Douglas Partners
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Integrated Practical Solutions

Report on
Contamination Management Plan

Western Sydney Cricket and Community Centre
Wilson Park, 4 Newington Road, Silverwater

Prepared for
Cox Architecture Pty Ltd

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	Signature	Date
Author	pp: J. Bearer	23 October 2019
Reviewer	pp:	23 October 2019

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Douglas Partners Pty Ltd
ABN 75 053 980 117
www.douglaspartners.com.au
96 Hermitage Road
West Ryde NSW 2114
PO Box 472
West Ryde NSW 1685
Phone (02) 9809 0666

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Contamination Management Plan
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1. Introduction

Douglas Partners Pty Ltd (DP) was commissioned by Cox Architecture Pty Ltd on behalf of NSW Cricket Association to prepare this Contamination Management Plan (CMP) for the proposed Western Sydney Cricket and Community Centre development at 4 Newington Road, Silverwater (the "site" as shown on Drawing 1, Appendix A).

The site (as part of the overall Wilson Park) is one of ten engineered remediated landfill areas managed by Sydney Olympic Park Authority (SOPA), and is subject to a 'maintenance of remediation notice' issued by the NSW EPA under Section 26 of the *Contaminated Lands Management Act 1997* (CLM Act).

This CMP has been prepared with reference to the *Remediated Lands Management Plan* (RLMP) prepared by SOPA dated January 2009 (SOPA, 2009), a document which describes how SOPA will manage their remediated landfills and their infrastructure within Sydney Olympic Park (SOP), with the overall objective to ensure that containment integrity is maintained, human health and the surrounding environment is protected, and statutory compliance is achieved.

This CMP will apply to all civil and construction activities associated with the proposed development of the site, as detailed further in Section 3, and will be integrated into the Construction Environmental Management Plan (CEMP) to be prepared by the main contractor undertaking the civil and construction works at the site. A CEMP is a requirement of the Secretary's Environmental Assessment Requirements (SEARs), issued as a result of the State Significant Development Application (SSDA).

1.1 Objectives

The key objectives of this CMP are to:

- Manage the integrity of the existing soil cap (refer Section 8);
- Manage planned excavations below the cap and elsewhere within the site, such that excavated soils are appropriately assessed, relocated and capped within the site (where required), or waste classified for off-site disposal;
- Ensure that imported soils used for raising the bulk of the site are validated as being suitable;
- Outline monitoring requirements through the construction phase and post-construction;
- Detail mitigation measures where required;
- Manage any unexpected finds of contamination;
- Minimise the risk of contamination exposure to workers involved in the development of the site; and

- Outline a post construction validation regime.

2. Site Description

2.1 Site Identification

The site is located at Wilson Park, in the suburb of Sydney Olympic Park, within the Cumberland Local Government Area (LGA) and is situated at the north western corner of the Sydney Olympic Park (SOP) precinct. The site's locational context is shown in Figure 1 below.

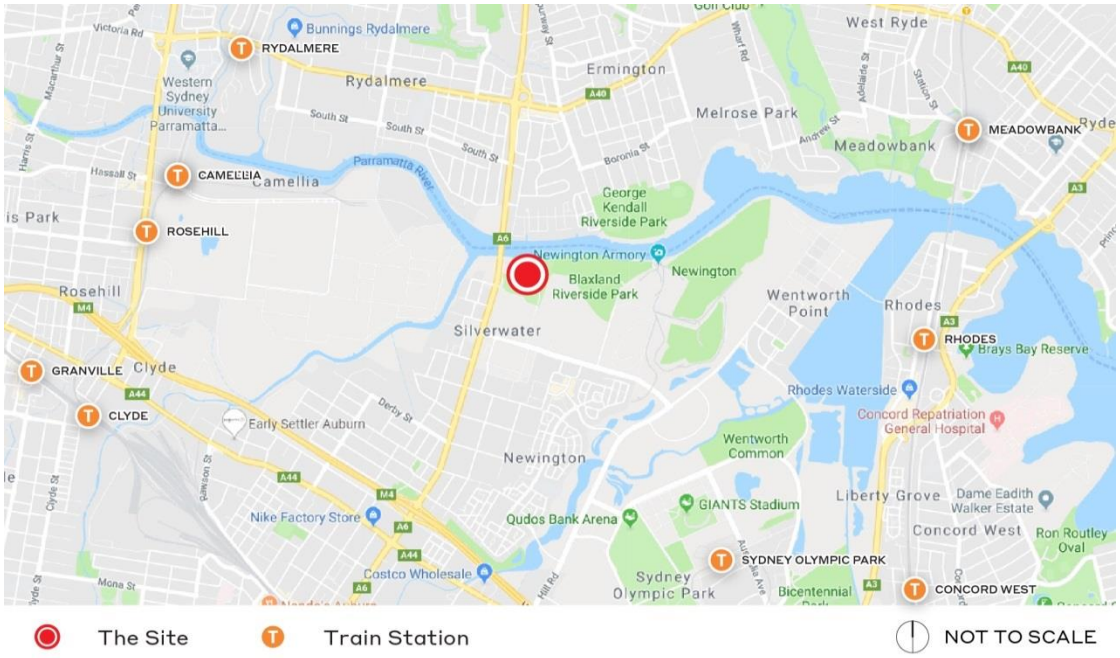


Figure 1: Locational Context

Wilson Park is irregular in shape and comprises a single allotment of land with an area of 119,894 m^2 and a leased area where development will occur (the site) with a site area of 65,768 m^2. The leased area excludes the portion of the Wilson Park site that is used for remediation purposes, as shown in the aerial image of the site provided at Figure 2. The site is legally described as Lot C in DP 421320 (with the exception of a fence line realignment as discussed below). The site is bounded by the Parramatta River to the north, Silverwater Correctional Complex to the east, a busway and industrial lands to the south and Silverwater Road to the west.

Figure 2: Site Aerial

The site is currently zoned as RE1 Public Recreation and SP2 Infrastructure (north east portion of Wilson Park) under the Auburn Local Environmental Plan 2010 and the SEPP – State Significant Precincts 2005. It is noted that the land zoned as SP2 Infrastructure has been declared as not suitable for any beneficial use.

Figure 3: Current Zoning

The parcel of land in between the proposed fence line and the existing fence line associated with the bioremediation area is shown on Figure 4 below. The total area is approximately 0.13 ha. This area is to be removed from the area declared as having “no beneficial use”.

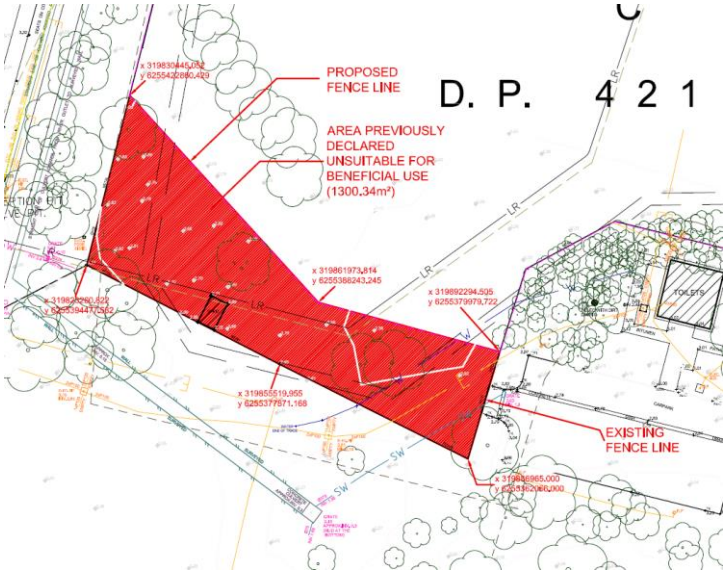


Figure 4: Portion of land in between of the existing fence line and proposed fence line

The site is one of ten engineered remediated landfill areas managed by Sydney Olympic Park (SOPA) under the Remediated Lands Management Plan, January 2009. The site falls under a ‘maintenance of remediation notice’ issued by the NSW EPA under Section 26 of the *Contaminated Lands Management Act 1997* (CLM Act).

It is noted that Wilson Park comprises north-west, north-east, south-west and south-east quarters, as referenced during previous investigations since 1999. The north-east quarter comprises the SP2 zoned land as described above. This part of Wilson Park falls outside the boundaries of the “site” with the exception of a minor fence line adjustment in the south-western part of this quarter, as described above.

2.2 Wilson Park Landfill and Related Infrastructure

2.2.1 Overview of System Components

The key components of the Wilson Park (the Park) infrastructure are listed below:

- Waste Containment System including the capping layer;
- Shallow Aquifer Leachate Collection and Transfer System;
- Deep Aquifer Leachate Collection and Transfer System;
- Leachate Treatment System; and
- Sub-surface Drainage System.

The majority of the above-mentioned infrastructure is located outside the proposed development site. Therefore, this CMP relates only to works that may penetrate the capping layer.

A plan of the current site infrastructure and drainage lines is presented in Appendix A, Drawing C06-P3 (together with proposed infrastructure). It is noted that the drainage line that currently exists at the site and extends towards the bioremediation area in the north-east quadrant, between the two proposed ovals, will be diverted at Node 4 (as shown on Drawing C06-P3, Appendix A) to the drainage line further to the west

It is noted that an interception pit (PP22) is located in the north-west quarter of the site, which connects to a rain infiltration interception drain along the centre of Wilson Park. It is understood that PP22 was diverted to the irrigation storage tank for the current sport oval irrigation in 2009. It is understood that this pit is not regulated by the EPA for the purpose of the Contaminated Lands Management Act Notice. It is understood that the pit will be relocated in consultation with SOPA.

2.2.2 Capping Layer

As stated in the RLMP, a capping layer exists within the north-west quarter of Wilson Park which comprises the following:

- A minimum of 0.5 m of compacted clay overtopped with 0.5 m of synthetically prepared and validated capping material, consisting of crushed sandstone and compost;
- Installation of a geo-fabric membrane beneath the cap;
- Placement of site topsoil (previously shown to have a significant population of indigenous hydrocarbon degrading microorganisms) within the top 0.1 m of the capping; and
- Maintenance of fertile grass cover over capping layer, which acts as a natural biofilter, eliminating risk of human exposure to volatile contaminants.

Further discussion in relation to the capping layer is presented in Section 4.

3. Proposed Development

The proposal relates to a State Significant Development Application (SSDA) to facilitate the development of a Cricket Centre for Cricket NSW at the Wilson Park site. Specifically, the works that are proposed for the SSDA include:

- A two storey cricket centre including an internal atrium, gymnasium, community facilities, sports science and sports medicine facilities and business offices;
- An International Cricket Council (ICC) compliant cricket oval 136 m long x 144 m wide (16,040 m^2) and associated seating;
- A community cricket oval with a diameter of 95m (6365 m^2);
- Outdoor practice nets with 71 wickets;
- A double height (8 m) indoor training facility with 15 wickets;
- A single storey shed for machinery;

- Associated car parking, landscaping and public domain works; and
- Extension and augmentation of services and infrastructure as required.

As shown on the preliminary Drawing C07, Appendix A, the proposed development will involve filling from current levels generally by around 0.5 m, with some cut into the existing mounds in the south-east quarter of the site. The existing internal parking, and existing and proposed internal roads will remain essentially at the current ground surface levels.

The main building for the development is understood to be located in the north-east quarter as shown on Drawing 3, Appendix A. It is understood that the ground floor slab will be at grade (following the planned filling as discussed above) and will be a suspended slab supported on piles bearing on bedrock.

Some localised trenching will be required for the main in ground stormwater system, as shown on Drawing C06 in Appendix A. Trench excavations are anticipated to depths of up to 2 to 3 m below current ground levels.

As part of the proposed development, a fence realignment is proposed at the south-west corner of the north-eastern quarter of Wilson Park, as shown on Drawings 1 to 3 and drawing ASK012, Appendix A. The fence realignment is designed to accommodate vehicular thoroughfare and at grade car parking, as shown on Drawing 3, Appendix A.

As mentioned in Section 2.2.1, the drainage line that currently exists at the site and extends towards the bioremediation area in the north-east quadrant, between the two proposed ovals, will be diverted at Node 4 (as shown on Drawing C06-P3, Appendix A) to the drainage line further to the west. The drawing also shows the planned surface drainage arrangement which is independent of the treatment system in the north-east quarter. There is proposed a subsurface system for the ovals and a surface collection system connecting to the existing council culvert system. Stormwater will be treated via filtration systems prior to discharge to council's system in accordance with council's DCP.

3.1 Summary of Key Construction Activities

A summary of the key construction activities relevant to the proposed development are summarised below:

- Filling to achieve final design levels (fill to be sourced from site and imported);
- Excavation works within the south east portion of the site, cutting down the existing landscape mounds;
- Piling works associated with construction of the main building;
- Trench excavations for the main in-ground stormwater system; and
- Minor excavation works for other services and general landscaping.

It is understood that all surplus soil generated from the construction activities will be retained on site and capped, where possible, which is the preferred option for waste management as per the RLMP. Soils found not to be suitable or accommodated by this process will be subject to waste classification prior to disposal to landfill.

4. Site History Review and Contamination Status

The history of the site, historical investigations, remediation and validation are documented in numerous reports prepared predominantly between 1999 and 2000. The history is summarised in the DP *Report on Preliminary Site Investigation* (PSI), *Western Sydney Cricket NSW and Community Centre, Wilson Park, Silverwater NSW,* Report 86694.00 dated 11 April 2019 (DP, 2019a). Reference should be made to the PSI report for a full summary of the previous reporting applicable to the site.

4.1 Land Use History

A review of the site history information and relevant searches indicated that the area currently occupied by Wilson Park (the Park) was largely cleared farm land, partly covered with an undulating mangrove swamp area bordering the Parramatta River. The area was generally poorly drained with lower portions of the site being only slightly above high tide level.

Petroleum and Chemical Corporation Australia Limited (PACCAL) took control of the unused site in the 1950s, constructing a Semet-Solvay Oil Gas Plant to supply Australian Gas Light Company with domestic gas. This process used crude oil as feedstock resulting in bituminous and tar by-products. This activity impacted upon the surrounding suburbs with air and water pollution problems, generated by poorly maintained manufacturing processes and wastes were disposed on-site in exposed sludge pits. The gas plant was closed in the early 1970's, and some of the sludge in the tar pits was mixed with crushed sandstone and used to level the north-west corner of the site. The remainder of the sludge remained buried in the tar pits, as can be seen on Drawing 2, Appendix A.

4.2 Historical Contamination

Generally, the nature of the contamination over Wilson Park has been well documented, particularly in the north-eastern quarter of the Park where the tar ponds are located. The pollution causing environmental and human concern at the Park consists of groundwater, sands and clays, contaminated to varying degrees with:

- Crude oil and thermally cracked crude oil, behaving as a dense non-aqueous phase liquid (DNAPL);
- Polyaromatic hydrocarbons;
- Benzene, Toluene, Ethyl-benzene and Xylene (BTEX); and
- Phenols.

Chemicals of concern that have been identified in contaminated soil samples taken from the Park include:

- Petroleum hydrocarbon tars (TPH), up to 1,000 ppm;
- PAH, up to 16,000 ppm;
- BTEX, up to 1,000 ppm;

- Phenolics (phenols, cresols, xylenols, trimethyl phenols), up to 50 ppm;
- Pentachlorophenol (PCP), up to 1 ppm;
- Octachloredibenzodioxin (OCDD), up to 730 ppb (1.3 ppb TEQ); and
- Heavy metals (zinc, lead, cadmium, chromium and copper), generally at or below the concentrations set out in regulatory guidelines.

Chemicals of concern that have been identified in contaminated groundwater adjacent to the two buried tar ponds are:

- PAH, up to 3 ppm;
- BTEX, up to 50 ppm; and
- Phenolics (phenols, cresols, xylenols, trimethyl phenols), up to 5 ppm.

Volatile organic compounds found at the Park are generated by the evaporation of low molecular weight organic components found in the petroleum DNAPL phase that contaminate soil and sediments. Chemicals of environmental and human concern being primarily the carcinogen benzene, the principal component of BTEX.

4.3 Stage 1 Remediation Works / Additional Investigations

In April 1997, the Stage 1 Remediation works at Wilson Park were commenced, and involved:

- Excavation and installation of an impermeable clay cut-off wall, surrounding the migration pathways of tar emanating from the two buried sludge pits into the Parramatta River;
- Installation of a clay coffer dam surrounding the contaminated foreshores of the Parramatta River adjacent to tar pit 2;
- Excavation of the contaminated foreshores and replacement with compacted validated clean clay;
- Containment and capping of all contaminated excavated materials over the original two tar ponds (i.e. two mounds as shown on Drawing 2, Appendix A);
- Construction of a leachate treatment pond between the two disposal mounds;
- Installation of nine piezometers outside the cut-off wall to monitor efficiency; and
- Over-covering the western landfill (including the north-west quarter) site with fertile topsoil and the eastern landfill with fertiliser and hydromulch grass seed.

Further investigation of the Park was carried out in 1999 to clarify the full extent of contamination over the site, particularly over the southern half and the north-western quarter of the Park (i.e. the “site” for the DSI). Further testing was also conducted over the north-eastern quarter of the site in order to clarify the location of sub-surface features. Pertinent results reported are summarised below:

- The soil gas probe readings in the south-west quarter ranged from 0.0 - 41.0 ppm. Overall, the results showed effective bio-remediation of VOCs occurring through the nutrient rich surface of this quarter;

- The soil gas probe readings in the south-east quarter ranged from 0.0 - 7.8 ppm, however, the majority of readings at 0.5 m and 0.2 m were non detect. Here, effective bio-remediation was also shown to be taking place; and
- The soil gas probe readings in the north-west quarter ranged from 0.0 - 163 ppm. The elevated readings at a depth of 0.5 m generally occurred in areas where only a thin cover of soil exists. However, overall, the results showed effective bio-remediation of VOCs occurring through the nutrient rich surface of this quarter.

Twelve groundwater monitoring wells were installed over Wilson Park during investigations in 1994 and 1995. All wells showed some degree of hydrocarbon contamination. Those adjacent or within the tar pond area in the north-east quarter showed elevated readings of total PAH (MW4, 182 ppm), while those in the southern half showed low level total PAH contamination (MW10, 15 ppb).

4.4 Stage 2 Remediation Works

The Stage 2 remediation works comprised the following:

- Validation of the southern half of the Park;
- Extensions of the Stage 1 clay cut-off wall to completely surround the tar pits;
- Covering the north-west quadrant with 0.5 m of artificial topsoil and validation;
- Installation of a sheet pile wall between the cut-off wall and Parramatta River to reduce migration of contaminants through the deeper groundwater;
- Installation of a pumping system to reduce groundwater levels to 0.5 m below mean tide level;
- Construction of two additional treatment ponds in the north-east quadrant;
- Stormwater improvements; and
- Revegetation and landscaping.

The guidelines used to develop the validation criteria for soils imported to the site for use in the surface included ANZECC (1992), Dutch guidelines (1992), the NEHF E guidelines, and the NSW EPA *Guidelines for the Site Auditor Scheme* (1998). The threshold levels adopted for the acceptance of imported soils are generally more stringent than those adopted in the current guidelines.

Based on the investigations carried out in the south-west and south-east quarters of the Park, minimal remediation was required in these areas. It was proposed that a shallow drain running east-west would be installed, and that soils excavated in the process will be relocated to the north-east quarter to be capped. The Site Auditor considered that subject to appropriate management of these measures, and validation of the soils for the intended land use, the southern half of the Park would be suitable for release to the public.

The distribution of contamination (TPH, BTEX, PAH) in soil greater than 0.5 m depth, across the north-west quarter was variable and primarily related to crushed sandstone and tar mixed fill. It was proposed to grade this quarter, cap with a cover of crushed sandstone and clay, then 0.1 m of topsoil. It was also proposed to pre-load the cap in the hope of bringing hydrocarbon impacted shallow soils to the surface for excavation and relocation to the north-east quarter to be capped.

The details of the proposed remediation of the north-east quarter have not been discussed further as this area falls outside of the subject site.

4.5 Validation and Site Audit

Frank Mohen was engaged as an EPA accredited Site Auditor to audit the investigation and remediation process at Wilson Park and to prepare a site audit statement confirming the suitability of the site (and the whole of Wilson Park generally) for public use.

Following completion of the Stage 2 remediation works, DP prepared a factual report, reporting on the results of a soil sampling and testing exercise conducted across the site as part of the remediation programme. Sampling was undertaken at 75 locations spaced in a 30 m grid pattern across the site. Samples were recovered from the surface to 0.1 m and at 0.5 m depth. The samples were analysed for a range of contaminants of concern. The results were presented to Waste Service for interpretation.

Following the completion of the validation assessment of the southern half of the Park the Auditor considered that area to be suitable for the proposed recreational open space use. The Auditor considered that the existing surficial soil in the north-west quarter met the validation criteria and was therefore suitable for re-use following remedial activities.

Sandstone and shale was imported to the site for crushing and mixing with compost to form the artificial capping of the north-west quarter. The materials were imported from various sites and validated as being suitable to use at the Park. The Auditor concurred that the materials were suitable for use at the Park.

A soil gas survey was conducted after the placement of the artificial soil, and the subsequent replacement of the validated surface soils that had been stripped and stockpiled. All reported concentrations were low and met the objectives of the monitoring. Whilst there were several locations of elevated PID readings at a depth of 0.5 m (refer Drawing 1, Appendix A for the locations of the highest concentrations) there were no readings exceeding 5 ppm at the surface.

4.6 Site Audit Statement

On the basis of the outcomes reported in the Site Audit Report, the Site Auditor issued a Site Audit Statement (SAS) under the CLM Act, which states that the south-east, south-west and north-west quarters of the Park are suitable for recreational, open space and park uses, subject to:

- Preparation and implementation of an auditor approved Environmental Management Plan including but not limited to controls to alterations of landforms and excavations below a depth of 0.5 m; and
- Implementation of an auditor approved groundwater monitoring programme to assess the impact of residual soil contamination on groundwater quality and potential risk of harm to the environment.

The bioremediation area (i.e. north-eastern quarter) was declared in the SAS as being unsuitable for any beneficial use.

4.7 Environmental Management Plan

The environmental management plan required as a condition of the SAS was documented in SOP (2009) *Remediated Lands Management Plan*, January 2009 (RLMP).

It is understood from SOPA that the existing fields in the north-west quarter of Wilson Park are maintained through the use of a range of fungicides, pesticides, herbicides as well as growth regulators. Depending on the plant's requirements the fertilizers range from quick releasing straight elements (nitrogen) to slow releasing (coated) blended fertilizer. Soil amendments (gypsum / lime) are used regularly depending on the findings of soil testing. Multiple fertilizer blends and liquid fertilizers are used depending on season and the field condition.

4.8 Geotechnical Investigation (DP, 2019b)

DP was commission in 2019 to conduct a preliminary geotechnical investigation to provide information on the subsurface conditions across the site, with reference to the proposed Western Sydney Cricket and Community Centre development. The scope of work included 44 cone penetration tests (CPTs) with pore pressure measurement (piezocones) to refusal as well as sampling and laboratory testing at 14 of the CPT locations. Details of the field work, comments relevant to design and construction, as well as factual reporting on sampling and laboratory testing undertaken for the turf design (by others) are given in the report. The cone and sampling locations are shown on Drawing 101, Appendix A.

Fieldwork results indicated that fill was encountered in all shallow bores and piezocones and comprised variable mixtures of sandy clay and clayey sand with layers of clay/sand/gravel. In some locations there was a distinct change in material at between 0.7 m and 1.5 m depth, which has been inferred to be the change from the capping layer to general filling. A distinct capping layer was not encountered at all test locations. The maximum depth of filling at the sampling locations was 4.2 m.

A trace amount of suspected asbestos containing material (ACM) was observed in the fill at CBR 27 (at greater than 0.15 m depth), and at CBR 39 (within the upper 0.8 m of fill).

4.9 Detailed Site Investigation (DP, 2019c)

DP was commission in 2019 to prepare a detailed site investigation (DSI) report with respect to the proposed Western Sydney Cricket and Community Centre development. The report is titled *Report on Detailed Site (Contamination) Investigation, Western Sydney Cricket NSW and Community Centre, Wilson Park, 4 Newington Road, Silverwater*, Project 86694.03 (DP, 2019c). The scope of works included a review of previous investigation and remediation results, groundwater sampling, and targeted soil and soil vapour sampling and testing.

Since completion of the Stage 1 and Stage 2 remediation works as documented in previous studies, the site has remained as recreational use, and the site has remained intact and managed by SOPA under the RLMP. Ongoing groundwater monitoring within the site (MW 1 to MW4) has not found any contamination within the site warranting remediation or further management. The results of the soil

vapour and groundwater testing during the investigation have not identified a vapour intrusion risk at the proposed locations of the main buildings within the proposed development.

A small number of fragments of potential ACM were encountered during the recent geotechnical investigation and the potential for ACM in soils at the site will need to be managed through the implementation of this CMP.

The proposed fence realignment in the south-west corner of the north-east quarter of the Park will encroach into the area noted in the SAS to the unsuitable for any beneficial use. The field results of the investigation have shown that a cap over the tar impacted soils in this area exists (possibly between 0.7 m and 1.5 m in thickness), and the soil vapour test results meet the adopted site assessment criteria (SAC). Whilst some elevated PAH concentrations were reported in the deeper soil profile, all soil test results for the “capping” soils were within the adopted SAC. As noted on Drawing 2, Appendix A, and as demonstrated by the bore finds documented in DP (2019c), the proposed fence line realignment appears to avoid the existing covered tar pit within the north-east quarter. On this basis, the portion of the “bioremediation area” within the site, as a result of the proposed fence realignment, was considered to be suitable for the proposed development, subject to implementation of a CMP.

On the basis of the findings reported in DP (2019c) the following conceptual site model (CSM) was presented and discusses the likely source-pathway-receptor linkages that may exist at the site both during and post construction, together with proposed management controls that are discussed in further detail in this CSM.

Table 1: Summary of Likely Complete Pathways and Management Protocols

Potential Source	Pathway	Receptor	Comments / Management
Large scale filling, with some of the fill mixed with tar. Some areas of the fill are likely to contain ACM	Ingestion and dermal contact Inhalation of dust Inhalation of ground gas/vapours	Construction and maintenance workers	Environmental consultant to monitor civil works for signs of odour, vapours, ACM, both visually and using PID screening. PPE including P2 dust masks, long sleeves, gloves and safety goggles to be utilised for all workers. PPE including half face respirators to be utilised when working in trenches, excavations, near the former tar pits, and/or as directed by the Environmental Consultant.

Potential Source	Pathway	Receptor	Comments / Management
		Future site users and visitors	A general minimum of 0.5 m of validated imported soil will be used to fill (cap) the majority of the site. Area of proposed cut will only be used in the upper 1.0 m if validated by the Environmental Consultant. New buildings to be designed with a passive soil vapour mitigation system. Excavated soils (including piling spoil) to be assessed by the Environmental Consultant for on-site re-use or off-site disposal to landfill.
	Rain infiltration and leaching of contaminants to groundwater	Aquatic ecosystems	Groundwater monitoring during and following completion of construction. Monitoring of civil works for indicators of significant contamination that could potentially leach. This would be subject to excavation and removal from site.
Buried tar pits, in close proximity to the north east of the main proposed oval	Ingestion and dermal contact Inhalation of ground gas/vapours	Construction and maintenance workers	Environmental consultant to monitor civil works for signs of odour, vapours, ACM, both visually and using PID screening. PPE including half face respirators long sleeves, gloves and safety goggles to be utilised for all workers.
		Future site users and visitors	A general minimum of 0.5m of validated imported soil will be used to fill (cap) the majority of the site. New buildings to be designed with a passive soil vapour mitigation system.
	Rain infiltration and leaching of contaminants to groundwater	Aquatic ecosystems	Groundwater monitoring during and following completion of construction. Monitoring of civil works for indicators of significant contamination that could potentially leach. This would be subject to excavation and removal from site.

Potential Source	Pathway	Receptor	Comments / Management
Application of fertilisers, herbicides and fungicides to the oval in the north-west quarter	Ingestion and dermal contact	Construction and maintenance workers; Future site users	PPE including P2 dust masks, long sleeves, gloves and safety goggles to be utilised for all workers. A general minimum of 0.5 m of validated imported soil will be used to fill (cap) the majority of the site. Validation sampling will be undertaken across the finished site levels.
Imported fill	Ingestion and dermal contact	Construction and maintenance workers; Future site users	All proposed imported materials will be assessed by the Environmental Consultant for suitability prior to being used for fill at the site A general minimum of 0.5 m of validated imported soil will be used to fill (cap) the majority of the site. Validation sampling will be undertaken across the finished site levels.

Based on the supported land use suitability documented in the previous site audit statement (SAS), and on the investigations and assessment summarised in DP (2019c), it was considered that the site can be made suitable for the proposed development, subject to implementation of the CMP.

5. Regulatory Requirements and Guidelines

5.1 Key Legislative Requirements

The following key legislative requirements affect the management of the site:

- NSW *Contaminated Lands Management Act 1997* (CLM Act):
  - Notice 28040 *Maintenance of Remediation* issued under Section 28 of the CLM Act requires SOPA to maintain remediation actions at SOP as detailed in the RLMP.
- *Sydney Olympic Park Authority Act 2001* (SOPA Act):
  - Protection of natural heritage;
  - Ensure development meets best practice environmental standards;
  - Implement principles of ecologically sustainable development as defined in the Local Government Act 1993 (s15);
  - Implement the Environmental Guidelines (s20); and
  - Carry out and give effect to the Parklands Plan of Management (s37) which applies to the area identified as ‘the Parklands”.

- *Protection of the Environment Operations Act 1997* (POEO Act):
  - Protects and restores the quality of the environment in a regulatory framework;
  - A conditional license may be required for activities which impact on water, soil or air quality, or which generate waste;
  - Penalties apply for non-compliances with licenses, or for environmental harm; and
  - SOPA currently holds Licence 10243, which conditionally permits miscellaneous discharge to the Parramatta River from Wilson Park bioremediation ponds.
- *Environmental Planning & Assessment Act 1979*;
- *Occupational Health and Safety Act 2000:*
  - Consideration of risk issues; and
  - Provision of information, consultation and control of premises, plant and substances
- Parklands Plan of Management:
- *State Environmental Planning Policy No.55 – Remediation of Land*.

5.2 RLMP – Works and Development on Remediated Landfills

Section 8 of the RLMP provides guidelines for proposed works and development on remediated landfills at SOP involving minor excavation works. It is noted that “major works” (such as the current proposed development works) are outside the scope of the RLMP. However, it is considered that the general procedure for minor works is applicable to the current development.

Section 8 (2) of the RLMP states that proposed works and development on the site must be consistent with the objectives identified for the site (see Appendix B) as well as principles and guidelines including:

- Protection of waste containment features including pipelines, membranes, bunds and caps;
- Assessment of adverse impact on human health or environmental damage;
- Compliance with relevant occupational health and safety plans and environmental protection requirements

A copy of the Standard Work Method Statement for minor excavation works, extracted from the RLMP is presented in Appendix B.

6. Roles and Responsibilities

In order to achieve the objectives of this CMP, the following key roles and responsibilities have been identified.

Table 2: Roles and Responsibilities

Party	Roles and Responsibilities
SOPA	• Retains ownership of the site; • Ensuring implementation of the RLMP; • Issuing of work permits; • Reporting to the EPA as required under the Notice.
NSW Cricket	• Leasing the site from SOPA; • Ensuring compliance with the CMP and RLMP; • Ensuring compliance of the CEMP; • Engaging an Environmental Consultant for the validation and monitoring as required under the CMP.
Earthworks (Civil) and Construction Contractor (TBC)	• Hold a SOPA Work Permit; • Responsible for conducting works in accordance with approval conditions, CMP, CEMP and RLMP; • Source materials for importation (under conditions outlined in the CMP) and gain approval from the Environmental Consultant prior to importing; • Maintain all site records, including tracking of materials; • Notify the Environmental Consultant of unexpected finds.
Sub-contractors	• Hold a SOPA Work Permit; • All subcontractors are to be inducted onto the site and informed of their responsibilities in relation this CMP and the CEMP; • Where necessary, sub-contractors will also be trained in accordance with the requirements of this document; and • Must conduct their operations in accordance with this CMP, the CEMP, as well as all applicable regulatory requirements.
Environmental Consultant	• Hold a SOPA Work Permit; • Undertaking inspections, testing and monitoring in accordance with the requirements of the CMP; • Provide environmental advice and recommendations arising from inspections, testing and monitoring; and • Updating of the CMP, if and when required.
AECOM (Frank Mohen)	• Site Auditor; • Review reports as required for the preparation of a Site Audit Statement confirming the suitability of the site for the proposed development.

7. Acceptance of Material for Filling

It is anticipated that a significant amount of material will need to be imported to site to achieve the proposed design levels. It is noted that some of the filling will also be sourced from the south-east quarter of the site where existing mounds will be cut.

The proposed formation of the design levels will effectively create an additional capping layer over the majority of the site, as shown on Drawing C07-P1 in Appendix A. The filling will also form a cap over the minor ACM impacts identified in DP (2019b), as well as any other currently unknown ACM impacted fill.

7.1 Imported Material

All material imported to the site for filling to design levels, as aggregate (e.g. base course), or in landscaping must comprise either:

- Virgin Excavated Natural Material (VENM); or
- Material complying with a general or specific Resource Recovery Order (RRO) under the Part 9, Clause 93 of the Protection of the Environment Operations (Waste) Regulation 2014, which permits land application.

Apart from complying with the conditions of the abovementioned classifications, all imported material used for filling at the site must also meet the site acceptance criteria (SAC) outlined in this section.

Any on-site materials proposed to be used as the capping layer must meet the SAC outlined in this section.

The Environmental Consultant and Site Auditor must review all documentation made available from a fill source site prior to any of the materials being imported to site. The documentation must be sufficient to confirm that the material complies with the above criteria. Upon review the documentation provided, the Environmental Consultant and Site Auditor may:

- Confirm that the documentation is sufficient to meet the site suitability requirements (subject to check sampling and testing discussed below); or
- Request additional information and/or testing data to confirm suitability; or
- Reject the materials.

All imported materials with appropriate documentation will also be subject to “check” sampling and testing by the Environmental Consultant, as follows:

- Samples will be recovered at a general rate of 1 per 1,000 m^3 or at the discretion of the Environmental Consultant in consultation with the Site Auditor. A minimum of one check sample per source site will be recovered;
- Analysis of the check samples for a range of common contaminants including metals, TRH, BTEX, PAH, OCP, OPP, PCB, phenols and asbestos, plus any other potential contaminants relevant to the source site; and

- The Environmental Consultant will assess the analytical results again the site acceptance criteria outlined in Section 7.3.

No material will be imported to the site for use until such time as the Environmental Consultant and Site Auditor confirm suitability in writing.

In order to keep adequate materials tracking records and to minimise the opportunity of importing unsuitable materials, or materials not approved by the Environmental Consultant and Site Auditor, the Contractor will appoint a "gate keeper" to monitor:

- The date and time of truck arrivals;
- The source location of the material;
- The truck registration details;
- Material type;
- Approximate volume of material per load;
- Visual assessment of material at gate;
- Record of load acceptance/rejection; and
- The approximate location of material placement (on a daily basis not per truck load.

The gate keeper will reject any materials entering the site when:

- The material is deemed to not be consistent based on a visual assessment of the material at the gate with that described in supporting documentation, as approved by the Environmental Consultant and Site Auditor;
- Supporting documentation has not been previously supplied and accepted by the Environmental Consultant and Site Auditor.

Similarly, the gate keeper will reject materials from source sites from which more material has been approved.

7.2 On-Site Material

As discussed in Section 3, the proposed development will involve filling from current levels generally by around 0.5 m, with some cut into existing the existing mounds in the south-east quarter of the site. It is not clear in previous investigation documentation if tar impacted soil was placed in these mounds area and/or whether a capping layer exists. As such, delineation of the areas of proposed cut will be undertaken as follows:

- The proposed depths and locations of cutting as part of the development will be confirmed;
- Once confirmed, an *in situ* investigation of these areas will be documented by the Environmental Consultant in a sampling, analysis and quality plan (SAQP) for review and approval by the Site Auditor. The investigation will aim to delineate the capping layer from deeper fill;
- Once delineated, capping layer soils will be excavated under the direction of the Environmental Consultant and stockpiled for re-use as a capping layer as required;

- Deeper fill soils will be excavated and reinstated in areas of the site, allowing for construction of a capping layer of minimum 0.5 m thickness;
- The approved capping layer soils will be placed over a marker layer to a minimum thickness of 0.5 m.

Soils considered suitable to be reinstated as a capping layer must comply with the SAC as outlined in Section 7.3.

7.3 Site Acceptance Criteria

The adopted SAC for the site, and the proposed development, is consistent with the SAC described in DP (2019c). The rationale for the selection of the soil SAC, and the numerical values are presented in Appendix B. In essence, the SAC comprises:

- Health investigation level (HIL) D and Health Screening Level (HSL) D for the building and hardstand footprints;
- HIL C and HSL C for parts of the site proposed as a recreational open area;
- Ecological investigation level (EIL) / ecological screening level (ESL) - Urban residential and public open apace in areas with no buildings or hardstand; and
- Management Limits – Residential, parkland and public open space land use.

With respect to asbestos, as per NEPC (2013) Table 7: *Health Screening Levels for Asbestos Contamination in Soil*, no asbestos is to be visible at the surface. Concentrations for bonded ACM are to be less than 0.02% w/w (recreational land use) and fibrous asbestos/asbestos fines (FA and AF) is to be less than 0.001% w/w.

7.4 Geotechnical Requirements

The materials to be imported to the site should have the geotechnical characteristics consistent with specifications regarding their physical properties.

8. Environmental Management Procedures and Control Plan

This section outlines the environmental management plan proposed to be implemented during the works and relates to the key construction activities listed in Section 3.1.

8.1 Excavation Works

This section describes procedures for bulk and minor excavations.

8.1.1 Recommended Sequence

The recommended sequence of excavation works is as follows:

- Identify underground services within the works footprint;
- Identify the likely soil composition, particularly the presence or otherwise of a capping layer or opportunities to separate difference fill / soil types. This may require additional targeted investigations in the area(s) of proposed excavation (refer Section 11.1);
- Determine the desired destination of excavated soils, including whether the soils are to be reinstated in the same position;
- Excavation, segregation and stockpiling of site materials and testing (where considered necessary to confirm their contamination status);
- Reinstating the soils either at the same position (e.g. trench backfill) or in another part of the site, including reinstatement of the capping layer where required; and
- Validation of the final profile as discussed in Section 11.

8.1.2 Excavation Works Procedure (Penetrating Capping Layer)

The following procedure adopted from Section 8.1.5 of the RLMP should be followed:

- Separate excavated topsoil and capping layer soils for reuse (i.e. stockpile separately to ensure cross contamination does not occur). It is recommended that supervision or regular inspections by the Environmental Consultant be undertaken during this process to enable appropriate delineation whilst excavating;
- Excavated capping soils should be placed on either hardstand surfaces, plastic lining or on areas where the capping layer will not come into contact with underlying contaminated soils. Signage should be placed around the “capping” stockpile including silt fencing to prevent unintended cross-contamination;
- Material excavated from below the capping layer is considered to be contaminated and should be stockpiled separately and stored on the high side of the excavation so that any liquid travels back into the pit; and
- Where stockpiles are kept for more than one day; cover excavated material and place erosion control measures around them.

Further detail of spoil management is provided in Section 8.4.

8.1.3 Gas and Vapour Monitoring Requirements

Whilst it is unlikely that excessive gas levels will be detected during the planned excavations for the proposed development, gas monitoring will be undertaken as a precautionary measure during all excavation works, unless advised otherwise by the Environmental Consultant. Gas monitoring will occur as follows:

- A records sheet is to be set up and completed for each excavator, including area of excavation, date(s) of excavation, gas readings (PID and LEL), and actions;

- Gas readings will be taken using a gas meter and PID at the surface of the excavation progressively through the entire bulk excavation process. Readings will be taken and recorded every 2 hours during the excavation process;
- If any readings exceed the Action Levels of 5% LEL or 10 ppm (PID) the excavation will cease until the gas readings fall below 5% LEL and 10 ppm. At this point, a water spray will be used ahead of the excavator to minimise the opportunity for sparks to develop; and
- If the gas reading persists at greater than the Action Levels the excavation will be abandoned in that area and the Environmental Consultant will be contacted to assess the significance and advise on further actions.

8.2 Piling Works

8.2.1 Generation of Spoil

It is anticipated that the piling works will result in the generation of spoil, if an auger process is utilised. Should the auger piling method be used, it is considered that segregation of different material types may not be feasible. As such, all spoil generated by the process should be managed as set out in Section 8.4. It is noted that deep excavations at the site, such as piling, are likely to encounter acid sulphate soils (ASS) which, if confirmed, will require additional management as outlined in Section 10.

8.2.2 Recommended Sequence

The recommended sequence of piling works is as follows:

- Identify underground services within the works footprint;
- Investigate the potential for ASS in the areas of proposed piling. The Environmental Consultant will undertake an investigation to bedrock and/or the proposed piling depth to ascertain the presence and severity of ASS. If ASS are identified, the management protocols in Section 10 will be enacted;
- Determine the desired destination of excavated soils, including whether the soils are to be reinstated in the same position and/or treated for ASS conditions;
- Determine, on the basis of the investigation, the likely depth to ASS (if present);
- Commence and advance piling to within 0.5 m of the anticipated depth of ASS, and stockpile the cuttings, managing stockpiles as outlined in Section 8.4;
- Continue to advance the piling, stockpiling the cuttings separately, as these may be impacted by ASS. Manage the stockpile as per Sections 8.4 and 10;
- Assess the stockpiles (following treatment if required) to determine the suitability for placement in the desired destination;
- Reinstating the soils (as suitable) in another part of the site, including reinstatement of the capping layer where required; and
- Validation of the final profile as discussed in Section 11.

8.2.3 Gas Monitoring Requirements

- Each piling rig is to be supplied with an LEL portable gas detector and PID capable of fitting a tube and pump for deep monitoring of vapours;
- All intended operators of the gas detectors are to be trained in the use of the detector by the supplier;
- A records sheet will be set up and completed for each bore, including the bore number, date(s) of boring, depths of gas measurements, gas readings, and actions;
- Whilst boring, at each 1 m depth the auger will be extracted and vapour (gas) measurements will be taken just above the bottom of the bore. This will require the use of appropriate tubing and pump fittings to the gas detector when sampling at depth. The readings will be taken from the top of the bore to the final depth of the bore;
- If any readings for petroleum gases exceed the Action Levels the boring will cease until the reading falls below the Action Levels. At this point a water spray will be used for the remainder of the bore drilling to minimise the opportunity for sparks to develop. The gas readings will then be taken at 0.5 m depth intervals until the readings at each depth again fall below the Action Levels; and
- If the gas reading persists at greater than the Action Levels the bore will be abandoned, and the Environmental Consultant will be contacted to assess the significance and advise on further actions.

Prior to moving the piling rig/establishing a new location, the following will be conducted:

- Measure the LEL at the ground surface where the auger will make contact with the ground and at a height of 1.5 m above the ground surface;
- Measure the LEL at the ground surface where the piling rig cabin and engine will be located and at a height of 1.5 m above the ground surface; and
- If any readings for gases exceed the Action Levels, then move to an alternative location or allow additional time for ventilation and remeasure the LEL. Once the reading is below the Action Levels then works in that area can commence.

8.3 Proposed Re-instatement Procedure of Capping Layer

The following re-instatement procedure has been adopted from Section 8.1.5 of the RLMP:

- Where excavated spoil is to be reinstated at the same location, replace excavated material in the reverse order that it was removed;
- If soils are to be relocated within the site, relocate and compact the deeper excavated soils (i.e. not the capping layer) at the intended destination;
- Prior to the placement of any capping materials the site/area should be inspected by the Environmental Consultant and surveyed by a registered surveyor to determine the pre-capping levels and the extent of the pre-capped area;

- Place a liner or geofabric on top of (waste) material prior to compacting the clay capping layer. The liner should be inspected by the Environmental Consultant prior to placement of capping material;
- Replace clay clapping in 200-300 mm layers, to a minimum compacted thickness of 0.5 m;
- Compact each layer with a powered compacter to a compaction density of 98%, or as per specification;
- Replace 100 mm topsoil on clay capping;
- Fully restore landscape and irrigation;
- The completed capped surface should be inspected by an Environmental Consultant; and
- Survey the location of new ground levels once the capping layer is completed.

8.4 Spoil Management

The following control measures will be adopted for the management of spoil generated by excavation and piling works at the site:

- Where possible, segregate different material types for assessment purposes;
- Soils excavated from below the water table (which is tidal) will need to be treated as potential ASS, unless an investigation demonstrates otherwise. The additional processes for assessing and managing ASS are outlined in Section 10;
- All stockpiles must be placed in areas that do not allow material to spill onto the road pavement or drainage lines / watercourses;
- Construct stockpiles, preferably with no slope greater than 2:1 (horizontal to vertical) to manage dust generation and erosion. A less steep slope may be required once the surrounding area is flattened to reduce dust emission;
- Apply periodic dampening, where necessary, to suppress dust from being released;
- Stockpiled materials must have a sediment control fence;
- Known contaminated material (i.e. beneath the capping layer or identified as a contamination find) is to be stockpiled separately, and should be placed on plastic sheeting to prevent leaching of contaminants into surrounding soils; and
- Areas where contaminated material has been stockpiled will be required to be validated accordingly as specified after the stockpiles have been removed.

8.5 Odour Control

In order to control odours at the site boundaries, the following processes are to be adopted:

- All plant and equipment exhaust levels are to be monitored by the site foreman to ensure acceptable levels. If unacceptable levels are determined, the equipment is to be replaced or repaired;

- If strong hydrocarbon odours are detected from any of the machinery or as a result of excavations, a hydrocarbon mitigating agent is to be used;
- A complaints register is to be set up on-site for recording complaints from adjacent residents, with respect to odours or dust. The complaints register is to be completed by the site foreman; and
- Once a complaint is received, the site foreman is to implement a corrective action to rectify any problems associated with the odour or dust source.

9. Vapour Mitigation

DP (2019c) did not identify any soil vapour issues requiring active remediation. However, given the history of industrial processes at the site (and nearby), the presence of tar pits in reasonable proximity to the proposed development, the presence of tar mixed in some of the fill, and the low detections of hydrocarbons in soil vapour, vapour mitigation will be incorporated as part of the proposal, as outlined in this section.

9.1 Proposed Buildings

Two buildings are proposed as part of the development, as shown on Drawing C06-P3, Appendix A. This includes the main building in the north-west quarter and the amenities block in the north-east. Each building will be fitted with a passive vapour mitigation system comprising the following general components:

- A granular layer, minimum 100 mm thickness;
- Perforated PVC pipe network within the granular layer to collect air / vapours within the granular layer. The pipe network will feed into a number of risers continuing up the outside walls of the buildings to enable venting of the vapour;
- The provision of two access ports at each building to enable sampling and testing of the vapour as part of a monitoring program. A gas tight cap with quick connect fitting will be inserted into the sampling point (refer Section 11);
- A Liquid Boot (or similar) vapour proof membrane system installed over the granular layer, with tight seals around slab openings (e.g. drainage pipes);
- The building slab formed above the vapour proof membrane.

9.2 Ground Surfacing

On completion of formation of the design top of fill levels, a topsoil layer (with turf) will be provided across the site (other than hardstand areas). This layer will be nutrient rich and will assist in ameliorating low level vapours that may be sourced from the deeper soils.

9.3 General Civil Works

The protection of works involved in the civil and construction works will be managed through the worker health and safety protocols outlined in Section 12.

9.4 Maintenance Workers

The protection of maintenance workers into the future will be managed through the development and implementation of a long-term environmental management (LTEMP) to be approved by the Site Auditor and SOPA.

10. Acid Sulphate Soils

The PSI identified the potential for acid sulfate soils (ASS) to exist at depths greater than 2 m across the site (which is likely to be at around the average groundwater level). Therefore, there is potential for ASS to be encountered during the proposed works, which will require ASS management.

Unless an investigation demonstrates that ASS is not present, all soils excavated from below the water table are to be presumed as ASS, and subject to this management plan.

The most appropriate management option is on-site treatment of disturbed ASS using a neutralising agent and treatment system, followed by either on-site re-use or off-site disposal.

10.1 Neutralising Materials

10.1.1 Aglime

Agricultural lime, commonly known as aglime, is the preferred neutralisation material for the management of ASS, as this material is usually the cheapest and most readily available product for acid neutralisation. Ag lime requires no special handling, however, it would be advisable to cover any ag lime stockpiles with a tarpaulin both to minimise wind erosion and wetting, as the material is more difficult to spread when wet.

10.1.2 Alternative Neutralising Material

An alternative neutralising material can be used subject to prior approval by a suitably qualified scientist or engineer. It should be noted that the following neutralising materials are not considered suitable due to the potential environmental risks:

- Coarse grained calcite; and
- Dolomitic aglime, or magnesium blend.

10.2 Treatment Systems

10.2.1 Small Volumes of Spoil (Using a Sealed Waste Bin)

For small volumes of spoil, the following treatment system is recommended:

- Sealed container such as a metal skip bin;
- HDPE sheet liner to line the bin;
- Application of a thin (10 kg/m^2) ag lime guard layer dispersed over the bottom of the bin liner; and
- Plastic covering over the material pile to cover from wind and rain.

10.2.2 Large Volumes of Spoil (Preparation of a Treatment Area)

The key features of the treatment area and design considerations are summarised below:

- **Pad area** – The treatment pad should be of an appropriate area for the volume of soil to be treated/stored, and should be prepared on relatively level or gently sloping ground to minimise the risk of potential instability issues, with a fall to the local drainage sump;
- **Pad location** – The pad should be located as far as practical from any potential ecological receptors (such as drainage lines which enter the stormwater system;
- **Lining** – A compacted clay layer (with a compacted thickness of 0.5 m) or an approved geosynthetic liner (such as HDPE sheeting) should be used to line the pad;
- **Guard Layer** – A guard layer of fine agricultural lime ('ag lime') should be applied over the lining to neutralise downward seepage, at a rate of 10 kg ag lime/m^2 of surface area of the pad/ metre height of stockpile. The guard layer should be re-applied following removal of treated soils prior to addition of untreated ASS;

  NOTE: if the stockpiled soils on the treatment pad are expected to be greater than 3 m in height, it is recommended that the guard layer be applied as a based guard layer, with interim guard layers through the height of the stockpile.
- **Bunded** – The treatment pad should be bunded to contain and collect potential leachate runoff within the treatment pad area and to prevent surface water from entering the treatment pad. The inner bund slopes should be lined to prevent leachate seeping into the ground surface, and sized to prevent overflow of untreated leachate onto the site.

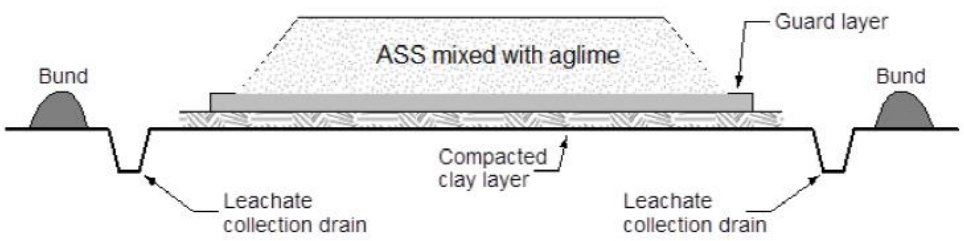


Figure 1: Schematic cross-section of a treatment pad, including clay layer, guard layer, leachate collection drain and bunding

10.2.3 Lime Application Rate and Pre-Treatment Testing

The required dosing rate for aglime treatment should be calculated from the following formula:

Neutralising Material Required (kg)

per unit volume of soil (m^3) = $$\left(\frac{\%\,S \times 623.7}{19.98}\right) \times \frac{100}{ENV\,(\%)} \times D \times FOS$$

Where: *%S = net acidity (% S units). This value is obtained from the SPOCAS/ chromium suite analytical results and should be the "worst case" result of the acid or sulphur trails of all samples;*

623.7 = converts % S to mol H^+/t;
19.98 =converts mol H^+/t to kg $CaCO_3$/t;
D = Bulk density of soil (as measured, or else assume 2 t/m^3);
FOS (factor of safety) = a minimum value of 1.5 needs to be adopted, although values of up to 2 can be suitable;
ENV = Effective Neutralising Value (e.g. Approx. 95% for fine aglime).

Notes:

- The ENV is calculated based on the molecular weight, particle size and purity of the neutralising agent and should be assessed for proposed materials in accordance with ASSMAC (1998); and
- The "worst case" of the acid or sulphur trail results should be used.

Whilst the above algorithm is provided as an option, the environmental consultant will provide the recommended liming rate based on the soil analysis.

10.3 Treatment Process

The general process for the treatment of ASS is as follows:

- Prepare a treatment pad / set up a skip bin system;
- Segregate any non-ASS soil horizons (if present) from the area containing ASS if material types can be separated during works (to be determined by the Environmental Consultant);
- Transport ASS material requiring treatment to the treatment area / skip bin (in sealed trucks if required);
- Manage ASS during stockpiling and treatment to minimise dust and leachate generation (e.g. by covering, or lightly conditioning with water). If wet weather prevails, stop works and cover the stockpiled material / skip bin with plastic sheeting to reduce the formation of leachate;
- If using a skip bin, spread the ASS into the bin in layers of up to 0.3 m thick, taking care not to churn up the lime guard layer;

- If using a treatment pad, spread the ASS onto the guard layer in layers of up to 0.3 m thick, leaving a 1 m flat area between the toe of the spread soil and the containment bund or drain. When spreading the first soil layer, care should be taken not to churn up the lime guard layer;
- Let the ASS dry to facilitate lime mixing (if too wet, then adequate mixing of lime cannot be achieved);
- Apply ag lime to the stockpiled soil / skip bin and harrow/ mix thoroughly prior to spreading the next layer. If using the skip-bin system, mixing can be done using an excavator;
- Continue the spreading/ liming / mixing cycle. This can be done one layer at a time, or with multiple ASS layers placed on top of each other;
- Assess the success of the treatment using verification testing;
- If verification sampling indicates that additional neutralisation is required, add additional lime (at an appropriate liming rate) and mix as described above;
- When verification testing indicates that lime neutralisation is complete, then the soil may be removed from the treatment pad / skip bin, and may be either re-used on-site or disposed off-site in accordance with waste classification; and
- Management of leachate water and groundwater.

10.4 Verification Testing

Soil pH should be regularly monitored in the ASS treatment area or skip bin during treatment. The field test and laboratory analysis will be used as a measure of the effectiveness of neutralisation, and the material will only be considered to be suitably treated when all validation results meet the acceptance criteria (as summarised in Table 3 below). It is likely that laboratory analysis will only be undertaken after the field screening results have passed.

Table 3: Summary of Monitoring Frequencies and Criteria

Material	Test	Frequency	Acceptance Criteria
Treated Soil (during and following neutralisation)	Field test: pHF and pHFox screening	• Between 1 sample / 25 m^3 to 1 sample / 100 m^3; OR • Minimum of 3 samples / treatment batch (depending on homogeneity)	• pHF ≥ 5.5 (and ≤8.5 for any materials to be re-used on site); • pHFox ≥ 6.5; • pH_{KCL} ≥ 6.5; • TAA = 0; and • Net acidity** is < 0.
Treated Soil (validation testing)	Laboratory analysis: SPOCAS* / SCr Method (preferred)	• Between 1 sample / 100 m^3 and 1 sample / 500 m^3; OR • Minimum of 3 samples / batch	

* It is noted that the fastest turnaround of results for SPOCAS testing is a minimum of three days from receipt of the sample to the laboratory. This should be taken into account to ensure adequate on-site storage is available for treated and untreated ASS.

** The net acidity is calculated from SPOCAS/ chromium suite analytical results as follows:

$$\text{Net Acidity } (\%_{Sulphur}) = (S_{pos} \text{ or } S_{Cr}) + TAA + S_{RAS} - ANC / FF$$

Where, S_{pos} or S_{Cr} is potential acidity (from SPOCAS suite or chromium suite)
s-TAA is actual acidity
S_{RAS} or S_{NAS} or is retained acidity (from SPOCAS suite or chromium suite)
ANC is acid neutralising capacity
FF is Fineness Factor of soils

10.5 Management Options for Treated ASS

10.5.1 On-site Reuse of Treated ASS

It is considered that the successfully treated ASS (natural soils) can be made suitable for use for any backfilling where there is no significant interaction with the surrounding soils (i.e. no mixing with other soils) and groundwater.

In terms of fill soils at the site, further contaminant testing may be required to determine suitability for re-use.

10.5.2 Disposal of Treated ASS

Waste classification and disposal of soil must be conducted in accordance to EPA *Waste Classification Guidelines* (EPA, 2014) and the POEO Act.

Part 4 (Acid Sulphate Soils) of EPA (2014) states the following:

- AASS must be treated (neutralised) prior to disposal to an appropriately licenced waste facility; and
- Following treatment (i.e. neutralisation), the soil must be chemically assessed (in accordance to Step 5, Part 1 EPA (2014)) to determine the classification of the waste.

The sampling density and analytes to be tested will depend on the volume of material being assessed and the risk of contamination in the material and is to be advised by the Environmental Consultant.

Once the classification has been established, the soil should be disposed of to a landfill that can lawfully accept that class of waste. Prior arrangements should be made with the landfill to ensure that it is licensed to accept the waste. The landfill should be informed that the ASS have been treated in accordance with the neutralising techniques outlined in this ASSMP, and that the waste has also been classified in accordance with EPA (2014).

It may also be possible to seek a specific exemption under the NSW EPA's Guidelines on Resource Recovery Exemptions (Land Application). If compliant with the guidelines, the EPA may grant an exemption to allow treated ASS to be re-used in a beneficial manner as filling on another development site, subject to conditions set out in the guidelines.

11. Final Validation and Monitoring Program

11.1 Finished Site Levels

The proposed works at the site will require some on site excavations and regrading, and the importation and compaction of other soils to raise site levels and improve drainage. Previous sections of this CMP outline the procedures for assessing and approving soils used as part of the overall filling process. The following validation process is intended to validate that the finished profile is suitable for the intended land use. The validation program is intended to be implemented prior to surface treatments (e.g. turf) outside of building footprints.

- Set out a 30 m square grid across the finished surface of the site;
- At each location use hand tools or a small push tube probe rig to construct small diameter bores to a depth of 1 m below ground surface level;
- Recover soil samples at the surface (0-0.15 m), then at 0.5 m and 1.0 m;
- Use a field portable PID to measure volatile gases in the soil samples;
- Analyse recovered soil samples for metals, TRH, BTEX, PAH and asbestos. Where elevated PID readings are recorded samples will also be analysed for VOC. Samples in the north-west quarter, or originating from the north-west quarter will also be analysed for pesticides and herbicides;
- Include industry standard quality assurance and quality control samples;
- Assess analyte concentrations against the SAC in Section 7.3 of this CMP; and
- Prepare a validation report.

Should any areas of the site be found to present a human health risk to future maintenance works or users of the site, the Environmental Consultant will formulate a management plan to mitigate the risk, which may involve localised remediation / replacement of soils.

11.2 Soil Vapour

11.2.1 Proposed Buildings

As stated in Section 9.1, the risers forming part of the vapour mitigation system for the new buildings will be fitted with two access ports at each building to enable sampling and testing of the vapour as part of a monitoring program. A gas tight cap with quick connect fitting will be inserted into the sampling point. The monitoring of the risers will be conducted as follows:

- Initial monitoring will be undertaken weekly for four weeks from installation. Subsequent monitoring will be undertaken quarterly for a period of two years, then reverting to biannually;
- At each event the exposed components of the vapour mitigation system will be inspected for damage, leaks or blockages;
- General gas readings will be measured using a GA5000 landfill gas analyser;
- A PID reading of the VOC levels will be undertaken over a 5-minute period to (a) obtain a PID reading and (b) purge the sampling tube;

- The sampling tube will be attached to a suma canister with a regulator set to collect a sample at a rate of 100 ml/min over a period of 8 hours;
- The sample canister will be labelled and the COC recorded the sample name, date and time the sample is collected, the canister and flow controller serial numbers, and the initial and final vacuum gauge readings;
- Samples will be analysed at a NATA accredited laboratory for VOCs, TRH and BTEX; and
- Indoor air monitoring including a PID sweep of the building, set out and collection of three indoor air suma canisters and laboratory analysis for VOC, TRH and BTEX will be undertaken.

12. Worker Health and Safety

12.1 Potential Health and Safety Hazards

A summary of potential landfill-related worker health and safety hazards, relevant to the proposed construction works, extracted from Table 10.1 of the RLMP is presented below. The hazards listed below should be considered in developing project specific Safe Work Method Statements.

Table 4: Potential Landfill-related health and safety hazards

Activity	Potential Hazard
Soil disturbance below the capping layer (e.g. digging, earthmoving, excavations, construction)	• Dermal chemical contact; • Asbestos contact; • Vapour chemical contact; • Explosive gases
Construction / welding / drilling	• Vapour chemical contact; • Explosive gases; • Grassfire
Subterranean services – installation (e.g. plumbing, drainage, pipework, electrical, telecommunications, gas)	• Dermal chemical contact; • Vapour chemical contact; • Low oxygen levels; • Explosive gases
Landscaping	• Dermal chemical contact with seeps or overflows; • Vapour chemical contact, particularly within fenced piezometer and pump pit enclosures; • Explosive gases; • Grassfire

Activity	Potential Hazard
Site Monitoring (e.g. inspection, sampling)	• Dermal chemical contact with seeps or spills; • Vapour chemical contact • Explosive gases

12.2 Site Induction

All employees engaged at the site, sub-contractors, and visitors should be inducted into the site. All site personnel are to sign off an induction statement to acknowledge full understanding of site activities, rules and requirements, including a familiarity with this CMP. A record of site inductions should be kept on file.

12.3 Personal Protective Equipment

All personnel on site are required to wear the following personnel protective equipment (PPE), as a minimum, at all times:

- Steel-capped boots;
- High visibility clothing; and
- Hard hat

The following additional PPE is to be worn as required:

- Hearing protection meeting AS1270-1988 requirements when working around machinery or plant equipment if noise levels exceed exposure standards;
- Safety glasses or safety goggles with side shields meeting AS1337-1992 requirements (as necessary);
- Half-face or full face P1/P2 respirator (as required);
- Nitrile work gloves meeting AS2161-1978 requirements or heavy-duty gauntlet gloves; and
- Any additional protection identified by the Environmental Consultant.

In the event that personnel are required to work in areas of potential contact with asbestos containing materials, the following additional protection will be required:

- Disposable coveralls to prevent contact with asbestos containing materials; and
- Particulate respirator (Class P2) or equivalent.

Excavation, handling, stockpiling, transport etc. of materials containing asbestos must be undertaken by a licensed contractor in accordance with should be undertaken in accordance with relevant regulatory requirements.

12.4 Air Monitoring

As mentioned previously, the potential for vapour impacts at the ground surface or in excavations off-site is considered to be low. However, as a precautionary measure, it is recommended that some form of air monitoring is undertaken in excavations, utility lines and trenches at (a) the opening of existing utility lines, pits or trenches and (b) during and at completion of new excavations. The following air monitoring protocols are recommended:

- Air monitoring to be conducted by a qualified environmental consultant using a pre-calibrated photo-ionisation detector (PID) fitted with an 11.7 eV lamp or a flame ionisation detector (FID);
- Total photo-ionisable/flame-ionisable concentrations exceeding 5ppm (time weighted average exposure level for vinyl chlorine and benzene) will be considered as the trigger level at which a confined space definition will be triggered). At this level, the contractor will cease works until advised by the environmental consultant;
- The works in the affected area will be deemed confined space works and the requirements of the WHS Regulation will be implemented. Ambient air monitoring will also be undertaken to a distance of up to 10m from the occurrence to assess potential impacts on workers and the general public; and
- Should workers involved in the excavation works detect unusual odours at any time, works will cease in that area.

13. Contingencies

13.1 Additional Contamination Finds / Unexpected Finds Protocol

All site personnel are required to report additional / unexpected signs of environmental concerns to the Site Manager if observed during the course of their works e.g. presence of ACM, petroleum, tar or other chemical odours, unnatural staining, or chemical spills.

The following protocol is based on Section 9 *Management of Unexpected Waste* included in the RLMP:

Should signs of concern be observed, the Contractor is to, as soon as practical:

- Restrict access to the area via placement of barricades;
- Cease work in that area. Covering of the surface with a geofabric or similar is also to be undertaken, where required;
- Report the location and nature of the waste to SOPA and the Site Manager;
- Notify authorities needed to obtain emergency response for any health or environmental concerns (e.g. fire brigade);
- Notify any of the authorities that the Contractor is legally required to notify (e.g. EPA, Council); and
- Notify the Environmental Consultant.

Following the immediate response outlined above a contingency plan is to be implemented.

13.2 Contingency Plan

The contingency plan for the site is as follows:

- The Environmental Consultant (or Occupational Hygienist as appropriate) is to inspect the issue of concern and determine the nature of the issue and the appropriate approach to assessing or (if appropriate) managing the issue;
- The Environmental Consultant (or Occupational Hygienist as appropriate) is to undertake an assessment considered necessary to determine the management strategy for the area. Assessment of occupational, public and environmental risk should be considered, particularly potential explosive or toxic gases, toxic chemicals and buried unexploded ordnance;
- If unexpected contamination is found and remediation action is considered necessary, a remediation strategy for the area is to be prepared by the Environmental Consultant; and
- Place excavated material back into the trench or remove it from the site. Any material to be removed from site must be placed in labelled skip bins or stockpiled as instructed by the Environmental Consultant and tested for subsequent disposal to a licenced facility.

13.3 Disposal of Waste

Section 1.4 - *Site Redevelopment* of the RLMP provides guidelines for handling surplus waste as presented below:

- Land remediation works should, as far as physically and technologically possible, result in no off-site disposal of any contaminated or treated landfill waste material;
- Land-use options and/or building technologies that would allow existing contaminated material to be contained and consolidated in-situ are always preferred;
- Where on-site retention of contaminated or treated landfill waste material is not practically, technologically, environmentally or economically feasible, site remediation works should be conducted in a manner that minimises off-site disposal of contaminated or treated landfill waste material; and
- Where proposed remediation works would involve extensive off-site disposal of contaminated or treated landfill waste material of total site waste material, such works are only permitted after detailed investigations have been undertaken that demonstrate retention in-situ or relocation within SOP is not practically or technically feasible, and it is contrary to interests of public health, the environment and/or the viability of SOP.

As stated previously, it is understood that all surplus spoil is to be retained on site and capped. However, should off-site disposal be necessary, the following would apply.

13.3.1 Waste Classification Assessment

A waste classification assessment in accordance with the NSW EPA Waste Classification Guidelines (2014) and the POEO Act will need to be undertaken during construction works to classify material for off-site disposal. All soils that are disposed off-site must have a formal waste classification report.

Copies of all necessary approvals from the receiving site must be given to the Site Manager and SOPA prior to any contaminated material being removed from the site.

Should assessment of stockpiled soils be required, the sampling frequency, assessment will be based on the volume of material, the contamination risk and homogeneity of the material, to be determined by the Environmental Consultant. An indicative sampling frequency is given below:

- Stockpiles ≤250 m^3: one sample per 25-50 m^3 or a minimum of three samples;
- Stockpiles >250 m^3: one sample per 50-250 m^3 and a minimum of ten samples; and
- For stockpiles which are observed to have heterogenous fill, an increased sampling frequency is likely to be necessary.

During excavation and stockpiling of material, and prior to loading out, the material is to be periodically inspected (and sampled if required) by the Environmental Consultant to confirm the waste classification.

13.3.2 Transport of Spoil

Transport of spoil must be appropriately managed via clearly delineated, pre-defined haul routes. Copies of all consignment notes for the transport, receipt and disposal of all materials are to be maintained as part of the site log and made available to the Environmental Consultant for inspection and reporting purposes upon request.

All relevant analysis results, as part of waste classification reports, are to be made available to the Contractor and proposed receiving site/ waste facility to enable selection of a suitable disposal location which is legally able to accept the waste.

13.3.3 Waste Tracking Requirements

The transportation of hazardous waste should be tracked, with reference to Part 4 of the POEO (Waste) Regulation 2014. Waste tracking involves:

- Obtaining approval from the EPA for the hazardous waste to be transported;
- Completing required documentation;
- Ensuring all parties are authorised to transport and receive the waste

The EPA website also provides a list of waste descriptions that must be tracked when transported within NSW or interstate.

It is noted that there are special requirements for tracking the transport and disposal of asbestos waste, under parts 6 and 7 of the Waste Regulation.

14. Closure

Following the processes outlined in this CMP will achieve the stated objectives listed in Section 1.1 and will enable the site to be appropriately managed with minimal risk to the workers involved in the construction and minimal risk of environmental harm.

This CMP must form part of the contractor's approved CEMP for the works.

15. Limitations

Douglas Partners (DP) has prepared this report for this project at 4 Newington Road, Silverwater in accordance with DP's proposal SYD190618 dated 15 August 2019. The work was carried out under DP's Conditions of Engagement. This report is provided for the exclusive use of Cox Architecture Pty Ltd on behalf of the client, NSW Cricket Association for this project only and for the purposes as described in the report. It should not be used by or relied upon for other projects or purposes on the same or other site or by a third party. Any party so relying upon this report beyond its exclusive use and purpose as stated above, and without the express written consent of DP, does so entirely at its own risk and without recourse to DP for any loss or damage. In preparing this report DP has necessarily relied upon information provided by the client and/or their agents.

The results provided in the report are indicative of the sub-surface conditions on the site only at the specific sampling and/or testing locations, and then only to the depths investigated and at the time the work was carried out. Sub-surface conditions can change abruptly due to variable geological processes and also as a result of human influences. Such changes may occur after DP's field testing has been completed.

DP's advice is based upon the conditions encountered during this investigation. The accuracy of the advice provided by DP in this report may be affected by undetected variations in ground conditions across the site between and beyond the sampling and/or testing locations. The advice may also be limited by budget constraints imposed by others or by site accessibility.

This report must be read in conjunction with all of the attached and should be kept in its entirety without separation of individual pages or sections. DP cannot be held responsible for interpretations or conclusions made by others unless they are supported by an expressed statement, interpretation, outcome or conclusion stated in this report.

This report, or sections from this report, should not be used as part of a specification for a project, without review and agreement by DP. This is because this report has been written as advice and opinion rather than instructions for construction.

The contents of this report do not constitute formal design components such as are required, by the Health and Safety Legislation and Regulations, to be included in a Safety Report specifying the hazards likely to be encountered during construction and the controls required to mitigate risk. This design process requires risk assessment to be undertaken, with such assessment being dependent upon factors relating to likelihood of occurrence and consequences of damage to property and to life. This, in turn, requires project data and analysis presently beyond the knowledge and project role

respectively of DP. DP may be able, however, to assist the client in carrying out a risk assessment of potential hazards contained in the Comments section of this report, as an extension to the current scope of works, if so requested, and provided that suitable additional information is made available to DP. Any such risk assessment would, however, be necessarily restricted to the (geotechnical / environmental / groundwater) components set out in this report and to their application by the project designers to project design, construction, maintenance and demolition.

Douglas Partners Pty Ltd

Appendix A

About This Report

Drawings

About this Report

Douglas Partners

Introduction

These notes have been provided to amplify DP's report in regard to classification methods, field procedures and the comments section. Not all are necessarily relevant to all reports.

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

Copyright

Borehole and Test Pit Logs

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

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

Groundwater

Where groundwater levels are measured in boreholes there are several potential problems, namely:

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

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

Reports

The report has been prepared by qualified personnel, is based on the information obtained from field and laboratory testing, and has been undertaken to current engineering standards of interpretation and analysis. Where the report has been prepared for a specific design proposal, the information and interpretation may not be relevant if the design proposal is changed. If this happens, DP will be pleased to review the report and the sufficiency of the investigation work.

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

- Unexpected variations in ground conditions. The potential for this will depend partly on borehole or pit spacing and sampling frequency;
- Changes in policy or interpretations of policy by statutory authorities; or
- The actions of contractors responding to commercial pressures.

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

About this Report

Site Anomalies

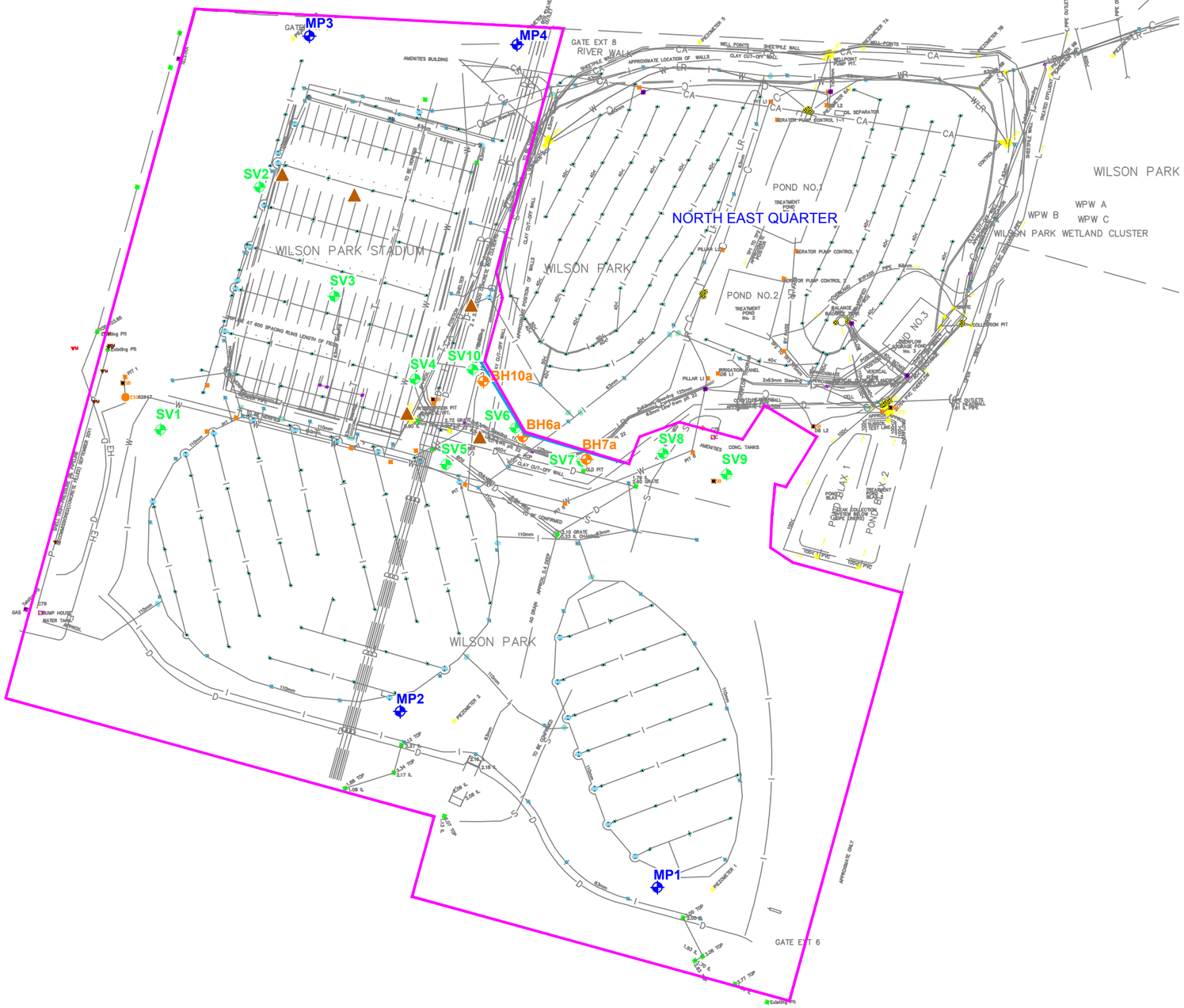
In the event that conditions encountered on site during construction appear to vary from those which were expected from the information contained in the report, DP requests that it be immediately notified. Most problems are much more readily resolved when conditions are exposed rather than at some later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

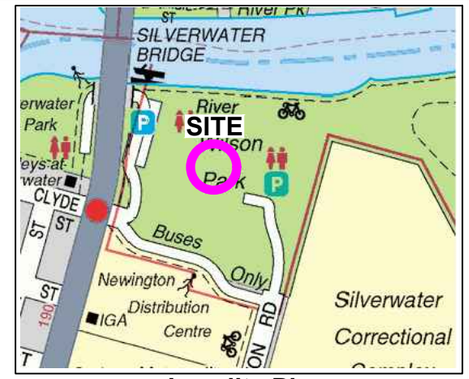
Information for Contractual Purposes

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

Site Inspection

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





Locality Plan

NOTE:
1: Base image from Sydney Olympic Park Authority (Dwg 085-P-P-0176REV.N, Dated 2.7.2019)
2: Test locations are approximate only and have been estimated based on historical drawings with reference to existing features.

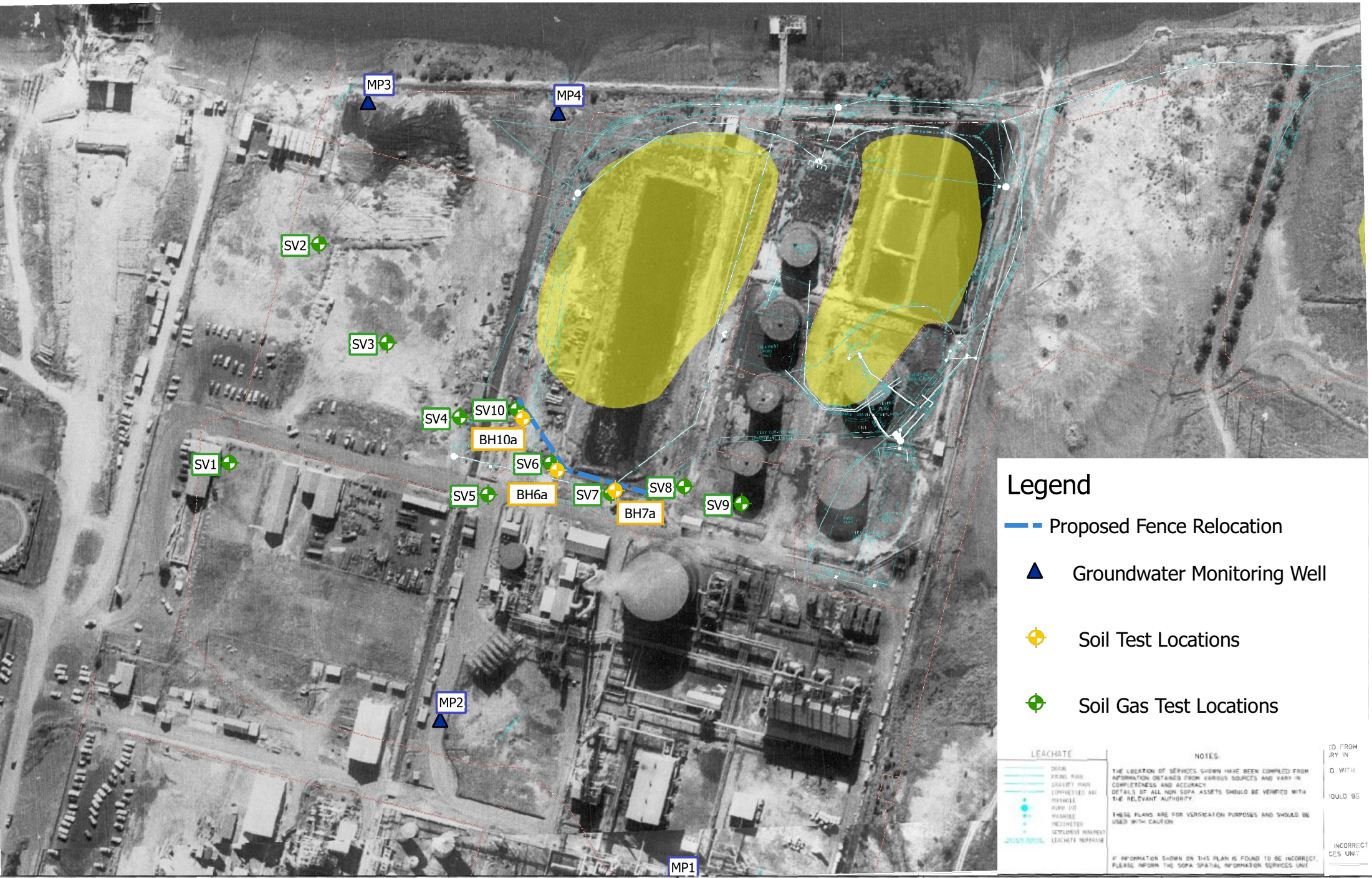
LEGEND

- Soil gas probes (10)
- Soil sampling (3)
- Groundwater monitoring well
- Soil probe locations (1999) with PID >20pm all at depths of 0.5m
- Site boundary
- Proposed fence relocation

Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT: Cox Architecture pty Ltd		TITLE: **Test Location Plan** **Western Sydney Cricket and Community Centre** **Wilson Park, SILVERWATER**
OFFICE: Sydney	DRAWN BY: PSCH	
SCALE: 1:2000 @ A3	DATE: 4.9.2019	

PROJECT No:	86694.03
DRAWING No:	1
REVISION:	0



NOTES

SYDNEY OLYMPIC PARK

WILSON PARK

Plan Showing Leachate Infrastructure, Extents of Waste and Fence Lines (Date of Photography: 1961)

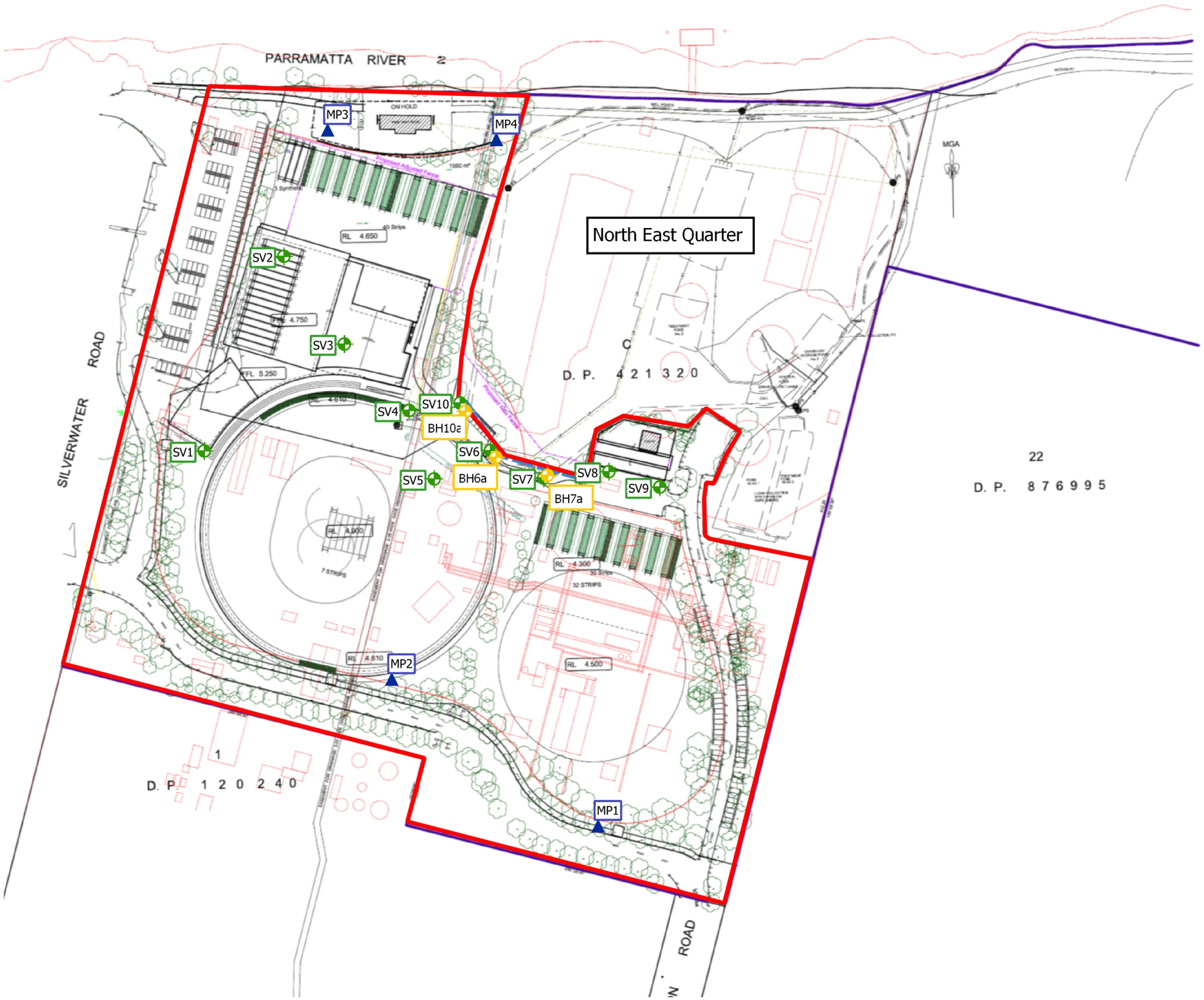
SYDNEY OLYMPIC PARK AUTHORITY

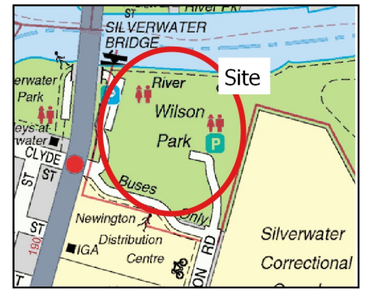
DISTRIBUTION CONTROL

SydneyOlympicPark

DRG. NO. : 085-P-P-0183 REV. A

SCALE : AS PER SCALE BAR





Locality Plan

Legend

- Groundwater Monitoring Well
- Soil Test Locations
- Soil Gas Test Locations
- Proposed Fence Relocation
- Site Boundary

0 50 100 150 200 m

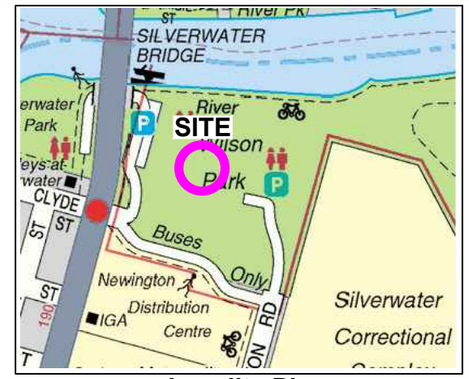
Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT:	Cox Architecture Pty Ltd		
OFFICE:	Sydney	DRAWN BY:	AD
SCALE:	1:2200 @ A3	DATE:	9/9/2019

TITLE: **Test Location Plan**
Western Sydney Cricket and Community Centre
Wilson Park, SILVERWATER

N

PROJECT No:	86694.03
DRAWING No:	3
REVISION:	0



Locality Plan

NOTE:
1: Base image from Nearmap.com (Dated 1.7.2019)
2: Test locations are approximate only and have been estimated based on historical drawings with reference to existing features.

LEGEND

PREVIOUS INVESTIGATION
- DP borehole and CPT (Proj. 23775 F& J, 1999 to 2000)
- DP borehole (Proj. 35205, 2002)
- CMPS&F borehole (1998)
- Groundwater Technologies borehole (1994)
- DP borehole and DCP (Proj. 73318, 2013)
- DP borehole (Proj. 84455, 2014)
- DP borehole (Proj. 86146, 2017)

CURRENT INVESTIGATION
- CPT
- CPT and CBR/ Atterberg limits sample
- Geotechnical Cross Section A-A'

Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT: Cox Architecture Pty Ltd		TITLE: **Test Location Plan**	PROJECT No: 86694.02
OFFICE: Sydney	DRAWN BY: PSCH	**Western Sydney Cricket and Community Centre**	DRAWING No: 1[01]
SCALE: 1:2000 @ A3	DATE: 16.8.2019	**Wilson Park, SILVERWATER**	REVISION: 0

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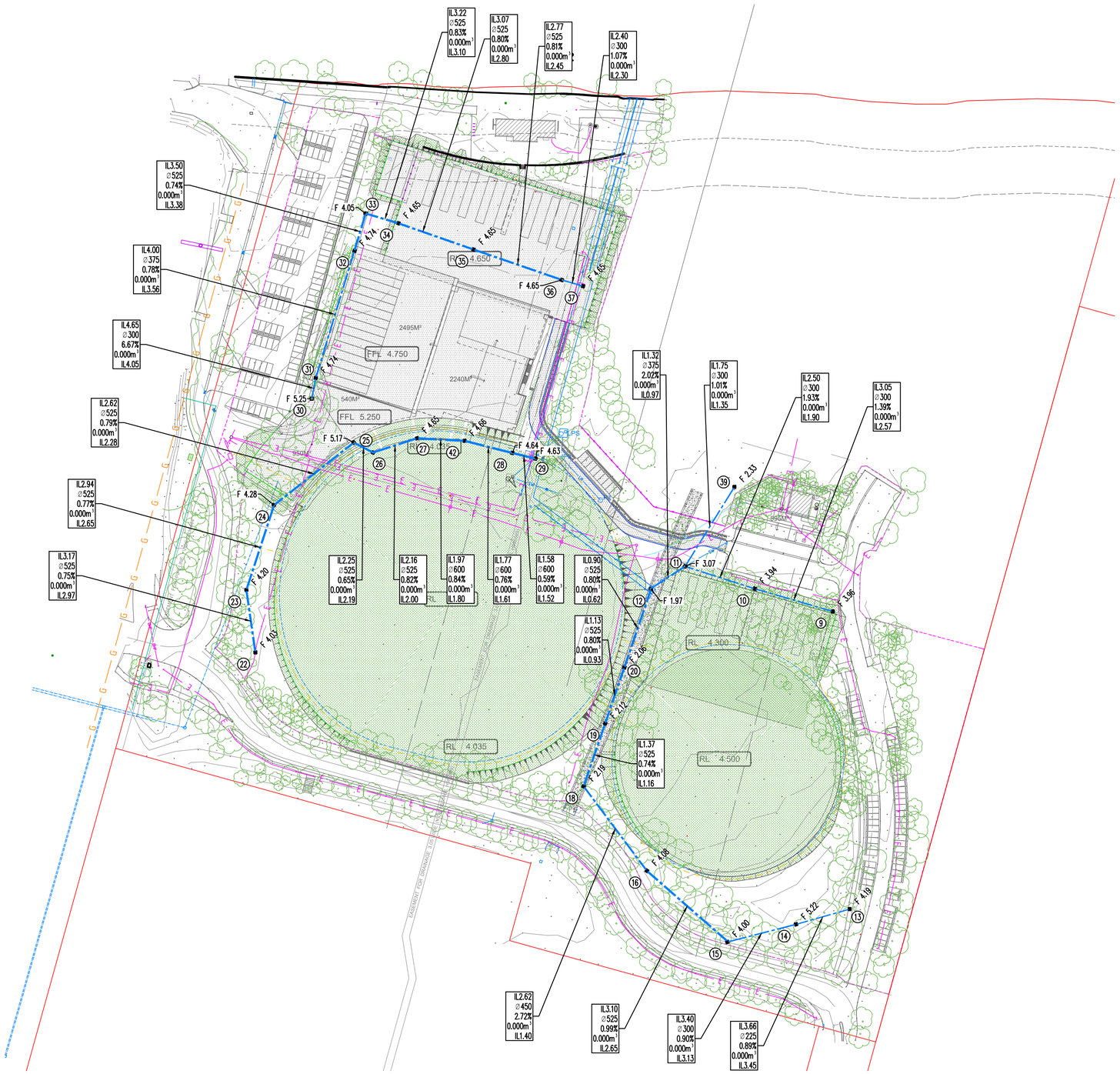

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AT ORIGINAL SIZE

FileName: C06.dwg – USER: andreas – Plot File Created: Aug 29, 2019 - 2:08pm

PRELIMINARY

Rev	Description	Eng	Draft	Date
P1	PRE SSDA	SB	AS	29.08.19

Architect
COX ARCHITECTURE
155 Clarence St, Sydney NSW 2000

Civil Engineer
Taylor Thomson Whitting
612 9439 7288 | 48 Chandos Street St Leonards NSW 2065

Project
CNSW WESTERN SYDNEY CRICKET & COMMUNITY CENTRE, SILVERWATER

Sheet Subject
OVERALL STORMWATER PLAN

Scale : A1 1:1000
Drawn AS
Authorised
Job No 191180
Drawing No C06
Revision P1
Plot File Created: Aug 29, 2019 - 2:08pm

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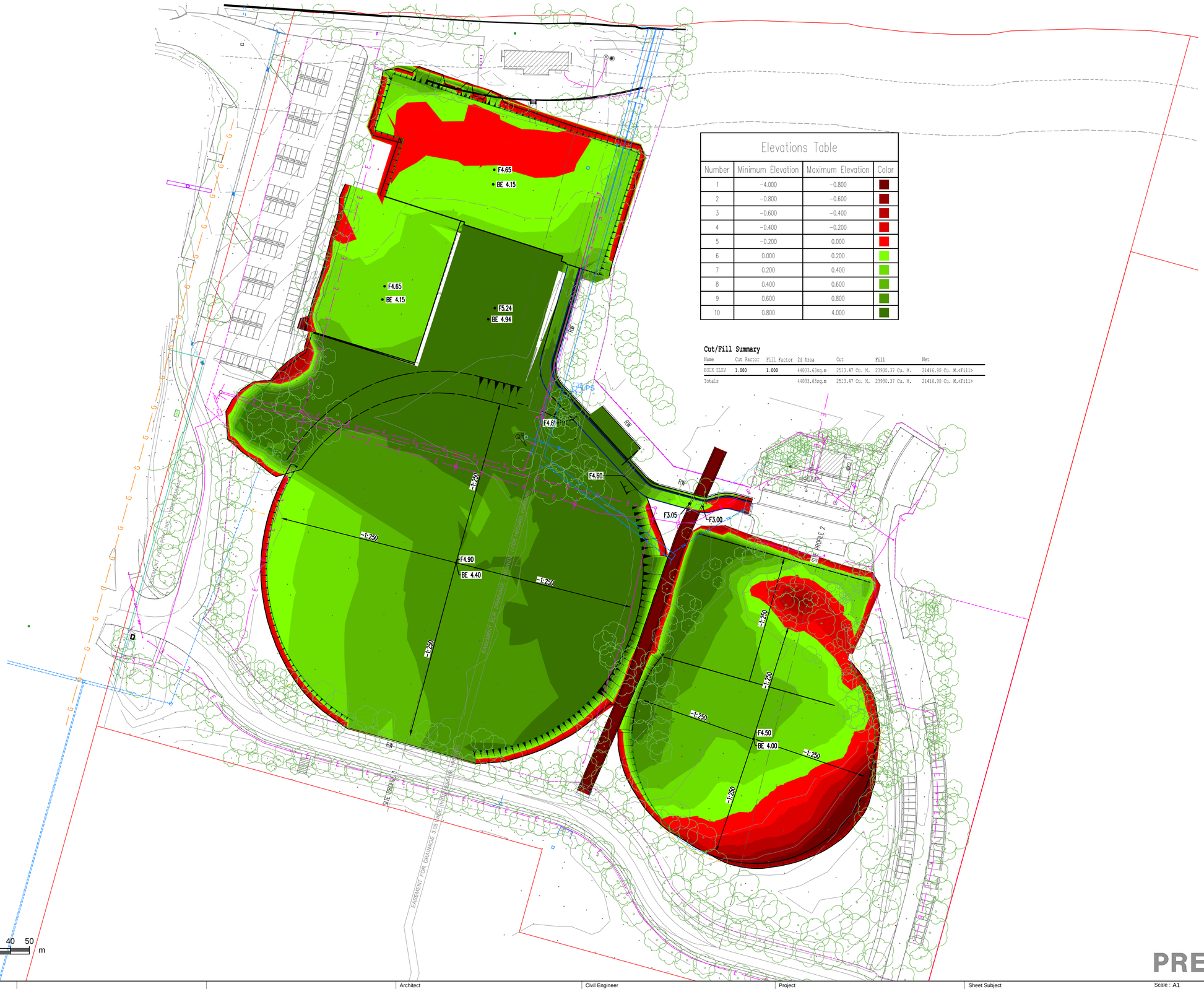

Elevations Table

Number	Minimum Elevation	Maximum Elevation	Color
1	-4.000	-0.800	
2	-0.800	-0.600	
3	-0.600	-0.400	
4	-0.400	-0.200	
5	-0.200	0.000	
6	0.000	0.200	
7	0.200	0.400	
8	0.400	0.600	
9	0.600	0.800	
10	0.800	4.000	

Cut/Fill Summary

Name	Cut Factor	Fill Factor	2d Area	Cut	Fill	Net
BULK ELEV	1.000	1.000	44033.63sq.m	2513.47 Cu. M.	23930.37 Cu. M.	21416.90 Cu. M.<Fill>
Totals			44033.63sq.m	2513.47 Cu. M.	23930.37 Cu. M.	21416.90 Cu. M.<Fill>

SCALE 1:1000 0 10 20 30 40 50 m
AT ORIGINAL SIZE

FileName: C07.dwg - USER: andreas - Plot File Created: Aug 29, 2019 - 1:48pm

PRELIMINARY

Rev	Description	Eng	Draft	Date
P1	PRE SSDA	SB	AS	29.08.19

Architect
COX ARCHITECTURE
155 Clarence St, Sydney NSW 2000

Civil Engineer
Taylor Thomson Whitting
612 9439 7288 | 48 Chandos Street St Leonards NSW 2065

Project
CNSW WESTERN SYDNEY CRICKET & COMMUNITY CENTRE, SILVERWATER

Sheet Subject
OVERALL BULK EARTHWORKS PLAN

Scale : A1 1:1000 | Drawn AS | Authorised

Job No 191180 | Drawing No C07 | Revision P1

Plot File Created: Aug 29, 2019 - 1:48pm

Appendix B

RLMP Extracts

Table 3.10.1 Wilson Park key management objectives and management targets

OBJECTIVE	RESPONSE	MONITORING*	MANAGEMENT TARGETS
Comply with conditions of a Notice issued under the *Contaminated Lands Management Act 1997*	Manage Wilson Park as per approved uses: • Park, recreational open space,playing field (south-east, south-west and north-west sectors) • Passive recreation (wetlands) • No public access (north east sector ie Bioremediation area) and in accordance with the Remediated Lands Management Plan and associated procedures	Regular review of Remediated Lands Management Plan and associated procedures for effectiveness.	1. An auditor-approved Remediated Lands Management Plan is developed and implemented. Requirements of the Remediated Lands Management Strategy are applied to all management, operation and development activities. 2. An auditor-approved site-specific environmental monitoring program is implemented 3. No alteration of landforms, or excavations below 0.5m, without regulatory authority approval 4. Bioremediation area is fenced to control public access 5. No public access to wetlands surface water or sediments
Maintain integrity of waste containment	Waste exposure and surface water infiltration managed by waste encapsulation and surface capping	Regular visual inspections	6. System components in good condition 7. No evident surface cracks, fissures, erosion or exposure of waste in containment mounds. 8. No tarry odours emanating from the surface of the containment mounds. 9. No discoloured soil or pools of visually evident leachate at toe and batter (particularly after heavy rain when groundwater tables are elevated). 10. No visual DNAPL seeps or tarry odours through the foreshore clay or seawall (eg after bank erosion). 11. Proper reinstatement after excavations so erosion risk is minimised. 12. Perimeter fence is secure.
Manage VOC emissions from containment mounds	Capping on the mounds is managed to promote a vigorously-growing turf biofilter, which promotes the proliferation of indigenous hydrocarbon degrading microorganisms in the soil	Regular visual inspection; soil testing as required	13. Vigorously-growing grass cover on mounds, with no evident vegetation die-off or bare patches. 14. Soil moisture levels are sufficient to promote grass growth on containment mounds, with irrigation applied as required

OBJECTIVE	RESPONSE	MONITORING*	MANAGEMENT TARGETS
Prevent leachate migration to the Parramatta River	Cut-off walls isolate contaminated groundwater from the containment mounds and treatment area Leachate collection and transfer system is managed to maintain an inward hydraulic gradient between the Parramatta River and the containment area. Subsurface drainage system installed in north-west sector of Park that directs potentially-contaminated subsurface flows to the central drain and PP22	SCADA Static water level and chemical monitoring	15. RL of deep aquifer is below RL of Parramatta River to maintain an inward hydraulic gradient between the Parramatta river and bioredediation area *(current pump setting PP21 RL99.2)* 16. RL of shallow aquifer is below RL of Parramatta River to maintain an inward hydraulic gradient between the Parramatta River and bioremediation area *(current pump settings PP23 RL98.7; PP24 RL99.2)* 17. Piezometers MP6A and 7A confirm deep aquifer RL characteristics and MP6B and 7B confirm the shallow aquifer RL characteristics. Monitor groundwater levels and water quality at defined monitoring sites 18. Groundwater level of north-west sector (controlled at PP22) is RL 100.5 *(2.6m below the ground surface)* 19. Key leachate indicators not detected in groundwater: • Piezometers MP1, MP2 monitor potential on-site migration of contaminants from land south of the Park • Piezometers MP3-MP9 monitor potential off-site migration of contaminants to the river 20. Integrity and gradient of north west sector is maintained (gradient slopes from north to south) 21. Leachate drains are operating freely – as confirmed by pump operational data
DNAPL levels are managed to prevent pump damage	DNAPL is pumped out before it reaches a level that interferes with pump operation	Drexelbrook level sensors and inspections	22. DNAPL; levels do not reach within 0.5 metre of pump, in pits PP21, PP24
Biologically treat contaminated water to a standard that allows off-site discharge	Biological treatment pond are managed to maintain suitable conditions for biological processes Pond oil separator is managed, biofilters are maintained/replenished, and water quality and nutrient levels are adjusted, as required to promote	Chemical, physical and biological monitoring of treatment ponds and associated infrastructure	23. Pond water quality parameters are kept within tested optimal levels for micro-organism growth, i.e. maximum salinity of 40,000 uS/cm, pH range 7 - 9, dissolved oxygen >6.5mg/L; temperature range 10 °C to 25 °C; C;N:P ratio of 40:1:0.1.

OBJECTIVE	RESPONSE	MONITORING*	MANAGEMENT TARGETS
	microbial growth		
Discharges to Parramatta River comply with Licence criteria	Test treated leachate in Pond 3 and PP22 before any discharge to River to demonstrate it meets DECC Licence discharge criteria. Treat at licensed discharge facility if any criteria failure.	Pond water level Water chemical and physical parameters monitored prior to discharge	24. Pond 3 does not exceed 50% capacity so risk of overland flows during rain events are minimised 25. Water tested in Pond 3 meets all Licence discharge criteria before any release to Parramatta River 26. Water from PP22 meet all Licence discharge criteria before any release to Parramatta River

* see section 11 for detailed program

8.1 Standard Work Method: Minor excavation works on remediated landfills at Sydney Olympic Park

8.1.1 Purpose

This method applies to approved minor excavation works in any of the lands identified in the Plan: Sydney Olympic Park Remediated Landfill Systems (Drawing 001-GG-0112) as subject to a CLM s28 notice.

8.1.2 Background

Remediation of Sydney Olympic Park has resulted in the formation of ten engineered remediated landfill areas. Typically these have 1 metre of clay capping over a consolidated waste containment mound, and subsurface cut-off walls and drainage systems. Disturbance to the cover and subsurface infrastructure must be managed to minimise environmental and health risks. Excavations deeper than 0.5m are prohibited on remediated landfills, except with the approval of the Department of Environment and Climate Change. Approval has been granted for certain types of excavations, where they are conducted in accordance with this Standard Work Method. SOPA must report on such excavations annually.

8.1.3 Responsibility

The SOPA Project Manager is responsible for ensuring:

- compliance with the Parklands Plan of Management (excavations over 0.5m deep are identified as a 'restricted activity' in relevant precincts)
- proposed excavations are of a type approved by DECC, and identified in this Standard Work Method
- this Work Method Statement is appropriately incorporated into relevant tender briefs, and contractor Work Permit Applications, and is implemented during the works.
- records of completed works (precinct, date, purpose and nature of work) are provided to SOPA Manager Environment & Ecology for reporting to DECC.
- Contractors are responsible for conducting works in accordance with approval conditions

8.1.4 Scope

This procedure applies only to works or activities that result in disturbance of a total land surface area of not more than 80m2 and that are listed in Table 8.1. It does NOT apply to major remediation works or where major excavation activities are required for construction of buildings. In these instances separate approval from the regulatory authority is required.

All permitted works must be conducted in accordance with the minor excavation works procedure (s8.1.5).

Table 8.1 Minor excavation works conditionally approved by DECC

Minor excavation works (deeper than 0.5m) permitted if the activity disturbs **no more than 80 square metres** of land surface area and **will not** result in the penetration of the clay capping

- Installation or investigation of services (gas, electricity, water, sewage, irrigation, leachate or communications) by means of open-cut or horizontal boring
- Installation or removal of posts, poles or support structures
- Installation of pathways or drainage lines
- Installation or removal of trees
- Installation or decommissioning of piezometers
- Environmental or geotechnical investigations
- Test pit investigations
- Emergency restoration works
- Other excavation and trenching activities that are part of a routine maintenance program

Minor excavation works (deeper than 0.5m) permitted if the activity disturbs **no more than 80 square metres** of land surface area and **will** result in the penetration of the clay capping or the disturbance of the buried waste

- Installation or decommissioning of groundwater monitoring/extraction wells or piezometers
- Installation or removal of posts, poles or support structures
- Environmental or geotechnical investigations resulting in minimal disturbance of waste oand creation of spoil, or
- Removal of trees

All permitted works must be conducted in accordance with standard Work Method

8.1.5 Minor Excavation Works Procedure

All works

1. Check proposed works are consistent with Table 8.1
2. Identify underground services and endangered species habitats within the works footprint
3. Obtain a SOPA Work Permit
4. Cordon the works footprint off from the general public
5. Separate excavated topsoil and capping for reuse
6. Store excavated material on the high side of the excavation so that any liquid travels back into the pit.
7. Where stockpiles are kept for more than one day: cover excavated material and place erosion control measures around them
8. At the completion of works, replace excavated material in the reverse order that it was removed
9. Replace clay capping in 300mm layers
10. Compact each layer with a powered compactor (whacker-packer) to a compaction density of 98%
11. Replace 100mm topsoil on clay capping
12. Fully restore landscape and irrigation
13. Use any excess spoil (from capping or topsoil) on-site for landscaping (this material has been previously validated; further validation is not required), or dispose off-site to a licensed landfill
14. Survey the location of new ground levels or new services/structures; provide information to SOPA CADD unit in electronic format within one week of completion of works

Works that penetrate the clay capping

Gas detection

15. Monitor gas levels during works
16. If methane levels exceed 5% LEL, implement constant natural airflow
17. Address risk of accumulated gas in the design and construction of new structures – fill voids or include ventilation in design

Compaction of replaced waste

18. Compact waste with excavator bucket while being placed back into the excavation
19. Place liner or geofabric on top of waste prior to compacting the clay capping

Spoil from the waste mass

20. Place spoil from within the waste mass into labelled drums or skips. Test material for subsequent disposal to a licensed facility (at the contractors expense)
21. Seal all drums and bins, and cordon the area if contractors leave the worksite.

Survey

22. Survey the exact worksite bounaries to provide baseline information for assessing possible settlement. Provide information to SOPA CADD unit in electronic format within one week of completion of works

Installation of poles, piezometers, other structures

23. Fill the void around the structure with a cement/bentonite (1:9 mix) slurry mix to the surface
24. Pump the slurry under pressure to avoid bridging
25. If the structure is hollow, fill it with a cement/bentonite slurry to the ground surface, or vent it, to avoid gas build-up (excluding piezometers)

Decomissioning/removal of structures

26. Fully remove the structure from the ground where possible
27. Fill the void with a cement/bentonite (1:9 mix) slurry mix (or a compacted validated clay) to 500mm from the surface
28. Restore and compact the clay capping, topsoil & landscaping
29. If it is not possible to remove the structure from the ground: cut it 500mm below the ground surface. If hollow, fill it with a cement/bentonite (1:9 mix) slurry mix. To avoid bridging, pump slurry under pressure.

Appendix C

Site Assessment Criteria

SITE ACCEPTANCE CRITERIA

The Site Acceptance Criteria (SAC) to be applied for the project is informed by the preliminary conceptual site model which identified receptors to potential contamination (refer to Section 6). Analytical results are assessed (as a Tier 1 assessment) against the SAC comprising investigation levels, screening levels and management limits of Schedule B1 of NEPC, 2013. The NEPC guidelines are endorsed by NSW EPA under the CLM Act 1997.

The investigation levels, screening levels and management limits are applicable to generic land use settings and include consideration of, where relevant, the soil type and the depth of contamination. The investigation and screening levels are not intended to be used as clean up levels. Rather, they establish concentrations above which further appropriate investigation (e.g. Tier 2 assessment) should be undertaken. They are intentionally conservative and are based on a reasonable worst-case scenario.

1.0 Health Investigation and Screening Levels

The Health Investigation Levels (HIL) and Health Screening Levels (HSL) are scientifically-based, generic assessment criteria designed to be used in the first stage (Tier 1) of an assessment of potential human health risk from chronic exposure to contaminants.

HIL are applicable to assessing health risk arising via all relevant pathways of exposure for a range of metals and organic substances. The HIL are generic to all soil types and apply generally to a depth of 3 m below the surface for residential use. Site-specific conditions may determine the depth to which HIL apply for other land uses.
HSLs are applicable to selected petroleum compounds and fractions to assess the risk to human health via the inhalation pathway. HSL have been developed in NEPC (2013) for different land uses, soil types and depths to contamination.

The generic HIL and HSL are considered to be appropriate for the assessment of contamination at the site. HIL D and HSL D have been adopted for the building and hardstand footprints; HIL C and HSL C have been adopted given the proposed use as a recreational open area.

As soil types encountered were variable, the most conservative HSL for the different soil types (sand) has been adopted. HSL for a depth of 0 m to < 1 m have been adopted as these are more conservative than those for greater depths.

The HSL for the vapour intrusion pathway has been adopted as the values are considerable more conservative than direct contact HSLs that are listed in CRC CARE documents.

The adopted HIL and HSL for the COPC are shown in Table 1.

The initial SAC for VOC was the laboratory practical quantitation limit (PQL). Any exceedance of PQL would trigger the use of NSW and National based standards for VOC in soil.

Table 1: HIL and HSL for Soil Contaminants

Contaminant	HIL D (mg/kg)	HIL C (mg/kg)	HSL D for vapour intrusion (mg/kg)
Metals and Inorganics			
Arsenic	3000	300	-
Cadmium	900	90	-
Chromium (VI)	3600	300	-
Copper	240 000	17 000	-
Lead	1500	600	-
Mercury (inorganic)	730	80	-
Nickel	6000	1200	-
Zinc	400 000	30 000	-
Phenols (Pentachlorophenol as initial screen)	660	120	-
TRH			
C_6 – C_{10} (less BTEX)	-	-	260
>C_{10}-C_{16} (less Naphthalene)	-	-	NL
BTEX			
Benzene	-	-	3
Toluene	-	-	NL
Ethylbenzene	-	-	NL
Xylenes	-	-	230
PAH			
Benzo(a)pyrene TEQ	40	3	-
Naphthalene	-	-	-
Total PAHs	4000	300	-
OCP			
DDT+DDE+DDD	3600	400	-
Aldrin + Dieldrin	45	10	-
Chlordane	530	70	-
Endosulfan (total)	2000	340	-
Endrin	100	20	-
Heptachlor	50	10	-
HCB	80	10	-
Methoxychlor	2500	400	-
Other Organics			
PCBs (non dioxin- like PCB only)	7	7	-

Note: TEQ is Toxic Equivalency Quotient.

NL is 'Not Limiting'. If the derived soil HSL exceeds the soil saturation concentration, a soil vapour source concentration for a petroleum mixture could not exceed a level that would result in the maximum allowable vapour risk for the given scenario. For these scenarios, the HSL is given as NL. Note that for all the nominated analytes the HSL is NL for a recreational / open space land use scenario.

2.0 Ecological Investigation Levels and Screening Levels

Ecological Investigation Levels (EIL) have been derived for selected metals and organic compounds and are applicable for assessing risk to terrestrial ecosystems (NEPC, 2013). EIL depend on specific soil physiochemical properties and land use scenarios and generally apply to the top 2 m of soil, which corresponds to the root zone and habitation zone of many species. The EIL is determined for a contaminant based on the sum of the ambient background concentration (ABC) and an added contaminant limit (ACL). The ABC of a contaminant is the soil concentration in a specific locality that is the sum of naturally occurring background levels and the contaminants levels that have been introduced from diffuse or non-point sources (e.g. motor vehicle emissions). The ACL is the added concentration (above the ABC) of a contaminant above which further appropriate investigation and evaluation of the impact on ecological values is required.

The EIL is calculated using the following formula:

EIL = ABC + ACL,

The ABC is determined through direct measurement at an appropriate reference site (preferred) or through the use of methods defined by Olszowy et al Trace element concentrations in soils from rural and urban areas of Australia, Contaminated Sites monograph no. 4, South Australian Health Commission, Adelaide, Australia 1995 (Olszowy et al., 1995) or Hamon et al, Geochemical indices allow estimation of heavy metal background concentrations in soils, Global Biogeochemical Cycles, vol. 18, GB1014, (Hamon, 2004). ACL is based on the soil characteristics of pH, CEC and clay content.

EIL (and ACLs where appropriate) have been derived in NEPC (2013) for only a short list of contaminants comprising arsenic, copper, chromium (III), DDT, naphthalene, nickel, lead and zinc. EIL, shown on Table 2, have been determined using the *Ecological Investigation Level Calculation Spreadsheet*, developed by the CSIRIO for NEPC. The following site specific data and assumptions have been used to determine the EILs:

- A protection level of 80% for urban residential areas and public open space has been adopted;
- Site contamination is aged (i.e.>2 years old);
- The site is in NSW and is located in an area of low traffic volume;
- The EILs will apply to the top 2 m of the soil profile (for the proposed development);
- A pH of 8.4 has been used as an input parameter, based on average pH values for soil collected across the site;
- A CEC of 5.5 $cmol_c/kg$ has been used as an input parameter, based on average CEC values for soil collected across the site;
- Given the variable filling types encountered, a clay content of 10% has been assumed and is considered to be a conservative value; and
- An organic carbon content of 0.5% has been assumed as a conservative value.

Table 2: Ecological Investigation Levels (EIL)

Analyte		EIL (mg/kg)
Metals	Arsenic	100
	Copper	120
	Nickel	45
	Chromium III	410
	Lead	1100
	Zinc	330
PAH	Naphthalene	170

Ecological Screening Levels (ESL) are used to assess the risk of selected petroleum hydrocarbon compounds, BTEX and benzo(a)pyrene to terrestrial ecosystems. ESL apply to the top 2 m of the soil profile as for EIL (for the proposed development).

ESL have been derived in NEPC (2013) for total petroleum hydrocarbon (TPH) fractions as well as BTEX and benzo(a)pyrene. The adopted ESL, from Table 1B(6), Schedule B1 of NEPC (2013) are shown in Table 3. The more conservative ESL for coarse and fine textures soils have been adopted given the variable soil types encountered.

Table 3: Ecological Screening Levels (ESL)

Analyte		ESL	Comments
TRH	C6 – C10 (less BTEX)	180*	All ESLs are low reliability apart from those marked with * which are moderate reliability
	>C10-C16	120*	
	>C16-C34	300	
	>C34-C40	5600	
BTEX	Benzene	65	
	Toluene	105	
	Ethylbenzene	125	
	Xylenes	45	
PAH	Benzo(a)pyrene	0.7	

3.0 Management Limits – Petroleum Hydrocarbons

In addition to appropriate consideration and application of the HSLs and ESLs, there are additional considerations which reflect the nature and properties of petroleum hydrocarbons, including:

- Formation of observable light non-aqueous phase liquids (LNAPL);
- Fire and explosion hazards; and
- Effects on buried infrastructure e.g. penetration of, or damage to, in-ground services.

Management Limits to avoid or minimise these potential effects have been adopted in NEPC (2013) as interim Tier 1 guidance. Management Limits have been derived in NEPC (2013) for the same four petroleum fractions as the HSLs (F1 to F4). The adopted Management Limits, from Table 1B(7), Schedule B1 of NEPC (2013) are shown on Table 4. The following site specific data and assumptions have been used to determine the Management Limits:

- The Management Limits will apply to any depth within the soil profile;
- The Management Limits for residential, parkland and public open space apply; and
- The soils encountered at the site comprised various types including sand and clay. A "coarse" soil texture (being the most conservative soil type) has been adopted.

Table 4: Management Limits

Analyte		Management Limit (mg/kg)
TRH	$C_6 - C_{10}$	700
	$>C_{10}-C_{16}$	1,000
	$>C_{16}-C_{34}$	2,500
	$>C_{34}-C_{40}$	10,000

4.0 Asbestos in Soil

Bonded asbestos containing material (ACM) is the most common form of asbestos contamination across Australia, generally arising from:

- Inadequate removal and disposal practices during demolition of buildings containing asbestos products;
- Widespread dumping of asbestos products and asbestos containing fill on vacant land and development sites; and
- Commonly occurring in historical fill containing unsorted demolition materials.

Mining, manufacturing or distribution of asbestos products may result in sites being contaminated by friable asbestos including free fibres. Severe weathering or damage to bonded ACM may also result in the formation of friable asbestos comprising fibrous asbestos (FA) and/or asbestos fines (AF).

Asbestos only poses a risk to human health when asbestos fibres are made airborne and inhaled. If asbestos is bound in a matrix such as cement or resin, it is not readily made airborne except through substantial physical damage. Bonded ACM in sound condition represents a low human health risk, whilst both FA and AF materials have the potential to generate, or be associated with, free asbestos fibres. Consequently, FA and AF must be carefully managed to prevent the release of asbestos fibres into the air.

Where an assessment of asbestos to NEPC (2013) is undertaken, the SAC will be as shown on the following Table 5.

Table 5: Asbestos HSLs

Health Screening levels (w/w)	
	HSL C
Bonded ACM	0.02%
FA and AF (friable asbestos)	0.001%
All Forms of Asbestos	No visible asbestos in surface soil

Bonded ACM: Asbestos containing material which is in sound condition, bound in a matrix of cement or resin, and cannot pass a 7 mm x 7 mm sieve.

FA: Fibrous asbestos material including severely weathered cement sheet, insulation products and woven asbestos material. This material is typically unbonded or was previously bonded and is now significantly degraded and crumbling.

AF: Asbestos fines including free fibres, small fibre bundles and also small fragments of bonded ACM that pass through a 7 mm x 7 mm sieve.