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**ENVIRONMENTAL, HEALTH & SAFETY PLAN
UNIVERSITY OF SA
DORRIT BLACK BUILDING & ENVIRONS
SOIL & GROUNDWATER CONTAMINATION
LIVERPOOL STREET ADELAIDE SA**

March 2014

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Attachments:

- 1: Contamination Zone Plan Calabrese Partners Drawing 1013-008-A March 2014

ENVIRONMENT, HEALTH & SAFETY PLAN

UNIVERSITY OF SOUTH AUSTRALIA

DORRIT BLACK BUILDING & ENVIRONS

SOIL & GROUNDWATER CONTAMINATION

LIVERPOOL STREET ADELAIDE SA

1.0 Introduction

Calabrese Partners has been engaged by the University of South Australia (UniSA) to provide an Environment, Health & Safety Plan (EHSP) for potentially contaminated soils and groundwater in the vicinity of the Dorrit Black building located in Liverpool Street Adelaide.

The EHSP provides details of soil and groundwater contaminants, their location, environmental, health and safety risks associated in potential soil disturbances by site works or works on infrastructure assets in this location and management of risks identified.

This documentation represents a due diligence measure initiated by the UniSA to appropriately manage potential risks to the environment, health and safety within the area of identified contamination.

2.0 Background

The subject land identified as part Lot 500 George and Liverpool Streets Adelaide (DP 46982) comprises a site area of some 1,750 m². The current site is the result of accumulated land acquisition and amalgamation of certificate of titles by UniSA. The land is located within the City of Adelaide within a zone where, among other uses, educational establishments are envisaged.

The redevelopment of the land required an environmental site auditor for the purpose of certification of suitability to a more sensitive land use. Mr Adrian Hall of URS Australia Pty Ltd was appointed as site auditor in 2003 and as part of audit requirements included the conduct of detailed soil and groundwater contamination investigations based on a site history. Environmental consultant, Calabrese Partners, was engaged to undertake these investigations and provide a report in order to full fill Audit requirements for the land to be developed as proposed.

The requirement of regular groundwater monitoring of four installed wells (MWD, MWJ, MWF and MWG) resulted from significant soil, and groundwater contamination that arose as a result of a leaking UST on-site during site redevelopment in 2003. Subsequently, the UST was removed and the impacted soil source was remediated to the extent that was reasonably practicable.

Groundwater monitoring has been undertaken on an annual basis since 2003 in accordance with Audit conditions. In addition, a Groundwater, Monitoring and Management Plan (GMMP) was prepared and finalised by Calabrese Partners on behalf of UniSA in April 2008. In September 2009 Mr Hall moved employment from URS to GHD Pty Ltd and was then re-appointed by UniSA as the Site Contamination Auditor.

More recently as part of routine groundwater screening of the wells located on-site, preliminary groundwater vapour checks of the source well (MWD) was undertaken at the request of Mr Adrian Hall. A report detailing the most recent groundwater contamination and vapour risks was provided to UniSA by Calabrese Partners in September 2013, Report No. 0513-009-1.

3.0 Local Hydrogeology

The underlying geology of the area consists of red brown clayey soils overlying the Bakara Calcrete. Information obtained from PIRSA indicates that depth to groundwater is highly variable and is dependent on the location of perched water adjacent the River Torrens. Natural soils in the region are calcareous overlying stiff clay of medium to high plasticity. Depth to groundwater noted for the City of Adelaide square mile varies between 6.0 m and 22.0 m depending on locality. Discussions held with the footing contractor responsible for the construction of the nearby Kingston and Way Lee Buildings in the late 1990's confirm the existence of several perched water aquifers for the locality. Monitoring of wells constructed as part of site redevelopment (MWD, MWJ, MWG, MWF) indicate that the average depth to groundwater from surface is approximately 7 m.

4.0 Site Contamination Details

4.1 Site Contamination Reports

Calabrese Partners was engaged by UniSA in 2004 to undertake a supplementary off-site groundwater contamination investigation on City of Adelaide land in Liverpool Street, Adelaide. The investigation was conducted as part of Auditor and the EPA requirements to assess and qualify potential environmental and public health impacts arising from the identification, removal and remediation of a former corroded UST located adjacent the Liverpool St site boundary on the University land Part lot 500 DP 4692.

Details related to the UST removal and soil remediation program have been provided in the Calabrese Partners Report No. 0703-002-1 May 2004 *"Supplementary Soil Contamination Investigation Report Early Works & Site Preparation Contract, University of South Australia"*.

Comprehensive details relating to groundwater contamination status have been provided in the following:

- Calabrese Partners Report No. 0503-003-1 Sept 2003 *"University of South Australia Groundwater Contamination Investigation Report Pt Lots 500 & 501 DP 46982 Fenn Place & George & Liverpool Sts Adelaide."*
- Calabrese Partners Report No. 0903-003-1 April 2004 *"University of South Australia Supplementary Groundwater Contamination Report Pt Lots 500 & 501 DP 46982. Fenn Place & George & Liverpool Sts Adelaide"*.

The findings of supplementary groundwater contamination conducted as part of EWSP Works and Auditor CUTEP submission for Pt Lot 500 (Site 2) and Pt Lot 501 (Site 3B) DP 46982 Adelaide on behalf of the UniSA have indicated;

- Groundwater contamination involving benzene (and to a lesser extent toluene and xylene) and hydrocarbons (C6-C9 and C10-C14) in MWD (Site 2) associated with a former corroded UST located in this position. Benzene concentrations significantly exceeded the NSW EPA reference criteria.
- The absence of significant hydrocarbon contamination in additional groundwater monitoring wells MWF & MWG installed on Site 2 as part of CUTEP requirements. A very minor degree of C15-C28 hydrocarbon contamination was noted in groundwater sample MWG-1. Hydrocarbon characteristics and groundwater gradient factors suggest an alternative source to the identified UST (MWD position).
- Inconclusive groundwater gradient data due to significant site disturbance and relative proximity of MWD, MWF and MWG suggest a potential for groundwater impacts related to the former UST (Site 2) across Liverpool Street. Additional groundwater sampling and survey was required to establish this post-building construction.
- The absence of hydrocarbon contamination from groundwater sample results obtained from MWB undertaken as part of baseline groundwater monitoring study (reported in Calabrese Partners 0503-003-1 Sept 2003).
- The identification of a significant and widespread boron groundwater contamination issue for all supplementary wells installed. Boron concentrations are typically higher in data obtained from Site 2 wells when compared with Site 3B positions. All supplementary results substantially exceed boron NEPM Drinking Water GILs (of 0.3 mg/L). The range of results obtained for boron is between 2.5 mg/L to 4.4 mg/L. A general external influence is likely to be operative.

A 2004 investigation aimed to supplement existing Site 2 groundwater data and provide new off-site groundwater information to provide the basis for risk assessment required by the independent Auditor and by the EPA.

Groundwater monitoring of on-site wells have been undertaken on an annual basis since this period.

In 2012 the Site Auditor imposed an additional requirement to provide a preliminary assessment of groundwater derived soil vapour risks. Groundwater monitoring and preliminary groundwater derived soil vapour information was summarised in Calabrese Partners Report No. 0712-002-1 September 2012 *“University of South Australia Monitoring Findings & VOC Vapour Monitoring Results May-July 2012 Site 2”* and updated with a risk assessment in Report No. 0513-008-1 September 2013 *“University of South Australia Review, Investigation & Risk Assessment of Groundwater VOC Soil Vapour Dorrit Black Building & Environs”*.

All reports include a continuing potential for soil hydrocarbon contamination risks that extend to both soil vapour and groundwater contamination risks that form the basis for an EHSP.

4.2 Contamination Zone

The extent and location of boundary of potential soil and groundwater hydrocarbon contamination including soil vapour within this location is depicted in Attachment 1. All site works conducted within the Contamination Zone are to comply with the EHSP.

5.0 Risk Identification

5.1 Existing Situation

The body of contaminated groundwater lies some 6-7 m below ground surface and is overlain by natural soil strata to about 1-2 m from surface. The Contamination Zone is covered by the building footprint, pavement or bitumen roadway. Minimum potential for direct contact with the contaminated groundwater exists within the locality. A risk assessment conducted on behalf of UniSA by EnRisks in 2013 for soil vapour risks originating from the source contaminated groundwater body has concluded that no significant risk exist for building occupants (*“EnRisks, 2013, Soil Vapour Risk Assessment: University of South Australia, Site 2 George and Liverpool Streets Adelaide”* appended as Attachment B in Calabrese Partners Report No 0513-008-1 Sept 2013).

5.2 Potential Risks

Potential environmental, health and safety risks are increased with any disturbance to the surface within the Contamination Zone that involves soil movement ie services installation/repair/upgrade, changes to stormwater, building work including demolition, alterations to building footprint, structures, paving, landscaping and the like.

Potential environmental risks and health and safety risks to university staff, students and the general public and to contractors and service operators undertaking works within the Contamination Zone include the following:

- Human exposure to contaminated soil (via physical contact)
- Human exposure to contaminated soil vapour eg volatile organic carbon vapours (VOCs) (via inhalation)
- Human exposure to contaminated groundwater (via physical contact)
- Dust emission (excavation)
- Explosive VOCs
- Spread of contamination to environment.

6.0 Risk Assessment

The risk potential associated with the disturbance of the surface area within the Contamination Zone includes an assessment of the consequence and likelihood of each risk through the use of a risk matrix as shown below in Figure 1. The risk rating assists to prioritise the potential risk level in order of significance and adopt appropriate mitigation measures to reduce risk potential to a residual risk.

Figure 1: Risk Matrix

	LIKELIHOOD			
CONSEQUENCE	1 Rare	2 Unlikely	3 Likely	4 Certain
4 Catastrophic	Medium	Significant	Significant	Significant
3 Major	Medium	Significant	Significant	Significant
2 Moderate	Low	Medium	Significant	Significant
1 Minor	Low	Low	Medium	Medium

Risk Level: Low: Manage with standard operating procedures
 Medium: Specify mitigation measures
 Significant: Requires immediate action

Potential Risk	Consequence	Likelihood	Risk Rating	Risk Level
Human exposure to contaminated soil (physical)	2	4	8	significant
Human exposure to VOCs (inhalation)	2	4	8	significant
Human exposure to contaminated groundwater (physical)	2	2	4	medium
Dust emissions (excavation)	2	2	4	medium
Explosive VOCs	3	4	12	significant
Spread of contamination to environment	3	4	12	significant

7.0 Risk Management Protocol

7.1 Roles & Responsibilities

7.1.1 Notification

UniSA and asset owners within the Contamination Zone have the responsibility of keeping each other informed of any works as described under section 5.2 undertaken either by themselves or on their behalf.

Proposed work within the Contamination Zone should be notified to the UniSA management in order for appropriate personal and public health and safety protection arrangements to be instigated.

7.1.2 Register of Works

A Register of Works within the Contamination Zone to be kept at the UniSA and updated accordingly of all works including plans and any follow up / remedial works undertaken by UniSA, asset owners or contractors on their behalf within the Contamination Zone that has the potential of disturbing the surface or subsurface.

7.1.3 Appointment of Environmental Consultant

UniSA or asset owners within the Contamination Zone or contractors acting on their behalf have the responsibility of engaging a qualified environmental consultant. The appointed environmental consultant should have access to this EHSP to provide background information and management protocols.

7.1.4 Tasks Prior to Commencement of Works

Prior to the commencement of works the following is required:

- ❖ A Job Safety Assessment (JSA) by the consultant to address the potential of encountering contaminated soil, groundwater, and soil volatile organic vapour.
- ❖ Preparation of a Site Induction Plan for all workers, contractors and staff.
- ❖ Notification to UniSA, asset owners and immediate neighbours of the intended work and the requirement for specific protection arrangements to campus staff, students, neighbours and the general public.
- ❖ Preparation of a Contingency Plan detailing emergency contacts and arrangements. Minimum contingency arrangements are expected to include:
 - Cease work and fence off immediate area;
 - Notify appropriate authorities;
 - Place any suspect soils and other materials under a plastic sheet cover;
 - Ensure no surface water or drainage to material;
 - Advise on procedures to re-establish appropriate safe physical conditions for the re-commencement of work.
- ❖ Engage a qualified consultant to assess suspect material and manage disposal if required.

7.1.5 Contractors / Service Operators

UniSA or asset owners within the Contamination Zone must ensure that any work undertaken by themselves or on their behalf comply with risk management procedures addressing environment, health and safety advised by the appointed environmental consultant and the health and safety officer.

Prior to commencement of any work, it is the responsibility of the contractor or site supervisor to ensure that any persons undertaking the work, be inducted in order to comply with the environmental, health and safety management protocol.

Ensure ready access to sanitary facilities prior to commencement of works.

7.2 Risk Management Controls

To minimise human risk exposure and potential adverse environmental impacts associated with any activity that disturbs the ground / underground surface within the Contaminated Zone the following risk management controls need to be in place for residual risks to be low.

Risk	Controls
Human exposure to contaminated soil (physical)	<p>Install shade cloth covered fence defining Works Exclusion Zone ie min 10 m to minimise access.</p> <p>Wear personal protection equipment (PPE) ie gloves, disposable overalls, goggles, boots and hat at all times during works within the Works Exclusion Zone.</p> <p>Remove disposable PPE directly into bins for appropriate off-site disposal at the end of day.</p> <p>Abstain from consumption of food or drink at all times during work within the Exclusion Zone.</p>
Human exposure to VOCs (inhalation)	<p>Wear appropriate respiratory protection capable of filtering out particulates and organic soil vapour at all times during works.</p> <p>Use portable monitoring device for potential soil vapour emission.</p>
Human exposure to contaminated groundwater (physical)	<p>Adhere to maximum depth of 6 m from ground to groundwater level.</p>

Risk	Controls
Dust emission (excavation)	<p>Install shade cloth covered fence defining Works Exclusion Zone ie min 10 m.</p> <p>Wear PPE at all times during works.</p> <p>Cover and secure excavated soils with plastic sheeting for off-site licensed disposal.</p>
Explosive VOCs	<p>Install portable monitoring device for potential soil vapour emission.</p> <p>No smoking within Works Exclusion Zone.</p> <p>No flammable or ignition sources within Works Exclusion Zone.</p>
Spread of contamination to environment	<p>Cover and secure excavated soils with plastic sheeting for off-site licensed disposal.</p> <p>Remove disposable PPE directly into bins for appropriate off-site disposal at the end of day.</p> <p>Contain any groundwater for removal off-site by licensed operator.</p> <p>Decontaminate equipment and machinery by washing or wiping down within a contained waste water area. Waste water disposed off-site to licensed liquid waste facility.</p>

8.0 Record & Review

A complete record of works undertaken within the Contamination Zone detailing operator, date of works, details of work including plans, remedial or other follow up works to be kept at the UniSA in accordance with section 7.1.2.

The EHSP contained herein represents a working document that is subject to additions and amendments according to site and working conditions. The Plan should be periodically reviewed and updated to ensure relevance and to maintain effectiveness.

Nicholas Calabrese
Director
Calabrese Partners

March 2014

ATTACHMENT 1: CONTAMINATION ZONE PLAN



DRAWING LOCATION PLAN
CLIENT: UNIVERSITY OF SOUTH AUSTRALIA
DESCRIPTION: ZONE OF CONTAMINATION AT: LIVERPOOL STREET ADELAIDE, S.A.

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