 to 0.1 mbgl). An additional sample is to be collected at the original sampling location at an approximate depth of 0.3 to 0.4 mbgl to delineate potential vertical migration of soil OCP impacts. No samples are required to be collected from the former boiler area test-pits as delineation of aesthetic impacts is based on visual and olfactory assessment

Prior to commencement of soil sampling activities in Zone 4, ground penetrating radar (GPR) should be utilised to delineate the extent of the landfilled area. Soil and groundwater (refer to **Section 4.3**) samples should be collected from locations adjacent to, but not within, the landfilled area.

Assessment of potential bacterial impacts associated with the settling ponds is proposed to include sampling and analysis of soil comprising the surrounding bank(s) to verify its suitability as capping material.

4.1.3 STOCKPILE SAMPLING

A number of stockpiles comprising a mixture of soil and demolition waste have been identified at the site within Zone 2, as shown on **Figure 2**. The fate of this material may include on-site burial within the dump at Zone 4, and/or off-site disposal at a licenced landfill facility. Accordingly, characterisation and assessment of the material is required.

Stockpiles are required to be sampled at the rate of 1 sample per stockpile or per 25 m³, whichever is greater, however adjacent stockpiles comprised of analogous materials may be considered as a single stockpile.

4.1.4 INTRUSIVE WORKS METHOD

Test-pits will be excavated to a maximum depth of 3 mbgl by an excavator, or to a depth where natural (based on field observations) material is encountered, or the maximum extent of the excavator. Test-pits will be reinstated with the exhumed material corresponding to the depth that it was derived, and then compacted by traversing the area with the excavator.

Samples from surface soils comprising natural material, as well as from stockpiled material, may be collected using hand-tools, provided minimum depths (200 mm from ground level, or 300 mm below the stockpile surface) can be achieved.

4.1.5 SAMPLING METHODOLOGY

Soil will be sampled directly from the excavator bucket or hand-auger whilst wearing disposable nitrile gloves and placed into acid-washed glass jars with Teflon® lids provided by the laboratory. Samples are to be collected in general accordance with Australian Standard AS1141.3.1–2012: *Methods for sampling and testing aggregates – Sampling – Aggregates* (Standards Australia 2012).

Samples from test-pits will be collected at the following depth intervals:

- Just below the hard stand (where present), approximately 0.2 mbgl
- 1.0 mbgl; then
- At regular (1 m) intervals until termination of test-pit, and at any observed change in sub-surface strata or potential contamination.

Of the sample locations where fill material is identified, a minimum of two samples per location will be collected and analysed (one representative of fill-material and the other from underlying natural material). Additional samples will be analysed where it will provide additional information regarding the extent of contamination.

All sample locations are to be given unique identifiers and physically marked using drive-in pegs and/or marker paint. Geo-referencing of sample locations to geographical spatial datum is also required. Field documentation will include, as a minimum, the following information, as applicable:

- Date, time, weather conditions;
- Sampling location;
- Type of sample;
- Sampling method;
- Sample identification and time of collection;
- Visual descriptions (including aesthetics); and
- Photograph numbers (where applicable);

Field indication of volatile compounds in soil will be measured using representative soil from each sample taken. This soil will be placed inside a zip-lock bag and screened using a portable photo-ionisation detector (PID). Results of field PID analyses will be reported on sampling logs.

4.1.6 QUALITY CONTROL

Quality control samples will be collected as outlined below:

- Intra-laboratory / Inter-laboratory duplicate samples will be collected by splitting each sample into the primary and duplicate sample containers. In accordance with the Amended NEPM (NEPC, 2013) both intra- and inter-laboratory samples will be collected at a minimum rate of 1 in 20 primary samples. In total this equates to a minimum of 10% of the primary sample set consisting of duplicate samples.
- An equipment rinsate blanks (collected daily) will be collected from dedicated equipment only, by pouring laboratory prepared supplied deionised water over the sampling equipment between sampling locations.
- Trip blank and spiked trip blank samples, comprising of laboratory prepared blank and spiked soil will be included in the analytical suite.

4.2 SURFACE WATER AND SEDIMENT INVESTIGATION

Surface water and sediment samples will be collected from the settlement ponds present in Zone 3 where water is observed to be present.

Ponds identified as 'farm dams' in Zone 3, as shown on **Figure 1**, which are understood to have not been utilised for storage or treatment of abattoir effluent will not be subject to specific assessment, and soil samples to be collected from Zone 3 are considered to be representative of soil comprising these dams.

4.2.1 SAMPLING METHODOLOGY

Surface water samples are to be collected from approximately 0.1 m depth below the water surface using a reusable plastic container on an extension pole. Samples are then transferred to the laboratory analysis bottles.

Sediment will be sampled using appropriate equipment (e.g. petite ponar) directly from sediment and placed into acid-washed glass jars with Teflon® lids provided by the laboratory.

Samples are to be stored in insulated containers and chilled on ice. Laboratory analysis bottles must contain chemical preservative specific to the analysis being conducted on the sample.

4.2.2 QUALITY CONTROL

Quality control samples will be collected during the surface water and sediment investigation as outlined below:

- Intra-laboratory / Inter-laboratory duplicate samples will be collected by splitting each sample into the primary and duplicate sample containers. In accordance with the Amended NEPM (NEPC, 2013) both intra- and inter-laboratory samples will be collected at a minimum rate of 1 in 20 primary samples. In total this equates to a minimum of 10% of the primary sample set consisting of duplicate samples.
- An equipment rinsate blank will be collected from dedicated equipment only, by pouring laboratory prepared supplied deionised water over the sampling equipment between sampling locations.
- Trip blank and spiked trip blank samples, comprising of laboratory prepared blank and spiked water will be included in the analytical suite.

4.3 GROUNDWATER INVESTIGATION

The area of the groundwater investigation is limited to the dump area in Zone 4, however opportunistic grab samples of groundwater will also be collected from test-pits proximal to the settlement ponds (Zone 3) where ingress of shallow groundwater is observed.

The preliminary locations of proposed groundwater wells are shown on **Figure 3**; however these locations may be subject to change once the findings of the soil assessment program (**Section 4.1**) confirm the lateral extent of the landfilled area. If groundwater is not intercepted in the upper 20 m of drilling, and the drilling core is not conclusively indicative of the presence of vertically aligned fractures, it may be inferred that the potential contaminant pathway from the landfill to underlying aquifer(s) is incomplete and no further groundwater investigations in this area are considered warranted.

4.3.1 GROUNDWATER MONITORING BORE INSTALLATION

Groundwater monitoring bores will be constructed as 50 mm unplasticised polyvinyl chloride (uPVC) wells, with a 0.4 mm aperture slotted section screening across the water bearing zone to intercept potential light non-aqueous phase liquid (LNAPL). Wells will be installed using a <2 mm washed sand filter pack and bentonite pellet seal above the slotted section to isolate the groundwater from percolating surface water. Wells will be completed at the surface with a concrete seal and a steel-encased lockable monument.

Construction of the groundwater monitoring bore will be reliant on the conditions encountered. However, general construction details will be:

1. Bores will extend to a depth that will intercept the groundwater system
2. A three (3) metre length of screen will be installed across the water bearing zone
3. The gravel pack will extend 1 m above the top of the screened interval
4. The bentonite seal will extend at least 0.5 m above the gravel pack layer
5. The bore annulus above the bentonite seal will be grouted to surface level
6. The bore annulus will be sealed at the surface with 0.5 m concrete / grout seal.

Each newly installed monitoring well will be developed immediately after installation by a dedicated submersible pump or bailer using a surging action.

The wells will be allowed to stabilise for a minimum of 7 days after development, prior to groundwater sampling.

4.3.2 SURVEY OF GROUNDWATER MONITORING WELLS

The top-of-casing and adjacent ground level of each monitoring well is required to be surveyed by a licensed surveyor. The spatial coordinates, as well as elevation in Australian Height Datum (AHD) is to be recorded.

4.3.3 SAMPLING METHODOLOGY

Water Level Gauging

Water level gauging is to be undertaken prior to purging of each well. The gauging point, from which all water level measurements are to be carried out, will consist of a small notch or mark on the casing to ensure consistent measurements over time. The groundwater levels in all wells are to be measured within the same day (within as short a period as possible) to enable a consistent comparison of water levels for the determination of hydraulic gradients and flow directions. The following measurements are to be undertaken:

- Thickness of non-aqueous phase liquids (NAPL) (if present);
- Static water level relative to the top of casing; and
- Total depth of well.

Measurements will be undertaken using an electronic interface probe, which will be decontaminated between wells. The measurements will be recorded on the field data sheets, and presented on the bore logs.

Well Purging and Sampling

Purging of monitoring wells is to be undertaken using a low-flow technique using a peristaltic pump (or similar). Purging is to be continued until water parameters have stabilised or until the bore becomes dry. A physical description of the sample will also be recorded on the field data sheets.

All bores will be sampled immediately following well purging.

If NAPL is observed within a well, no samples of groundwater will be collected from that location.

The water parameters and a physical description of the sample are also to be recorded on the field data sheets.

Water Parameters

A physical description of the sample will be recorded on the field data sheets including:

- Colour
- Turbidity
- Odour
- Thickness of phase separated liquids / non-aqueous phase liquids (NAPL), if any.

The water parameters will be tested in the field at the time samples are collected for the following field parameters:

- pH
- electrical conductivity (EC)
- temperature
- dissolved oxygen (DO)

Decontamination

Re-usable equipment, such as the water level meter and water quality meter sensors, will be decontaminated before each use. The water level meter will be rinsed in a decontamination solution, and then rinsed in potable water. The water quality meter sensors will be rinsed in potable water, and then rinsed in a sample of water to be measured, prior to measuring water quality parameters. Cleaning agent will not be used on the sensors, as it will affect the accuracy of the measurements.

Other materials and equipment (e.g. sampling tubing, bailers, liners and nitrile gloves) used for groundwater sampling will be single-use and dedicated to individual wells. Dedicated single-use items will not be decontaminated, but will be placed within an identified waste disposal bin on-site following use.

4.3.4 QUALITY CONTROL

Quality control samples will be collected during the groundwater investigation as outlined below:

- Intra-laboratory / Inter-laboratory duplicate samples will be collected by splitting each sample into the primary and duplicate sample containers. In accordance with the Amended NEPM (NEPC, 2013) both intra- and inter-laboratory samples will be collected at a minimum rate of 1 in 20 primary samples. In total this equates to a minimum of 10% of the primary sample set consisting of duplicate samples.
- An equipment rinsate blank will be collected from dedicated equipment only, by pouring laboratory prepared supplied deionised water over the sampling equipment between sampling locations.
- Trip blank and spiked trip blank samples, comprising of laboratory prepared blank and spiked water will be included in the analytical suite.

4.4 SAMPLING PLAN CONTINGENCIES

Where the schedule of sampling cannot be conducted as described (e.g. due to access constraints, or difficulties in reaching the target depth for sampling) alternative methodologies of achieving the objectives of the P2 DSI may be considered.

Alternative methodologies may include, but not necessarily be limited to:

- Re-location of intrusive sampling locations.
- Consideration of likelihood of the presence of a data-gap, based on field observations and data sourced from surrounding sampling locations, and inferences that may be drawn from these locations.

Laboratory Analysis Program

5.1 GENERAL

All primary and duplicate samples are to be submitted to a NATA accredited laboratory who will conduct all analysis. An independent assessment of the QA/QC measures adopted by the laboratory must also be performed. The performance of the lab QA/QC measures will be assessed in accordance with the PARCC parameters (precision, accuracy, representativeness, comparability and completeness). The laboratory QA procedures, the performance of which will be assessed independently will include the following:

- Method Blanks;
- Laboratory control samples;
- Matrix Spike and Matrix Spike Duplicates (to be specifically requested to be performed by the primary laboratory, for each sample batch submitted);
- Laboratory Duplicates; and
- Surrogates.

The objective of this section is to describe the methods and procedures that will be used by the selected laboratories to ensure quality, accuracy, precision and completeness of the analytical data generated as part of this investigation.

The following sections provide descriptions of the analytical methodologies that will be used for the duration of this project in accordance with Australian Standards (AS4482.1 2005 and AS4482.2 1999). All United States Environment Protection Agency (US EPA) methods referred to are from “*Test Methods for Evaluating Solid Waste*” (SW-846), Revision A, July 1992, US EPA.

5.2 SCHEDULE OF SAMPLE ANALYSIS

The proposed analytical schedule for chemicals of potential concern (COPC) at each zone for the P2 DSI is presented below:

Table 5.1 – Analytical Schedule and Minimum Required Limit of Reporting (LOR)

COPC and Required Analytical LOR	Zone 1	Zone 2	Zone 3	Zone 4
TPH/TRH 10 mg/kg (short chain) to 100 mg/kg (long chain) 20 µg/L (short chain) to 100 µg/L (long chain)	Soil ¹ ;	Soil ¹ ; Stockpiles ¹ ;	-	Soil; Groundwater;
BTEXN 0.2 mg/kg to 0.5 mg/kg 1 µg/L to 2 µg/L	Soil ¹ ;	Soil ¹ ; Stockpiles ¹ ;	-	Soil; Groundwater;
PAHs, Phenols 0.5 mg/kg 1 µg/L	Soil ¹ ;	Soil ¹ ; Stockpiles ¹ ;	-	Soil; Groundwater;
8 Metals 5 mg/kg 1 µg/L	Soil ¹ ;	Soil ¹ ; Stockpiles ¹ ;	Soil; Groundwater ³ ; Surface Water; Sediment;	Soil; Groundwater;
Asbestos 0.001 %	Soil ¹ ;	Soil ¹ ; Stockpiles;	Soil ⁴ ;	Soil;

Table 5.1 – Analytical Schedule and Minimum Required Limit of Reporting (LOR)

COPC and Required Analytical LOR	Zone 1	Zone 2	Zone 3	Zone 4
OC / OP Pesticides 0.2 mg/kg 0.2 µL to 0.5 µL	Soil;	Soil; Stockpiles ¹ ;	Soil; Groundwater ³ ; Surface Water; Sediment;	Soil; Groundwater;
Microbiological E. coli and Faecal Coliforms	-	-	Groundwater ³ ; Surface Water; Sediment;	Groundwater;

Notes:

1 – Not required for samples collected from former transformer and Skin Shed delineation test-pits.

2 – Stockpiled material is to be analysed for total concentration of COPCs. Where exceedance of assessment criteria is evident (**Section 3**), samples are subsequently to be analysed for the leachable concentration of COPCs using the Australian Standard Leaching Procedure (ASLP), described in Australian Standards AS4439.2 and 44396.3.

3 – Opportunistic samples of groundwater only, if ingress of shallow groundwater is observed in test-pits proximal to settlement ponds.

4 – Northern boundary samples only.

Drawings

FIGURE 1:
SITE LAYOUT AND ZONE 3 SAMPLING LOCATIONS



-  Site Boundary
-  Previous Sample Location (Environ, 2007) - Approximate
-  Soil Sampling Location
-  Soil, Surface Water and Sediment Sampling Location

FIGURE 2:
ZONE 1 / ZONE 2 SAMPLING LOCATIONS



FIGURE 3:
ZONE 4 (DUMP) SAMPLING LOCATIONS

