AECOM

Remedial Action Plan, Proposed Rozelle Village Site

DKO Architects

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Prepared for

DKO Architects

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3	05/11/2009	Final	Jason Veale Principal Consultant - Sustainability	
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Table of Contents

Executive Summary

This report presents a Remedial Action Plan (RAP) prepared by AECOM Australia Pty Limited (AECOM) for the Proposed Rozelle Village Site, located near the corner of Victoria Road and Darling Street, Rozelle, NSW (the Site).

The RAP was prepared to accompany the development application for a proposed mixed retail / commercial / club / residential development on the Site.

The objectives of the Phase 1 ESA were to:

- comply with the requirements of SEPP55 and Leichhardt Council's DCP 42;
- assess remedial options and identify a preferred remedial strategy;
- document the remediation and validation scope and methodology;
- present a framework for site management during the remediation; and
- provide a conclusion that following implementation of the remediation action plan the Site will be suitable for the proposed landuse.

The site is not known to be contaminated, nor has it been investigated and found uncontaminated. However, based on the requirements of the Leichhardt Council's "Request for Further Information' this RAP has been prepared to account for the potential presence of contamination on the site.

Previous investigations indicate that remediation could potentially be required to address:

1) Fuel USTs and associated petroleum hydrocarbon contamination (if any) in the front driveway of 154 Victoria Road (the former workshop site).
2) Potential petroleum hydrocarbon contamination associated with chemical storage or use in other parts of 154 Victoria Road during previous use of this area as a mechanical workshop.
3) Fuel oil / diesel UST and associated petroleum hydrocarbon contamination (if any) in the Leagues Club Loading dock Area.
4) PAH contamination that was previously detected in one shallow soil sample in the open air car park at the rear of the Site.
5) Fill material across the Site which may be variably contaminated.
6) Potential contamination hotspots across the Site resulting from past chemical storage or usage prior to development of the Site as a Leagues Club (if any).
7) Potential contamination hotspots resulting from introduction of hazardous building materials (e.g. fibro asbestos, lead paint) to soil through past weathering from or demolition of former buildings on the Site.

It is proposed to excavate a basement some 15m to 20 m below the existing Site surface, therefore, it is considered the most suitable remediation strategy is to excavate and dispose any present contaminated soil to a suitably licensed disposal facility.

Given the proposed depth of the basement, the act of excavation (including dewatering) would effectively constitute an excavation and offsite disposal remedial strategy and should result in remediation of the Site so that it is suitable for the proposed land use.

There is the potential for some localised offsite impacts from the fuel USTs in the front driveway of 154 Victoria Road, close to the Site boundary. Contingency actions have been included in this RAP covering the event that such offsite impacts are identified.

This remedial action plan documents the remediation and validation strategy to address contamination on the Site including a requirement to further delineate the extent of contamination and provision of contingency measures for various scenarios that could arise during the remediation.

It is considered that following full implementation of this RAP the Site will be suitable for the proposed mixed use development.

1.0 Introduction

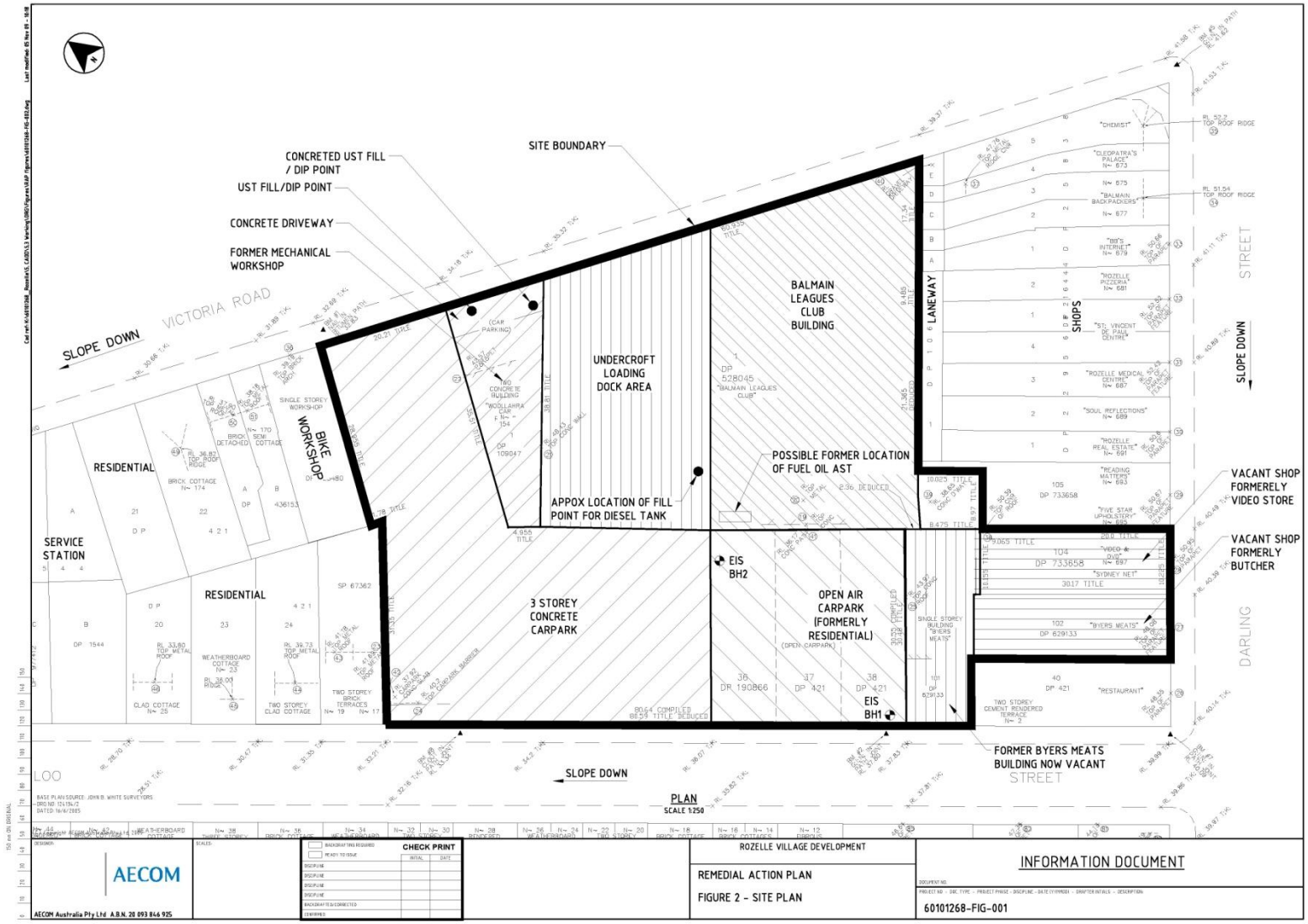
1.1 General

AECOM Australia Pty Limited (AECOM) was engaged by DKO Architects to prepare a Remedial Action Plan (RAP) for the Proposed Rozelle Village Site, located near the corner of Victoria Road and Darling Street, Rozelle, NSW (the Site). The location of the Site is shown on Figure 1 and detail of the property layout is shown on Figure 2.

The RAP was prepared to accompany the development application for a proposed mixed retail / commercial / club / residential development on the Site. The RAP was prepared in response to Leichhardt Council's Request for Information and/or amendments to proposal, dated 29 September. 2009

Figure 1: Site Location Plan

Figure 2: Site Plan



1.2 Proposed Redevelopment

A mixed use development is proposed for the Site including new premises for the Balmain Leagues Club, retail shops, commercial space and residential apartments.

At the time of preparation of this report the proposed development included:

- Six basement levels with the lower basement slab at RL17 (between around 15m to 20m below the existing ground surface). The basement levels covered the entire Site with the exception of a small area adjacent to Darling Street.
- Buildings above the basement levels ranging up to 12 storeys high.

1.3 Objective

The objectives of the Remedial Action Plan were to:

- comply with the requirements of SEPP55 and Leichhardt Council's DCP 42;
- assess remedial options and identify a preferred remedial strategy;
- document the remediation and validation scope and methodology;
- present a framework for site management during the remediation; and
- provide a conclusion that following implementation of the remediation action plan the Site will be suitable for the proposed landuse.

1.4 Scope of Works

The scope of works included preparation of a remedial action plan (RAP) which in accordance with the NSW DEC (2006) Guidelines for Consultants Reporting on Contaminated Sites includes section / discussions covering the following:

- Executive summary.
- Scope of work.
- Site identification.
- Summary of site history, site history, surrounding environment, geology, hydrogeology and Site characterisation.
- Remediation goals.
- Discussion of the extent of remediation required.
- Discussion of possible remedial options and rationale for the selection of recommended remedial option.
- Proposed testing to validate the Site after remediation.
- Contingency plan if the selected remedial strategy fails.
- Site management plan.
- Remediation schedule and hours of operation.
- Contingency plans.
- Identification of regulatory compliance requirements such as licences and approvals.
- Community relations plans, where appropriate.
- Staged progress reporting, where appropriate.
- Long-term site management plan.

2.0 Site Identification

The Site is identified in Table 1:

Table 1:Site Identification

Item	Description
Site Owner	Balmain Leagues Club Ltd
Site Occupier (if different from above)	The majority of the Site is occupied by the Balmain Leagues Club. 154 Victoria Road is occupied by a dance studio tenant. 697 & 699 Darling Street and 1 Waterloo Road are vacant
Site Address	138-156 Victoria Road, 1-7 Waterloo Street and 697 Darling Street, Rozelle
Legal Description (Lot and DP)	Lot 1 DP 528 045 Lot 1 DP 109047 Lot 104 DP 733658 Lots 101 &102 DP 629 133, Lot 37 & 38 DP 421 & Lot 36 DP 190866
Site Survey	Appendix A
Local Government Authority	Leichhardt City Council
Current Zoning	Background business zoning and Site specific amended controls in Leichardt LEP 2000 allowing mixed used shops, commercial, clubs and residential use
Current Land Use	The majority of Site is occupied by the Balmain Leagues Club. 154 Victoria Road is occupied by a dance studio tenant. 697 & 699 Darling Street and 1 Waterloo Road are vacant.
Proposed Land Use	Mixed club, commercial, retail and residential
Geographical Coordinates (AMG)	330500 E 6251250 N
Site Elevation (mAHD)	Approximately RL32 to RL41m AHD on Victoria Road and Waterloo Streets
Site Area (Approximate)	7,400m^2
Site Location	Figure 1
Site Layout	Figure 2

Notes:

AMG - Australian Map Grid

AHD – Australian Height Datum

Geographical coordinates are approximate to centre of Site

3.0 Previous Contamination Investigations

3.1 EIS (2005)

EIS previously prepared a report entitled '*Phase 1 Preliminary Environmental Site Screening for Proposed Balmain Leagues Club Redevelopment at 138-152 Victoria Road, Rozelle'* dated April 2005 (Ref: E19319FK-RPT). The report was prepared for DG Jones Australia to assess contamination for a proposed development scheme at the Site.

The EIS (2005) report documented the findings of a Phase 1 Preliminary Environmental Site Assessment carried out at 138-152 Victoria Road, Rozelle (i.e. on a large part of the Site which is the subject of this report).

The scope of the EIS assessment included:

- A site history review including: review of historical aerial photographs; review of the deposited plan and development applications/building approvals held by Council; review of regional geology and groundwater conditions including the location of registered groundwater bores and major underground services in the vicinity of the Site; search of WorkCover Dangerous Goods Licenses for underground fuel storage tanks (USTs); and check for investigation/remediation orders issued by the NSW DECCW.
- Completion of a very limited field and sampling program (undertaken in conjunction with a geotechnical investigation) including the drilling of two boreholes in the open air car park at the rear of the Site and the collection and analysis of a single soil sample.

EIS reported that the search of historical information has indicated the Site has been used for commercial/industrial purposes since at least 1951 and that there are no recorded notices listed on the NSW DECCW register and WorkCover have no records of underground storage tank licenses issued for the Site.

EIS concluded that historical information and inspection of the Site and surrounding areas did not indicate any obvious on-Site or nearby off-Site activity expected to generate significant soil or groundwater contamination other than previous industrial Site use including a mechanics workshop.

The single soil sample EIS collected and analysed (collected from BH2 in the open space car park at the rear of the Site at a depth of 0.2-0.4m) contained high levels of polycyclic aromatic hydrocarbons (PAHs). No visual or olfactory evidence of contamination is indicated on the EIS borehole log at this location.

EIS note groundwater was encountered in a borehole at a depth of approximately 3.6m.

3.2 AECOM (2009)

AECOM prepared a Phase 1 Preliminary Environmental Site Assessment (Phase 1 ESA) in 2009 as part of the development application process for the currently proposed development.

The objectives of the Phase 1 ESA were to:

- evaluate past and present potentially contaminating activities which may have occurred at the Site;
- identify potential areas of environmental concern (AECs) and associated potential chemicals of concern (COCs); and
- assess the need for further investigations and/or remedial action.

To achieve the objective, the following scope of work was undertaken:

- review previous available contamination and heritage reports;
- review of Lands Title Office documents;
- review of Council Development and Building Application Records;
- search of the Department of Environment, Climate Change and Water (DECCW) contaminated land register;
- review selected available historical aerial photographs for the Site;
- search of the NSW WorkCover (Dangerous Goods Licences) records;
- conduct interviews with personnel or former workers who have worked at the Site and with neighbours, where readily available;
- review available geological and hydrogeological information for the area;
- conduct an inspection of the Site to assist with the identification of potential on and off-site sources of contamination to understand the general condition of the Site; and
- preparation of this report discussing the methodologies used, the results of the investigation, identifying potential AECs and COCs and making a preliminary assessment of the likely suitability of the Site for the proposed development.

The findings of the Phase 1 ESA are summarised in the following sections.

4.0 Summary of Site Condition and Surrounding Environment

The following sub-sections present a summary of history of the site and surrounding area based on the findings of the Phase 1 ESA previously carried out by AECOM on the Site.

4.1 Current Land Use

The majority of the Site is currently occupied by the Balmain Leagues Club and associated car parking. A dance studio occupies the former workshop at 154 Victoria Road. 697 and 699 Darling Street are now vacant but were most recently a butchers shop and a video hire store. 1 Waterloo Road is vacant but was most recently used by the butchers.

4.2 Surrounding Land Use

Current land uses surrounding the Site comprise the following:

- North – Victoria Road and then a Pub and a School. Two service stations are located across Victoria Road to the north-west of the Site and are down-slope of the Site;
- East – retail shops;
- South – Waterloo Street then two commercial light industrial / retail properties near Darling Street and then residential dwellings further to the west. At the time of the Site visit one of the light industrial properties was a car hire shop (likely formerly a workshop) and the other a 'Variety Bash Office' (possible previously a post office); and
- West – Residential properties, a motorcycle workshop and a service station on the corner of Victoria Road and moody Street downslope of the Site

4.3 Topography and Drainage

Victoria Road and Darling Street are both located on ridges making the Site a local high point. Stormwater from the Site flows down through the local stormwater systems on Victoria Road and Waterloo Streets to the west eventually draining to Iron Cove approximately 1km from the Site. Given the Site is at a local topographic high point contamination from surrounding Sites (if any) would not be expected to flow onto the Site.

4.4 Surface Water and Flood Potential

No surface water was observed on the Site during the Site inspection. The closest surface water body to the Site is Iron Cove, part of Sydney Harbour approximately 1km to the west of the Site. The Site is not considered to have the potential to flood as it is located at a local high point at the top of two ridges. The Site elevation ranges from approximately 32m to RL41m AHD on Victoria Road and Waterloo Streets

4.5 Geology

According to EIS (2005) the 1 :100,000 geological map of Sydney (Map 9130, 1 :100,000 Department of Mineral Resources - 1983) indicates the Site to be underlain by Hawkesbury Sandstone of the Wianamatta Group that is medium to coarse grained, with very minor shale and laminite lenses. The sandstone bedrock is typically overlain by residual soils and in some cases imported fill material.

Two boreholes on the Site by EIS (2005) in the open air car park at the rear of the Site encountered fill material in the order of 2m deep underlain by a thin layer of residual soil and then sandstone bedrock. This is consistent with the expected geology.

4.6 Hydrogeology

Given the predominantly paved nature of the Site, the shallow bedrock and the location of the Site on a local high point, it is expected that there would be limited groundwater above the bedrock. After rainfall events some groundwater may be present perched on the bedrock and would be expected to follow the topography of the bedrock down to the west and south eventually discharging to Iron Cove. Shallow groundwater would not be expected to flow onto the Site from nearby Sites. Regional groundwater may be present deeper in the bedrock.

A search of registered groundwater bores undertaken by EIS (2005) indicated there were no registered bores within 1km of the Site.

Based on the above, groundwater in this area is not considered to be a significant resource for human use.

4.7 Site Observations

A walkover of the Site was undertaken by an AECOM Principal Environmental Engineer in July, 2009 as part of the Stage 1 PESA.

Observations made of the Site during the walkover are summarised as follows:

- 138-152 Victoria Road contained the main Balmain Leagues Club building. In the eastern part, the club building extended from street level while in the western part there was an undercroft loading bay / carpark area with an additional building level above. A small substation was located within a room in the loading bay area. A fill point, presumably for diesel storage tanks for the back-up generator, was observed in the southern corner of the loading dock area.

- 154 Victoria Road contained a two storey brick building (formerly a mechanical workshop) with the workshop on the ground level accessed by a roller door and office on the second level. This building was viewed from the outside only. The building is being used as a dance studio. A small concrete driveway car parking area was located at the front of the property adjacent to Victoria Road. Two fill / dip points for USTs were observed in this area. One of these was located in the south-eastern corner and was concreted in place. The other was approximately in the centre of the driveway. This property was lower than the main leagues club Site, separated by a retaining wall some 1m high. No evidence of significant oil staining was observed in the external parts of this property.
- 1 Waterloo Street contained a brick building previously used as a butcher's warehouse.
- 3-7 Waterloo Street contained an asphalt paved open air carpark extending from Waterloo Street to the main leagues club building.
- 156 Victoria Road contained a multi-level concrete car park structure with the lower level an under-croft level. This car park extended from Victoria Road through to Waterloo Street and was L-shaped extending behind the former workshop to the open air car park on Waterloo Road. The car park was accessed by ramps on Victoria Road and Waterloo Street. At the Waterloo Street frontage the undercroft level car park was typically about 1m below the level of Waterloo Street.
- 697 and 699 Darling Street contained retail shops, one of which was formerly a butcher and the other a video shop.

5.0 Summary of Site History

5.1 Summary of Site History

Based on the Phase 1 ESA previously prepared by AECOM the site history can be summarised as follows:

- The Darling Street properties were developed through the late 1800s and early 1900s as shops with uses including fishmongers, butchers, furniture warehouse, billiard parlour, chemist, grocers, lingerie factory, video hire etc. These properties have recently been vacated.
- In 1880 only three entries were listed between Moodie and Darling Street on Victoria Road (then Weston Road) namely Edwin Glassop Temperance Cottage, Theopollus Murray, shipwright and Mrs. E Murray, general store. It is not clear whether these were on the Site or further to the west.
- A map from the late 1950s or early 1960s shows one large building on the Site of 140 Victoria Road, a free standing dwelling at No. 142 and a terrace of five houses Nos. 144, 146, 148, 152 and 154. Another freestanding house is at No. 154. Four semi- detached dwellings are located at Nos. 156 and to the west of the Site 158, 160 and 163 Victoria Road.
- The Balmain Leagues was developed in the early 1960s on 138-152 Victoria Road.
- The Site was further expanded in 1968 when a number of properties in Waterloo Street were purchased and a 3-storey car park was constructed on 156 Victoria Road extending through to Waterloo Street. The heritage report indicates that a brass moulder owned part of the Victoria Road frontage in the 1920s and possibly operated a small foundry. In Waterloo Street an area bought to develop a carpark had formerly been a blacksmiths, before becoming the factory of a tailor.
- 1 Waterloo Road was used as the refrigerated warehouse for the butchers and has recently been vacated.
- The majority of properties on Waterloo Road were residential prior to being redeveloped. An asphalt paved car parking area was built on three of these properties post 1986.
- 154 Victoria Road was previously a mechanical workshop understood to have been developed in the early 1960s. The Site walkover revealed two underground storage tanks (USTs) fill or dip points in the concrete driveway / car parking area in front of the Site. One of these was concreted in indicating one of the USTs may have been abandoned in-situ. A search of WorkCover records indicates that a 5,000L mineral spirit UST (UST) was present on 154-156 Victoria Road since at

least 1962. In 1980 the records indicate that a new 23,000L UST typically holding 10,000L petrol was installed. It is considered likely that the concreted fill point may be associated with the 1962 UST while the 23,000L UST may be associated with the other fill point in this area. It is noted that an old undated photograph in the Heritage Report shows a view looking from the corner of Darling Street and Victoria Road. This shows an old petrol bowser on the footpath of Victoria Road outside a mechanics with a sign saying 'Chevrolet'. It is not known exactly where along the existing Victoria Road frontage this is located.

- A fuel tank fill point was observed in the southern corner of the Leagues Club loading dock area. The Leagues Club maintenance manager advised that a diesel UST for the emergency generator is present in this area and was pumped out around 4 years ago. A DA file held by council indicates two fuel oil ASTs were installed in this vicinity in the 1970s. These ASTs were not observed during the Site walkover and the maintenance manager was not aware of their existence.
- As the Site is located at a local high point it is considered that there is a low potential for migration of contamination onto the Site from nearby properties.

6.0 Site Characterisation Based on the Stage 1 ESA

Table 2 summarises the potential Areas of Environmental Concern (AECs) and associated Chemicals of Concern (COCs) that were identified by the Phase 1 ESA.

Table 2: **Summary of Potential Areas and Chemicals of Concern from the Stage 1 ESA**

Potential AEC	Description	Potential COCs	Comments
Front Driveway of 154 Victoria Road	Fuel USTs and associated pipe-work are located in this area.	TPH, BTEX, PAH, lead	At least two petrol / mineral spirit USTs are believed to be located in this area associated with the former use as a mechanical workshop. The USTs are located close to Site boundary.
Remainder of 154 Victoria Road	Potential chemical storage or use during previous use as a mechanical workshop	TPH, BTEX, PAH, metals, VOCs	This property has been used as a mechanical workshop since at least the 1960s. Fuel and chemical storage, handling and disposal practices are not known.
Leagues Club Loading Dock Area	Fuel oil / diesel USTs and potentially former ASTs and associated pipe-work are leaked in this area	TPH, BTEX, PAH, metals, VOCs	A pumped out diesel UST is present in the southern corner of the Leagues Club loading dock area. Two ASTs may also have been formerly located in this vicinity.
Leagues Club Open Air Carpark	A single soil sample from EIS revealed high levels of PAHs in this area (EIS boreholes BH2 at 0.2 m depth).	PAHs	Concentrations indicate may be a coal tar or a coal tar derived product such as coal tar bitumen. However, the source and extent of this contamination is not known

Potential AEC	Description	Potential COCs	Comments
	Electrical substation	TPH, PCB	Substation is located within a room and hence low potential for contamination
Overall Site	Past importation of potentially contaminated fill material.	Metals, TPH, BTEX, PAH, OCP, PCB, asbestos	EIS borehole logs in the open air carpark indicate the presence of fill material to depths of up to around 2m. It is expected that similar fill depths would be encountered across the majority of the Site although this will need to be confirmed through boreholes. The fill depth may be shallower where basement / undercroft car park areas exist. The single fill sample tested by EIS indicated high levels of PAHs as discussed above. The contamination status of the remainder of the fill is not known.
	Introduction of hazardous building materials (e.g. fibro asbestos, lead paint) through past weathering from or demolition of former buildings on the Site.	Asbestos, metals	Some current or past buildings on the Site may have contained such hazardous materials.
	Chemicals may have been used or stored during possible past light industrial used on parts of the Site	TPH, BTEX, PAH, metals, VOCs, cyanide	The exact historical usage of some parts of the Site is not known. For example a blacksmith and a small foundry may have operated on parts of the Site

The Phase 1 ESA concluded that:

- Review of available geological information suggested that the Site is underlain by a thin soil layer, then relatively shallow sandstone bedrock. Given this geology, and the nature of the potential contamination sources and chemicals of concern identified through this Phase 1 ESA (as summarised in the above table), it is considered that significant soil contamination would be unlikely to extend beyond relatively shallow depths.
- Based on current development plans, basement construction is proposed across the entire Site (with the exception of a small portion adjacent to Darling Street) extending down to RL 17m: approximately 15m to 20m below the current ground surface across the Site.
- The basement excavation therefore, is likely to remove all soil / rock containing contaminants exceeding the site landuse criteria from beneath the Site. Significant groundwater contamination (if present) onsite would also, under this scenario, be largely removed through the basement excavation process.

- In summary, the act of constructing the basement would effectively constitute an excavation and offsite disposal remedial strategy and would be expected, to result in remediation of the Site to a point where the Site can be considered suitable for the proposed land use.
- It is therefore considered that there is a high likelihood that the Site is capable of being remediated, and that it can be made suitable, for the proposed land-use through the development process.

It is noted that at this stage only limited sampling and analysis has been undertaken on the Site (by EIS 2005). Normally detailed investigations would be undertaken prior to preparation of a RAP. However, given the deep proposed basement excavations, it is considered that in this case the main purpose of further sampling will be to provide waste classification of soil and groundwater for offsite disposal and that this sampling can form part of the remedial action plan. On this basis it is considered that the Stage 1 ESA provides adequate Site characterisation information for the purposes of preparation of this remedial action plan.

7.0 Remedial Goals

The broad remediation goals are:

1) To render the Site suitable, with respect to contamination, for the proposed development (i.e. to remediate the Site to levels which do not pose an unacceptable risk to Site users and the general public).
2) To reduce potential environmental impacts (if any) from the Site to acceptable levels.
3) To ensure that soil or groundwater disposal during remedial and basement excavations is in accordance with DECCW waste classification guidelines.

8.0 Discussion of the Extent of Remediation Required

Based on the previous investigations remediation will potentially be required to address:

1) Fuel USTs and associated petroleum hydrocarbon contamination (if any) in the front driveway of 154 Victoria Road (the former workshop Site).
2) Potential petroleum hydrocarbon contamination associated with chemical storage or use in other parts of 154 Victoria Road during previous use of this area as a mechanical workshop.
3) Fuel oil / diesel UST and associated petroleum hydrocarbon contamination (if any) in the Leagues Club Loading dock Area.
4) PAH contamination that was previously detected in one shallow soil sample in the open air car park at the rear of the Site.
5) Fill material across the Site which may be variably contaminated.
6) Potential contamination hotspots across the Site resulting from past chemical storage or usage prior to development of the Site as a Leagues Club (if any).
7) Potential contamination hotspots resulting from introduction of hazardous building materials (e.g. fibro asbestos, lead paint) to soil through past weathering from or demolition of former buildings on the Site.

As discussed in the previous section it is considered that significant soil contamination (if any) would be unlikely to extend beyond relatively shallow depths and that any contamination on the Site is expected to be removed through the deep basement excavations. Given this, while the exact extent of contamination requiring remediation still requires delineation, it is considered this delineation can form part of the remedial action plan and will be mainly for waste classification purposes.

There is the potential for some localised offsite impacts from the fuel USTs in the front driveway of 154 Victoria Road which are close to the Site boundary. Contingency actions have been included in this RAP covering the event that such offsite impacts are identified.

9.0 Remedial Options and Rationale for the Selection of the Preferred Remedial Option

Given the proposed depth of the basement, the act of excavation (including dewatering) would effectively constitute an excavation and offsite disposal remedial strategy and should result in remediation of the Site so that it is suitable for the proposed land use.

There is the potential for some localised offsite impacts from the fuel USTs in the front driveway of 154 Victoria Road, close to the Site boundary. Contingency actions have been included in this RAP covering the event that such offsite impacts are identified.

Soil will need to be waste classified and then disposed of to a suitably licensed disposal facility.

In the event that soil is identified that exceeds the restricted solid waste criteria (i.e. classifies as hazardous waste) then that soil would need to be treated prior to disposal to landfill. Such pre-treatment could either occur onsite or could occur at a suitably licensed offsite treatment facility. In the event hazardous waste was encountered and onsite pre-treatment was proposed then an addendum to the remedial action plan would be prepared.

The RAP includes contingency measures covering the event that offsite contamination is identified.

10.0 Remediation Criteria

The proposed development will involve a deep excavation which should remove all soil on the site as well as well as a large volume of sandstone bedrock. As all soil and a large volume / depth of underlying sandstone should be disposed of to a suitably licensed landfill using waste classification techniques, remediation criteria are not considered necessary. However, for whatever reason should some material remain *in situ* which is considered to require validation then the remediation criteria would be based on:

- Human health based investigation levels (HILs) presented in the National Environment Protection Council's (NEPC) National Environment Protection Measure (NEPM 1999, Assessment of Site Contamination) which are reproduced in NSW DEC (2006) Guidelines for the NSW Site Auditor Scheme (2nd Edition); and
- Soil investigation levels presented in the NSW EPA Guidelines for Assessing Service Station Sites: Table 3 Threshold concentrations for sensitive landuse – soils.

NEPM (1999) and NSW DEC (2006) present human health based investigation levels for different land uses (e.g. industrial/commercial, residential with minimal access to soil, residential with accessible soil, recreational etc.) as well as phytotoxicity based investigation levels.

The Site is proposed to be developed for mixed use comprising residential with minimal access to soil (noting that a basement will cover practically the entire Site preventing access to Site soils) and commercial landuses.

NEPM (1999) states that "where land is used predominantly for one purpose, but contains within it a more 'sensitive' use, then the exposure setting relevant to that more sensitive use must be adopted for that particular parcel of land."

Of the proposed landuses, residential with minimal access to soil is the more sensitive and hence the HILs for residential with minimal access to soil (Column 2 of the table in the NSW DEC (2006) *Guidelines for the NSW Site Auditor Scheme*) will be adopted as remediation criteria for the respective contaminants of concern.

As it is proposed that the development will excavate a basement under the Site area the phytotoxicity criteria are not considered to be applicable.

NEPM (1999) provides criteria for hydrocarbon components based upon aliphatic and aromatic fractions, rather than general fractions, and does not provide criteria for BTEX. The NSW EPA *Guidelines for Assessing Service Station Sites* (NSW EPA, 1994) will be adopted to assess laboratory data for BTEX and total petroleum hydrocarbons (TPH) that are not differentiated into aromatics and aliphatics. It should be noted that these guidelines apply to sensitive land use and are therefore conservative for this Site.

NSW DEC (2006) states that there are currently no national or DECCW endorsed guidelines relating to human health or environmental investigation or material containing asbestos on sites. Until such guidelines become available, auditors must exercise their judgement when assessing whether a Site is suitable for a specific use in the light of evidence that asbestos may be a contaminant of concern. NSW Health will provide advice to auditors on a case by case basis where appropriate. Subsequently WA has adopted a guideline for asbestos however this is not endorsed by the NSW DECCW. In lieu of specific guidance from the DECCW we have adopted a conservative criteria of non-detect for asbestos as an initial remediation criteria for asbestos.

If any contaminants are identified that are not covered by the above guidelines, criteria will need to be selected / derived by the consultant.

The proposed soil remediation criteria are summarised in Table 3 below.

Table 3: **Summary of Soil Remediation Criteria**

Contaminant	Remediation Criteria
Arsenic	400[1]
Cadmium	80[1]
Chromium (III)	48%[1]
Chromium (VI)	400[1]
Copper	4000[1]
Lead	1200[1]
Nickel	2400[1]
Zinc	28000[1]
Mercury	40[1, 5]
Benzo(a)pyrene	4[1]
Total PAH	80[1]
Aldrin and Dieldrin	40[1]
Chlordane	200[1]
DDT, DDD + DDE	800[1]
Heptachlor	40[1]
TPH C6-C9	65[3]

Contaminant	Remediation Criteria
TPH C10-C36	1000[3]
Benzene	1[3]
Toluene	130[3]
Ethylbenzene	50[3]
Xylene	25[3]
Total PCB	40[1]
Phenol	34000[1]
Asbestos	Not Detected[2]
Other Contaminants	See note below[4]

1. NEPM (1999) HILs for residential with minimal access to soil including high rise apartments and flats
2. In lieu of specific guidelines 'non-detect' has been adopted as an initial investigation level for asbestos
3. NSW EPA (1994) Guidelines for Assessing Service Station Sites
4. Criteria for other contaminants to be selected / derived by consultant if detected
5. Based on methyl mercury

Note that the HILs are designed as investigation levels. The NEPM states that - *An investigation level is the concentration of a contaminant above which further appropriate investigation and evaluation will be required*" (NEPM 1999). An exceedance of an investigation level does not necessarily indicate that there is a definite risk to a receptor, but rather, that there could potentially be a risk. While these have been adopted at this stage as remediation criteria alternate remediation criteria may be proposed by the environmental consultant based on risk assessment (health / ecological), consideration of background concentrations and a range of other factors.

At this stage no specific groundwater remediation requirements have been identified. In the event that evidence of groundwater contamination is identified then groundwater remediation criteria will be developed. If groundwater is encountered it should be disposed of in accordance with the protocol outlined in Section 12.5.

11.0 Remediation and Validation

The following sections provide procedures for remediation and validation of the Site based on the strategy discussed in Section 9.0.

This section discusses:

- Remedial investigations;
- Site establishment and Preliminaries
- Removal of USTs and remediation of associated contamination
- Remediation and validation of additional contamination identified in the remedial investigations (if any)
- Remaining basement excavations and validation of Site
- Materials tracking
- Managing unexpected occurrences
- Validation methodology and reporting

12.0 Remedial Investigations

As discussed in Section 6.0, at this stage only limited sampling and analysis has been undertaken on the Site. Normally detailed investigations would be undertaken prior to preparation of a RAP. However, given that the development proposes to excavate a deep basement, it is considered that the main purpose of further sampling will be to waste classify soil and groundwater for offsite disposal and that this sampling can form part of the remedial action plan.

This section documents the requirements for a further sampling program to be undertaken prior to commencement of remediation and earthworks.

Prior to commencement of remediation and earthworks, soil and groundwater sampling and analysis will be undertaken by a suitably qualified environmental consultant with the objectives of providing further data on the extent of contamination associated with the identified contamination issues and the waste classification of soils for offsite disposal.

The investigations will include at a minimum:

- Soil sampling in the existing open air car park at the rear of the Site to assess the extent of the PAH hotspot that was identified in this area;
- Soil sampling in the former workshop area at 154 Victoria Road to check for potential chemical contamination in this area;
- Soil sampling across the Site to assess the contamination status and waste classification of fill material and other soil above bedrock;
- Installation of groundwater monitoring wells across the Site to assess the groundwater quality both internally within the Site and on the Site boundaries. At this stage it is anticipated that around 10 groundwater monitoring wells would be required. At least 2 groundwater wells should target the UST area in the front driveway of 154 Victoria Road;

Soil sampling may also be undertaken targeting the UST areas on the Site however given the shallow bedrock such investigations may be of limited use and it may be elected to undertake the UST remediation without prior soil sampling with the extent of contamination determined by chasing out contaminated soil following the UST removal.

Generally soil sampling would extend to the top of sandstone bedrock. Groundwater wells would be installed to screen in the sandstone bedrock.

Soil and groundwater samples will be tested for chemicals of concern identified in Table 2.

A sampling, analysis and quality plan (SAQP) for the remedial investigations will be completed prior to their implementation.

Given the access limitations on the Site posed by existing structures the complete remedial investigations would need to be undertaken following Site demolition. The proponent may elect to undertake some of the investigations in accessible areas ahead of Site demolition to assist in remedial planning.

Following completion of the remedial investigations this remedial action plan shall be reviewed and updated where required to take into account the findings of the investigations.

12.1 Site Establishment and Preliminaries

It is assumed that the majority of remediation activities will occur in conjunction with the basement excavations and following Site demolition.

This RAP therefore assumes that general Site establishment activities will have already been undertaken including establishment of Site security / fencing, Site sheds and amenities, traffic management controls, general health and safety and environmental controls, geotechnical design of excavations, dilapidation surveys of nearby structures etc along with demolition of structures and isolation of services on the Site.

It is further assumed that any shoring required to support the basement excavations will have been completed and hence remedial excavations would not require additional support.

Additional preliminary activities that may be required specifically for the remediation activities include:

- Setting up specific environmental and health and safety controls for the remedial works (see Section 13.0 for more detail);
- Development and implementation of a comprehensive materials tracking system to track all contaminated and clean soil and groundwater movement on and off the Site (see Section 12.6 more detail).

The proponent may elect to undertake some remedial activities ahead of Site demolition and /or earthworks. If this occurs then additional preliminaries required will be reassessed.

12.2 Removal of USTs and Associated Contamination

UST removal work should be carried out in accordance with the relevant procedures outlined in the following documents :

- The Australian Standard for the “Removal and Disposal of Underground Storage Tanks” (Ref: AS 4976-2008).
- WorkCover Requirements for “Abandoning Underground Tanks” (Ref: DG 310)
- Protection of the Environment Operations (Underground Petroleum Storage Systems) Regulation 2008.

Excavation and remediation/management of associated contaminated soil, if any, and subsequent validation of the excavations should be carried out in accordance with the NSW EPA (1994) Guidelines for Assessing Service Station Sites.

The known USTs are two in the front driveway of 154 Victoria Road (the former workshop Site) and one in the Leagues Club Loading Dock Area. Additional USTs could potentially be encountered during the works. From a technical standpoint, these would also be managed in accordance with the procedures in this section.

12.2.1 WorkCover Notification

WorkCover require notification of UST removal prior to commencement of work. A Notice of Intention to Commence Construction Work form (available from any WorkCover office) will be filled out and sent to WorkCover by the Contractor prior to commencement of work. WorkCover also require notification following completion of the UST removal.

12.2.2 Product Removal and Vapour Freeing of USTs

Prior to excavations around the USTs, petroleum product (if any) will be removed from the UST by a licensed liquid waste contractor using an air operated pump or other equipment suitable for a hazardous area and a suction hose, or spear, reaching to the bottom of the tank. The product will be pumped into a tanker and disposed of to an appropriately licensed facility for treatment and/or recycling. Dockets for liquid waste disposal must be supplied by the Contractor.

Also, prior to excavations around the UST, the UST will be vapour freed. Typical procedures for vapour freeing are presented in Appendix B of AS 4976.

12.2.3 UST Removal

Concrete or asphalt pavement is to be removed above the UST and along the paths of UST pipework. All redundant pipework will then be drained, disconnected and removed, along with any tank mounted equipment, and all openings (including the vent) plugged. One plug should have a 3mm hole to act as a pressure equalising vent.

The excavation should then be completed to expose the total width and length of the tank, and concrete anchors, if present, should be removed. Care should be taken to prevent the excavator striking the tank in any way. On no account should the excavator be used to punch holes in the tanks.

As soon as the tank is clear of the excavation, scrape off all loose soil and inspect the shell of the tank for defects. The operator shall remain clear of the tank. Cold patch or plug any holes prior to loading the tank onto the transport vehicle.

Once exhumed, the condition of the UST will also be observed by the environmental engineer / scientist, who will assess the UST for rust or any holes and hence assessing the likelihood of product having leaked from the tank.

The work should be planned so that as soon as the tank is fully exposed, it is immediately removed from the excavation and transported offsite as soon as practicable. The UST should be disposed to an approved facility for destruction. Destruction certificates must be provided by the Contractor.

12.2.4 Excavation of Contaminated Soil around the UST (if any)

At this stage, the extent of contaminated soil around the USTs and associated pipework is not known.

The UST excavation will be extended until visual, olfactory and PID observations by the environmental engineer / scientist indicates that the contaminated soil is likely to have been removed to the extent practicable.

Excavated soil will be temporarily stockpiled on a designated temporary stockpiling area.

An appropriately experienced environmental engineer / scientist will be present onsite full time to guide the excavation activities.

If the contamination is found to extend close to or under adjacent structures or the Site boundary, making excavation of all contaminated soil impracticable, then other remedial strategies may be considered for that portion of the contamination.

Remedial excavations must be maintained safely until validation results are received and excavations are either backfilled or bulk earthworks in this area commences.

12.2.5 Management of Contaminated Soil Excavated from Around UST

Contaminated soil from the UST excavations will be disposed of offsite in accordance with the NSW DECC Waste Classification Guidelines.

The material will be temporarily stockpiled (in accordance with procedures in Section 13.0) and representative samples will be collected from the stockpiles for laboratory analysis to assess the waste classification of the material. The soil will then be disposed of to a suitably licensed landfill in accordance with the classification.

If the classification of some or all of the contaminated soil exceeds the general solid waste classification criteria then the material may be treated onsite by enhanced bioremediation to a level where it could be disposed as general solid waste. This would likely only be considered if soil classifying as hazardous waste or relatively extensive volumes of contaminated soil exceeding the

general solid waste criteria is encountered around a UST. Should such treatment be proposed then an addendum to this RAP would be proposed discussing the methodology.

12.2.6 Validation Associated with UST Remediation

The validation work will entail collecting soil samples for laboratory testing when it is judged in the field that all material requiring remediation has been removed from around the USTs. Visual checks will also be made in the excavations for potential preferred migration pathways such as bedding planes or joints in the sandstone bedrock or underground service trenches.

The validation work at the UST area will be undertaken in accordance with the guidelines presented in NSW EPA (1994) *Guidelines for Assessing Service Station Sites*. Validation soil samples will be collected from each wall and floor of each UST excavation as well as from beneath the pipework to assess the extent of removal of hydrocarbon impacted soil. The number of validation samples will be decided based on the size of each excavation.

At this stage, the validation sampling rate will be as follows:

- 1 sample per 25m^2 on the base of each excavation (minimum one per base);
- 1 sample per 10m length of each wall of each excavation (minimum one per wall);
- Potentially additional samples targeting preferred migration pathways on the walls or base of the excavation (if identified);
- 1 sample per 10m length of pipework (minimum one per pipe);
- 1 sample beneath any bowser stands identified.

At this stage, the soil samples will be tested for TPH, BTEX and lead. In addition, 25% of samples will also be tested for PAHs and VOCs.

The UST excavations should be left open in a safe condition until validation results indicate the excavations have been appropriately remediated and validated.

Depending on the extent (vertical and lateral) of contamination identified in the UST excavations observations of the ground conditions on the UST excavations including whether groundwater is present in the UST excavations, the need for groundwater validation will be assessed. Groundwater validation may comprise collecting grab samples from groundwater in the UST excavations (if present) and/or groundwater monitoring from monitoring wells.

It is noted that the basement excavations are likely to extend well below the base of the UST remedial excavation and therefore the validation samples will be more for waste classification purposes than for site validation.

12.2.7 Contingency in Event Contamination Associated with USTs Extends Beyond Site Boundary

Given the proximity of the USTs in the former workshop area to the Site boundary, it is possible that associated petroleum hydrocarbon contamination could extend beyond the Site boundaries onto Victoria Road.

Excavation beyond the Site boundary is unlikely to be practicable due to the presence of underground services and the disruptions this would cause to traffic on Victoria Road. For this reason, in the event that contamination was encountered extending beyond the Site boundary alternate remediation options would be considered for the offsite contamination.

In the event that contamination was encountered extending beyond the Site boundary, initially the extent and significance would be assessed along with the need for further remediation / management through monitoring and potentially fate and transport assessment / risk assessment.

In the event that offsite impacts were identified and were found to be significant warranting further action, remediation / management options would be assessed options would be assessed and an addendum to this remedial action plan would be prepared documenting the preferred remediation strategy.

It would be expected that following removal of the primary contamination sources (the USTs) and the secondary source of contamination (surrounding soil and groundwater contamination) there would be an improvement in residual contamination conditions over time through a natural attenuation process. An assessment would be made as to whether such natural attenuation by itself would be adequate to address the risk from residual offsite impacts.

There are also a range of other in-situ remediation technologies that may be suitable including, but not limited to monitored natural attenuation, in-situ enhanced biodegradation, oxidant injection, oxidising agent injection, air sparging, pump and treat, and these would also be considered in the remediation options review.

The potential for contamination to be drawn back into the basement excavation on the Site will also need to be considered.

12.2.8 Backfilling of Excavation (if required)

Backfilling of the excavation would only be required if the UST remediation was undertaken significantly ahead of Site earthworks activities.

If backfilling of the excavation is required it should be undertaken with soil validated as virgin excavated natural material as defined in the NSW DECC (2008) Waste Classification Guidelines.

12.3 Remediation and Validation of Additional Contamination Identified in the Remedial Investigations (if any)

Should areas of contamination be identified during the remedial excavations that do not classify as General Solid Waste and/or require alternate excavation methodologies (such as enhanced health and safety controls) then excavation of this material may be undertaken ahead of bulk earthworks.

Excavation of the material will be undertaken and will extend to the pre-determined extent of contamination and /or until visual, olfactory and PID (if volatile contamination) observations by the environmental engineer / scientist indicates that the contaminated soil is likely to have been removed to the extent practicable.

An appropriately experienced environmental engineer / scientist will be present onsite to guide the excavation activities.

Excavations must be maintained safely until validation results are received and excavations are backfilled.

Contaminated soil from the excavations will be disposed of offsite in accordance with the NSW DECC (2008) Waste Classification Guidelines.

The material will be temporarily stockpiled (in accordance with procedures in Section 13.0) and representative samples will be collected from the stockpiles for laboratory analysis to assess the waste classification of the material. Alternatively the material could potentially be classified based on pre-excavation in-situ sampling results. The soil will then be disposed of to a suitably licensed landfill in accordance with the classification.

In the event that soil is identified that exceeds the restricted solid waste criteria (i.e. classifies as hazardous waste) then that soil would need to be pre-treated prior to be disposed to landfill. Such pre-treatment could either occur onsite or could occur at a suitably licensed offsite treatment facility. In the

event hazardous waste was encountered and onsite pre-treatment was proposed then an addendum to this remedial action plan would be prepared. Note that if the pre-excavation sampling results indicate the material is likely to classify as hazardous waste then the addendum to the RAP should be prepared prior to excavation of this portion of soil.

When it is judged in the field that all material requiring remediation in a particular area has been removed, validation samples will be collected for laboratory testing. Visual checks will also be made in the excavations for potential preferred migration pathways such as bedding planes or joints in the sandstone bedrock or underground service trenches.

Validation soil samples will be collected from the wall and floor of each excavation. The number of validation samples will be decided based on the size of each excavation.

At this stage, the validation sampling rate will be as follows:

- 1 sample per 25m^2 on the base of each excavation (minimum one per base);
- 1 sample per 10m length of each wall of each excavation (minimum one per wall);
- Potentially additional samples targeting preferred migration pathways on the walls or base of the excavation (if identified);

The validation samples will be tested for the chemicals of concern for the specific area being remediated.

The excavations should be left open in a safe condition until validation results indicate the excavations have been appropriately remediated and validated.

Backfilling of the excavation would only be required if the remediation was undertaken significantly ahead of Site earthworks activities. If backfilling of the excavation is required it should be undertaken with soil validated as virgin excavated natural material as defined in the NSW DECC (2008) Waste Classification Guidelines.

12.4 Remaining Basement Excavation and Validation of Site

The anticipated Site geology is a shallow layer of fill material, overlying a thin layer of residual soils in turn overlying sandstone bedrock. The fill and residual soil layers are anticipated to be in the order of 2m to 3m thick meaning the majority of the 15m to 20m deep basement excavation is likely to be in sandstone bedrock.

Providing the identified contamination discussed in the previous sections has already been removed the remaining fill would be expected to mainly classify as 'General Solid Waste' although there could be areas of higher waste not identified by the remedial investigations remaining within the fill.

Residual soil (where present) underlying the fill could potentially classify as VENM although there may be some or even a large portion of the residual soil that could classify as General Solid Waste (or higher) as a result of mixing with or leaching from overlying fill material or contamination from past activities on the Site.

The majority of sandstone bedrock (which will form the bulk of the excavated material) would be expected to classify as VENM although there could potentially be some portions of the sandstone that would not meet the VENM criteria as a result of contamination seepage into the sandstone (e.g. potentially around the USTs or if chemical spillage / leakage had occurred elsewhere on the Site).

A carefully planned and implemented excavation program is essential to ensure that excavated material is appropriately classified and that the portion of material able to be classified as VENM is maximised.

Materials will be provided an interim waste classification based on the results of the remedial investigations and any validation results obtained following remedial excavations (described in the previous sections).

This will be supplemented by an inspection and testing program during excavations to confirm the classifications of soil and bedrock. A detailed inspection and test plan will be prepared prior to commencement of bulk earthworks.

Should any evidence of contamination hotspots be identified during the excavations, excavations in that part of the Site will temporarily cease and the potentially impacted material will be dealt with in accordance with the procedures in the previous sections.

Initially the fill material across the Site, which would not, by definition, classify as VENM and has the greater potential to contain contamination hotspots would be excavated, classified and disposed offsite.

Following the removal of the fill material, a visual assessment of the underlying residual soil will be made to assess whether there is any remaining visual / olfactory evidence of non virgin or contaminated material remaining. Excavations will then continue to remove any non-VENM soil from the Site.

Once visual assessment indicates that remaining soil is consistent with VENM, the remaining soil will be sampled to confirm the VENM classification (i.e. that there are only background concentrations of contaminants in the remaining material). This sampling may also be used for Site validation.

Once remaining material has been assessed through the above procedure to classify as VENM then excavation and offsite disposal of the material as VENM can proceed. However an inspection program must continue to be implemented and in the event evidence of non-VENM material is identified, work in that part of the excavation should temporarily cease, while the material is assessed by the environmental consultant.

Once the basement excavation is complete an inspection will be undertaken by the environmental consultant to confirm that there is no evidence of contamination remaining on the base of the excavation. This inspection in conjunction with the various inspections and testing during the remediation and basement excavations will be used to confirm the validation of the Site.

12.5 Managing of Dewatered Groundwater

Dewatering of groundwater will be required during basement excavations. The dewatered groundwater will require disposal. The groundwater will be required to be tested to assess its quality.

Depending on the outcomes of the testing potential options during basement excavation for disposal of dewatered groundwater may include:

- direct discharge to stormwater;
- discharge to stormwater after treatment;
- discharge to sewer after obtaining a trade waste permit from Sydney Water; and
- disposal to a suitably licensed water treatment plant.

Depending on the basement design there may be some seepage of groundwater in the basement post construction. The seepage water will be required to be tested to assess its quality. Again depending on the quality, potential options post basement construction for disposal of groundwater seeping into the basement (and collected in a sump) may include:

- direct discharge to stormwater;
- discharge to stormwater after treatment;
- disposal to a suitably licensed water treatment plant.

Disposal to sewer is generally not available as an option post construction.

An alternate option may be to tank the basement to prevent inflow of groundwater, although it is understood that this is not proposed on this site.

In the event that groundwater seeping into the basement was found to contain volatile contaminants then further assessment of potential risks to site users from vapour generation would also be required.

12.6 Materials Tracking

It is important that the movement of contaminated, clean and treated soils and groundwater on and off the Site be tracked. To this end a materials tracking system should be designed and implemented for the remediation works and any other works involving disturbance of soil or water.

The movement of materials across the Site will need to be documented on a daily basis. This will be undertaken using plans of the Site marked up daily. These daily materials tracking plans will show all relevant feature of the Site including all excavations, validated areas, treatment areas, stockpiles, holding tanks for water etc as well as indicating any movement of material within onto or off the Site. Appropriate tracking forms should also be developed and completed for materials movements.

12.7 Validation Reporting

A Site remediation and validation report will be prepared at the completion of remediation.

The report will be prepared in accordance with the relevant sections of the NSW EPA (1997) Guidelines for Consultants Reporting on Contaminated Sites and the NSW DEC (2006) Guidelines for the NSW Site Auditor Scheme.

Interim validation reports may be prepared for aspects of the remediation as the remediation progresses. These would then be incorporated into the final validation report.

13.0 Site Management Plan

A site management plan for the remediation will be prepared prior to commencement of remediation works.

The objectives of the site management plan will be to:

- Protect the health of Site workers and the general public during the remediation works and comply with applicable health and safety legislation; and
- Ensure the works do not negatively impact on potential environmental receptors and comply with applicable environmental legislation.

The site management plan is required to be in accordance with Leichhardt Council DCP 42 and a copy is required to be onsite at all times during the remediation. Table 4 lists some of the key environmental and health and safety hazards (specifically related to the remediation works) and potential control measures to manage these hazards.

Note the information provided in this table is a guide only. The contractor is required to undertake environmental and safety hazard identification and risk assessment and develop an appropriate site management plan to manage these hazards / risks prior to commencement of work.

Table 4: **Summary of Key Environmental and Health and Safety Hazards and Potential Controls**

Environmental / OH&S Hazard	Proposed Control Measures
Site access and security	Only approved persons will be allowed to enter the Site and remediation areas. Site fencing will be erected with appropriate warning signs.
Air Quality - Vapours / odours generated from the remediation	Odour and vapour levels to be monitored during the remediation. In accordance with Council DCP 42, controls will be put in place to reduce the potential for odours to be detected at the Site boundary during remediation works. The following procedures may be employed to comply with this requirement: • use of appropriate covering techniques such as the use of plastic sheeting to cover excavation faces or stockpiles; • use of fine mist sprays and hydrocarbon mitigating agent on the impacted areas/materials; and • adequate maintenance of equipment and machinery to minimise exhaust emissions. If odours are detected the Site is to be inspected by a recognised environmental consultant and any recommended control measures are to be implemented throughout the remediation process. Records of volatile emissions and odours should be logged, kept on-Site and made available to Council Officers on request. No material will be burnt on-Site.
Air Quality - Dust	Dust management measures will be implemented aiming to confine dust within the Site boundary and may include: • erection of dust screens around the perimeter of the Site / remediation / excavation areas; • securely covering all loads entering and exiting the Site; • use of water sprays across the Site and on exposed soil; • cessation of operations that may generate dust during periods of high winds; • covering of stockpiles of contaminated soil when not in use and minimising periods of stockpiling; • keeping excavation surfaces moist; and • dust monitoring. In the event, complaints are received or if directed by Council, dust monitoring will be carried out by an environmental consultant. Control measures as recommended by an environmental consultant will be implemented throughout the remediation process.
Air Quality - Asbestos	Where materials containing asbestos are being handled or are exposed, works would be supervised by an asbestos contractor licensed by WorkCover and undertaken in accordance with WorkCover guidelines for handling with asbestos. Some key controls for such works are likely to include: • an exclusion zone to be set up around the area where the works will be taking place with warning signs; • supervision of works by licensed asbestos contractor; • wearing of appropriate additional PPE such as a suitable respirator, disposable overalls, steel capped boots and gloves removed in a decontamination area prior to leaving the asbestos impacted zone; • minimisation of dust generation in accordance with measures implemented for dust control; and • air monitoring for airborne asbestos fibres for the duration of the works

Environmental / OH&S Hazard	Proposed Control Measures
Air Quality - Emissions from vehicles and plant	Plant and vehicles involved in the remediation will be properly maintained to ensure their emissions comply with applicable guidelines. Vehicles and plant will be turned off when not in use.
Surface water and sediment	The contractor will put in place adequate stormwater runoff, run-on and sediment control measures for the remedial works to avoid sediment discharge to the stormwater system. It is considered that the following control measures may be required: • Placement of silt fencing and straw bales down-gradient of the work areas to intersect sediments and reduce the risks of erosion. • Installing measures to divert clean stormwater away from exposed contaminated soil. • Stop works during heavy rain events. • Surface of stockpiles should be covered with polythene sheets or tarpaulins weighted with heavy objects when not in use. • Soil stockpiles should be appropriately bunded to prevent spreading of contamination. The Contractor should install these control measures in accordance with the guidelines stated in Managing Urban Stormwater – Soils and Construction (NSW Department of Housing, 1998). All remediation areas shall be bunded to contain surface water runoff from the remediation areas and to prevent the leaching of contaminants into the subsurface. All surface water discharges from the bunded areas to Council's stormwater system shall not exceed the threshold concentrations specified in the NSW DECCW Guidelines.
Soil stockpiles	Stockpiles will be located in designated areas. No stockpiles of soil or other materials shall be placed on footpaths or nature strips unless prior Council approval has been obtained. To reduce dust and stormwater issues, the period and volume of stockpiling should be minimised. Stockpiles require the following or similar measures: • All stockpiles of soil or other materials shall be placed within an erosion containment boundary away from drainage lines, gutters or stormwater pits or inlets. • Polythene sheets or similar to be placed beneath stockpiles, or stockpiles will be established on paved or hardstand areas. • Covering of stockpiles with membranes (polythene sheets or tarpaulins weighted with heavy objects), surface binding agents, spray grass or similar when not in use. • Appropriate bunding of stockpiles to prevent spreading of contamination. • Placement of silt fencing and straw bales downslope of the stockpile area to intersect sediments.

Environmental / OH&S Hazard	Proposed Control Measures
Transport and disposal of contaminated soil	Contaminated soil must be classified prior to disposal in accordance with NSW DECC (2008) Waste Classification Guidelines. Disposal of contaminated soil must meet the following requirements: • Contaminated soil is be trucked in accordance with NSW DECCW requirements. • Trucks used to transport contaminated fill shall meet the NSW DECCW licensing requirements for the waste transported. • Trucks used to transport contaminated fill must have a suitable covering for the load. • The wheels and exterior of the vehicles must been cleaned down prior to leaving Site. • Truck movements shall be along designated transport corridors approved by Council. • A copy of the landfill's weigh-bridge docket for each load delivered will be forwarded to the environmental consultant. • Drivers code of conduct to be developed and signed by all truck drivers.
Designation, delineation and control of access to various work zones	Appropriate work zones should be set up and maintained for the remedial works for the purposes of containing and controlling the potential transfer of contaminated soil and managing health and safety of workers and the general public during the remedial works. Some examples of zones that are likely to be required include: • Remediation zones – these would be set up for various remedial works across the Site. Only people who are necessary for undertaking the work should enter these zones; • Decontamination Zone – should be attached to each remediation zone. At the completion of the work, personnel and equipment used in remediation are to be decontaminated within the Decontamination Zone; • Validated Zones – area where remediation and validation has been completed. Controls required to be implemented to ensure that the areas do not become recontaminated (e.g. by tracking contaminated soil through such zones etc); • General Construction Zones – Areas where normal construction protocols apply and no specific remediation protocols are required.
Hazardous materials (including fuel and chemical management)	Hazardous material storage onsite should be minimised. Any hazardous materials should be stored in accordance with appropriate environmental and health and safety regulations. Refuel plant and equipment using mobile tanker in a designated area with appropriate environmental controls / bunding. Make available "spill kits" onsite. Clean up spillage as soon as practicable using spill kits.

Environmental / OH&S Hazard	Proposed Control Measures
Noise and vibration	No offensive noise as defined under the Protection of the Environment Operations Act (1997) (POEO) should be created during the remediation works. For construction and demolition periods of 4 weeks or less the L10 level, measured over a period of 15 minutes when the construction or demolition site is in operation, must not exceed the background level by more than 20dB(A). For construction and demolition periods greater than 4 weeks and not exceeding 26 weeks the L10 level, measured over a period of 15 minutes 31 when the construction or demolition site is in operation, must not exceed the background level by more than 10 dB(A). For construction and demolition periods exceeding 26 weeks the L10 level, measured over a period of 15 minutes when the construction or demolition site is in operation, must not exceed the background level by more than 5dB(A). All equipment and machinery shall be operated in an efficient manner to minimise the emission of noise. In the event that complaints are received or if directed by Council, noise monitoring should be carried out by a recognised acoustic consultant. Noise control measures as recommended by the acoustic consultant should be implemented throughout the remediation process. Vibration emissions during remediation works must not result in damage to near-by premises or results in an unreasonable loss of amenity to nearby residents. The relevant provisions of the POEO Act must be satisfied at all times. Specific vibration controls will be set in vicinity of heritage structures. In the event that complaints are received or if directed by Council, vibration monitoring will be carried out by a recognised vibration consultant. Vibration control measures as recommended by the vibration consultant will be implemented throughout the remediation process. Hours of operation will be in accordance with conditions of approval.
Traffic management	Traffic management during the remediation would be in accordance with the overall project traffic management plan.
Groundwater Management	Groundwater management during the remedial works is discussed in detail earlier in this RAP.
Excavation pump-out	All excavation pump-out water must be analysed for suspended solid concentrations, pH and any contaminants of concern prior to discharge to the stormwater system. The analytical results must comply with relevant DECCW and ANZECC standards for water quality. Other options for the disposal of excavation pump-out water include disposal to sewer with prior approval from Sydney Water, or off-site disposal by a liquid waste transporter for treatment/disposal to an appropriate waste treatment/processing facility.
Waste management	Appropriate waste disposal bins will be established as part of Site mobilisation, which shall be maintained onsite for the duration of the remedial works. The waste disposal bins shall be emptied as necessary to avoid overflowing, and the contents disposed of to a waste disposal facility approved for the relevant waste type. Recycling will be undertaken where possible.

Environmental / OH&S Hazard	Proposed Control Measures
Tracking of contamination on truck /plant wheels	Truck / plant movements on the Site should be managed to avoid contact with contaminated soil, where possible. A truck wash / cleaning area should be set up at the exit point to the Site. The trucks shall be visually assessed prior to leaving the Site and any accumulated soil on the wheels should be removed. Trucks should also be decontaminated before leaving any remediation zone. Vehicle access to the Site shall be stabilised to prevent the tracking of sediment onto roads and footpaths. Soil, earth, mud or similar materials must be removed from the roadway by sweeping, shovelling or a means other than washing, on a daily basis as required. Soil washings from wheels should be collected and disposed of in a manner than does not pollute waters.
Material tracking and documentation	A comprehensive materials tracking system will be developed to track all contaminated and clean soil and groundwater movement on and off the Site.
Occupational health and safety	A Site Specific Health and Safety Plan (SSHSP) shall be prepared prior to the commencement of the work in accordance with the relevant legislation. Potential hazards specific to the remediation works (i.e. not hazards that would be commonly encountered on construction projects) include, but are not necessarily limited to: • dermal contact or ingestion of contaminated soil or groundwater; • inhalation of contaminated respirable dust (including potentially asbestos contaminated dust); • inhalation of contaminated vapours; and • explosion hazard during removal of USTs. Some control measures that could be implemented for work resulting in disturbance or exposure of contaminated soils could include: • Appropriate personal protective equipment (PPE) could include long sleeve clothes, chemical resistant gloves and P2 dust masks (or half face respirators with particulate filters). Half face respirators with organic vapour filters may be required if significant odours or vapours are being generated. Safety glasses may be required if there is a risk of soil or water contact with the eyes. Other personal protective equipment such as safety boots, hard hats etc, required for protection against physical hazards, should be used for all construction related activities; • Decontamination before leaving the remediation enclosure. • No eating, drinking, chewing gum or tobacco, smoking or any practice that involves hand to mouth transfer increases the probability of ingestion of foreign matter into the body. • Personnel should ensure that hands are thoroughly washed before eating, drinking or smoking with an appropriate sanitizers (such as Chlorohexidine). • Any clothing that becomes dirty from onsite work should be disposed of or washed separately from other clothes. The hazards and control measures should be reviewed when preparing the SSHSP. UST removal works should be undertaken by an experienced contractor and in accordance with the Australian Standard methodologies.
Community consultation	A community relations plan is required to be developed. This is further discussed in Section 18.0.

Environmental / OH&S Hazard	Proposed Control Measures
Inductions and awareness of personnel accessing the Site during remediation	A Site induction process will be documented and implemented, including access to the Site, emergency response, emergency muster point, occupational health and safety and environmental management. All personnel accessing the Site must complete the Site induction. Records of the Site inductions should be maintained.
Monitoring requirements	The Site Management Plan will include a monitoring plan. Some monitoring requirements are likely to include: • regular visual monitoring to check environmental and safety controls are in place and effective; • regular visual monitoring for dust generation and dust monitoring; • observations of odours during the works on the Site and onsite boundaries; • monitoring using a PID for volatile compounds in the breathing zone for workers as well as on site boundaries. The action limits should be set based on the response factor of the PID to contaminants of concern on the Site; • monitoring for specific compounds using Draeger tubes or similar (if required); • noise monitoring (in conjunction with Site wide noise monitoring); and • monitoring for airborne asbestos fibres (if asbestos is present).
Contingency management	The site management plan will include a contingency plan for the environmental and health and safety controls.

14.0 Remediation Schedule and Hours of Operation

Council DCP 42 requires all remediation work be carried out only between the hours of 7.00am and 6.00pm Monday to Friday inclusive and between 8.00am and 5.00pm on Saturdays. No work shall be carried out on Sundays and public holidays.

The hours of operation will be consistent with the requirements imposed by Council's policy and by the approved development consent conditions.

Due to restrictions imposed by existing Site structures, the remediation is proposed to be undertaken following Site demolition.

The majority of remedial activities will be undertaken in conjunction with or just ahead of Site bulk earthworks.

The proponent may desire to bring some remediation activities forward. If this is proposed then Council will be provided at least 30 days prior notification in accordance with the requirements of SEPP55.

15.0 Contingency Plan

Table 5 lists some potential events that may arise during or following the remediation and actions that will be undertaken if such unexpected conditions occur. The Contractor is to assess other potential events that could occur (if any) and identify contingency measures prior to commencement of remediation.

Table 5: **Contingency Items**

Event	Action
1. Proposed development plans change	Review the applicability of this RAP to the revised development plans. This would have the greatest potential to affect the remedial strategy if the basements excavations were modified to cover less of the Site or to be shallower.
2. Contamination is found to extend below proposed basement depth (considered to be highly unlikely)	Review of the remediation strategy will be undertaken. Possible responses could include: further excavation, treatment and offsite disposal of soils; risk assessment; further delineation sampling / monitoring; onsite containment of a portion of the soil etc.
3. Soil classifying as hazardous waste is identified	In the event that soil is identified that exceeds the restricted solid waste criteria (i.e. classifies as hazardous waste) then that soil would need to be treated prior to be disposed to landfill. Such pre-treatment could either occur onsite or could occur at a suitably licensed offsite treatment facility. In the event hazardous waste was encountered and onsite pre-treatment was proposed then an addendum to this remedial action plan would be prepared.
4. Identification of asbestos impacted materials	Engage a WorkCover licensed asbestos contractor to supervise works involving handling of the impacted material. Enhance environmental and health and safety controls / monitoring as required to comply with WorkCover guidelines relating to asbestos. For soil classifying as general or restricted solid waste dispose to suitably licensed landfill as asbestos waste. For soil classifying as hazardous waste pre-treatment still required. Consider asbestos when selecting treatment process (noting for example that high energy mixing of asbestos impacted soils in a pug mill could potentially result in liberation of asbestos fibres into the treated soil)
5. Contamination is found to have migrated offsite	See Section 12.2.7 of this RAP
6. Underground cables or pipes containing unknown product or substance identified	Stop work temporarily, identify product / substance (through sampling), determine extent and origin of subject pipe, develop remediation and or material handling protocol dependant on product or substance.
7. Validation samples fail criteria.	Excavate additional soil / rock and revalidate that area or assess other potential remediation or validation options.
8. Environmental and / or OHS Controls Fail or environmental or OHS monitoring indicates potential hazards	Environmental and OHS contingencies are to be presented in the Site Management Plan

Event	Action
9. Identification of unexpected contaminated materials or contamination sources	If during the remediation works, material is encountered which appears to be potentially contaminated and appears to be different from the contamination described in this RAP, or point sources of contamination such as underground storage tanks which were not expected to be present are encountered, the following procedures should apply: • Any suspicious material/soil which has been excavated should be stockpiled on bunded, strong, impermeable plastic sheeting, protected from erosion and all seepage retained. • Excavation works at that part of the Site where the suspicious material (soil) was encountered should cease until inspection is carried out by the environmental consultant. • Based on visual inspection, the environmental consultant should provide interim advice on construction health and safety, soil storage and soil disposal to allow construction to proceed if possible. • Based on sampling and analysis of the material, the environmental consultant should provide final advice, based on comparison of the laboratory test results to suitable criteria relating to human health, potential environmental impacts and waste disposal. In the context of the above, “suspicious” material may include underground storage tanks, odorous material, fibrous material, brightly coloured material, tarry or ashy material, drums, or metal / plastic chemical containers etc.
10. Other	Any other unexpected events which may affect the outcome of the investigation should be notified to the environmental consultant. At that time potential actions to address the unexpected event will be assessed and presented.

16.0 Identification of Regulatory Compliance Requirements

This section discusses some of the regulatory compliance requirements associated with the remediation. It is important to note that this section is not exhaustive and the Contractor must ensure that they comply with all applicable legislation and guidelines etc.

During the course of the project, the Contractor will comply with all relevant applicable environmental regulatory and legislative requirements. The following list includes some State legislation that may be relevant to the remediation activities:

- Contaminated Land Management Act 1997;
- Environmental Planning and Assessment Act 1979 (Department of Planning) (EP&A);
- Protection of the Environment Operations Act 1997;
- Waste Avoidance and Resource Recovery Act 2001;
- OHS Act 2000 and OHS Regs 2001; and
- UPSS Regulation (2008).

The remedial work should be carried out in accordance with SEPP55 and appropriate NSW DECCW guidelines.

It is considered that the remediation classifies as Category 2 remediation in accordance with SEPP55 as the remediation / development does not meet any of the criteria for Category 1 remediation, namely:

- The development is not designated development under Schedule 3 of the EP&A Regulation or under a planning instrument.
- The remediation is not on proposed on land identified as critical habitat under the Threatened Species Conservation Act 1995.
- Consideration of s. 5A of the EP&A Act does not indicate the remediation work is likely to have a significant effect on threatened species, populations, ecological communities or their habitats.
- The remediation is not proposed in an area or zone identified in a planning instrument as being an area of environmental significance such as scenic areas, wetlands.
- The remediation does not require consent under another SEPP or a regional environmental plan.
- The proposed remediation is consistent with Council's Contaminated Land Policy.

Category 2 remediation requires written notification to Council a minimum of 30 days prior to commencement.

Prior approval from a licensed disposal facility will be required prior to removal of contaminated soil or liquid from the Site. Soil or liquids disposed from the Site must be classified in accordance with the NSW DECC (2008) *Waste Classification Guidelines*.

A licensed Contractor is required to pump liquids from the USTs. USTs must be disposed to an approved facility.

WorkCover require notification of UST removal prior to commencement of work. The form Notice of Intention to Commence Construction Work (available from any WorkCover office) must be filled out and sent to WorkCover before UST removal work begins. WorkCover also require notification following completion of UST removal.

The UPPS Regulation (2008) requires that underground storage tank decommissioning requires approval from the local authority and that a validation report be supplied to indicate suitable remediation has occurred.

Handling (including excavation) of any materials containing asbestos containing materials and removal of any asbestos from the Site will need to be undertaken by an AS1 licensed contractor in accordance with WorkCover regulations and guidelines. A WorkCover permit would be required for any works involving handling of asbestos.

17.0 Contacts during the Remediation

Contacts during the remediation should be confirmed prior to commencement of remediation.

18.0 Community Relation Plans

A community relations plan should be prepared for the overall development to cover remediation activities.

In accordance with DCP42, owners and/or occupants of premises adjoining, and across the road, from the Site should be notified at least two days prior to the commencement of remediation works.

19.0 Staged Progress Reporting

Refer to Section 12.7.

20.0 Long Term Site Management Plan

As practically the entire Site is proposed to be excavated down to greater than 15 m depth it is anticipated that all contamination will be removed from the Site.

Therefore, a long term site management plan is not expected to be required.

In the event that during remediation it becomes apparent that a long term site management plan is required then such a plan should be prepared by the environmental consultant.

21.0 Conclusions and Recommendations

Based on the previous investigations remediation will potentially be required to address:

1) Fuel USTs and associated petroleum hydrocarbon contamination (if any) in the front driveway of 154 Victoria Road (the former workshop site).
2) Potential petroleum hydrocarbon contamination associated with chemical storage or use in other parts of 154 Victoria Road during previous use of this area as a mechanical workshop.
3) Fuel oil / diesel UST and associated potential petroleum hydrocarbon contamination (if any) in the Leagues Club Loading dock Area.
4) PAH contamination that was previously detected in one shallow soil sample in the open air car park at the rear of the Site.
5) Fill material across the Site which may be variably contaminated.
6) Potential contamination hotspots across the Site resulting from past chemical storage or usage prior to development of the Site as a Leagues Club (if any).
7) Potential contamination hotspots resulting from introduction of hazardous building materials (e.g. fibro asbestos, lead paint) to soil through past weathering from or demolition of former buildings on the Site.

Given the proposed depth of the basement, the act of excavation (including dewatering) would effectively constitute an excavation and offsite disposal remedial strategy and should result in remediation of the Site so that it is suitable for the proposed land use.

There is the potential for some localised offsite impacts from the fuel USTs in the front driveway of 154 Victoria Road, close to the Site boundary. Contingency actions have been included in this RAP covering the event that such offsite impacts are identified.

This remedial action plan documents the remediation and validation strategy to address contamination on the Site including a requirement to further delineate the extent of contamination and provision of contingency measures for various scenarios that could arise during the remediation.

It is considered that following full implementation of this RAP the Site will be suitable for the proposed mixed use development.

22.0 Limitations

Site characterisation for this RAP has been based upon the Stage 1 ESA previously undertaken by AECOM supplemented by limited sampling and analysis results (by EIS 2005). Given the deep basement this is considered adequate for the preparation of this RAP. However, it is important to note that sampling and testing, which has been proposed in this RAP in the form of 'Remedial Investigations' is required to check the presence or absence of contamination.

It is the nature of contaminated site investigations that the degree of variability in site conditions cannot be known completely and no investigation program can eliminate all uncertainty concerning the condition of the Site. Professional judgement must be exercised in the collection and interpretation of the data.

In conducting this review and preparing the report, current guidelines for assessment and management of contaminated land were followed. This work has been conducted in good faith in accordance with AECOM's understanding of the client's brief and general accepted practice for environmental consulting.

The assessment was based on the condition of the Site and proposed development plans at the time of the assessment.

Assessment of buildings / structures on the Site for the presence of hazardous buildings materials and management of such materials was outside the scope of this report.

23.0 References

City Plan Heritage (2005). *Balmain Leagues Club Masterplan, Heritage Assessment* (Ref: 25158, October 2005).

EIS (2005). *Phase 1 Preliminary Environmental Site Screening for Proposed Balmain Leagues Club Redevelopment at 138-152 Victoria Road, Rozelle'* (Ref: E19319FK-RPT, April 2005)

National Environment Protection Council (NEPC) 1999. *National Environmental Protection Measure (Assessment of Site Contamination)*.

NSW Department of Environment and Conservation (DEC) 2006. *Guidelines for the NSW Site Auditor Scheme (2nd Edition)* April 2006.

NSW DECC (2008) *Waste Classification Guidelines*

NSW Environment Protection Authority (EPA) 1997. *Guidelines for Consultants Reporting on Contaminated Sites*, November 1997.

Appendix A Site Survey