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Dear Dean,

Barangaroo South - Stage 1B Basement and Residential Towers, Revised SEPP 55 Letter, Hickson Road, Millers Point. State Significant Development Applications SSD 6960, 6964, 6965 & 6966

1.0 Introduction

This letter has been prepared by AECOM Australia Pty Limited (AECOM) for Lendlease Building Pty Ltd (Lendlease) in support of the State Significant Development Application (**SSD 6960**) submitted to the Minister for Planning pursuant to Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) and to respond to Condition 12 of the Secretary's Environmental Assessment Requirements (SEARs) for the ***Stage 1B Basement, Barangaroo South*** (dated 2 April 2015). This letter supersedes the previous iteration (dated 12 November 2015) and reflects the current development proposed as part of SSD 6960.

SSD 6960 seeks approval for construction of the Stage 1B Basement and associated works at Barangaroo South as described in **Section 3.0** (Overview of Proposed Development). The works associated with SSD 6960 also include the construction of services within the following areas.

- ORWN Services Zone;
- Block 4 Services Zone;
- ORWN Interim Public Domain (Barangaroo Avenue); and
- Hickson Road Infrastructure and Services Zone.

This letter also relates to Residential / Retail Buildings R4A, R4B and R5 which are currently proposed to be constructed above the footprint of the Stage 1B Basement (i.e. within the Stage 1B Basement Area) and which are the subject of development applications SSD 6964, SSD 6965 and SSD 6966 (refer to **Attachment 4**).

The above areas (hereafter referred to as 'the Site') are described further in **Section 3.0** and illustrated in the following figure provided in **Attachment 1**:

- **Figure 1** – which is based on Figure F5 from the *Remedial Action Plan (RAP), NSW EPA Declared Remediation Site 21122 and Block 4 (Stage 1b) Development Works, Barangaroo, Millers Point, NSW* (AECOM, 2013b) (hereafter referred to as the *VMP/Block 4 RAP*) and has been amended to reflect the Site considered by this letter.

Other remediation related reports which are relevant to the Site and this letter are:

- *Remedial Action Plan, Barangaroo South Stage 1B Waterfront Public Domain* (AECOM, 2016a). The *Stage 1B Waterfront Public Domain RAP* includes the southern portion of the 'ORWN Services Zone' (refer to **Attachment 2**); and
- *VMP/Block 4 Remedial Action Plan Addendum - Part Stage 1B Public Domain (Watermans Quay), Hickson Road, Millers Point, Barangaroo South* (AECOM, 2016b). The *Watermans Quay RAP Addendum* covers the 'Block 4 Services Zone' (refer to **Attachment 3**).

This letter should be read in conjunction with these two reports.

2.0 Review of Available Documents

In preparing this letter, AECOM has reviewed the following Lendlease development drawings (refer to **Attachment 4**).

Table 1 Lendlease Development Drawings (Stage 1B Basement SSD 6960)

Drawing No.	Revision	Drawing Title
BB2_PA2_A000	Rev B	Title Sheet
BB2_PA2_A001	Rev B	Aerial Location Plan
B1B_PA1_A002	Rev B	Survey Plan
B1B_PA1_A003	Rev B	Demolition Plan
BB2_PA2_A100	Rev B	BASEMENT PLAN LEVEL B0
BB2_PA2_A101	Rev B	BASEMENT PLAN LEVEL B1
BB2_PA2_A102	Rev B	BASEMENT PLAN LEVEL B2
BB2_PA2_A103	Rev B	BASEMENT PLAN LEVEL B3
BB2_PA2_A104	Rev B	BASEMENT PLAN LEVEL B4
BB2_PA2_A105	Rev B	BASEMENT PLAN LEVEL B5
BB2_PA2_A300	Rev B	SECTION 01
BB2_PA2_A301	Rev B	SECTION 02
BB2_PA2_A302	Rev B	SECTION 03
BB2_PA2_A303	Rev B	SECTION 04
BB2_PA2_A400	Rev B	BUILDING ELEMENTS - GROUND FLOOR
BB2_PA2_A401	Rev B	BUILDING ELEMENTS - PODIUM 1
BB2_PA2_A402	Rev B	BUILDING ELEMENTS - PODIUM 2
BB2_PA2_A501	Rev B	BUILDING ELEMENTS – ELEVATIONS

3.0 Overview of Proposed Development

The Stage 1B Basement Development Application (SSD 6960) seeks approval for construction of a four level basement to accommodate parking for the Stage 1B Residential Buildings (subject to separate SSD applications SSD 6964, SSD 6965 and SSD 6966, refer to **Attachment 4**).

The works contemplated by SSD 6960 (here after referred to as the Stage 1B Basement and associated works) include (refer to **Figure 1** and **2**, **Attachment 1**):

- Stage 1B basement works:
  - rock/fill excavation where required for the future Stage 1B basement; and
  - construction of the Stage 1B basement including common plant and services, loading docks, waste rooms and storage areas, as well as structural cores and associated building services for the Stage 1B Residential Buildings.
- Associated works within the ORWN Services Zone:
  - construction of services outside the Stage 1B Basement and within an area that is approximately 30 m wide and is bounded by:
    - the proposed Stage 1B basement retention wall and Block 4 Services Zone to the east;
    - the existing Stage 1A basement retention wall to the south; and
    - the approved future Crown Stage 1C basement retention wall to the north (which has been subject of a separate Development Application approval).

It is understood that excavations within the ORWN Services Zone may extend to a depth of approximately 6.0 m below ground level (bgl).

Note that for the purpose of this letter, the eastern portion of the ORWN Services Zone, which overlaps with the southern portion of the ORWN Interim Public Domain, is considered to extend below the ORWN Interim Public Domain (refer to **Figure 1**).

- Associated works within the ORWN Interim Public Domain - construction of Barangaroo Avenue at grade . The southern part of the ORWN Interim Public Domain overlies the eastern portion of the ORWN Services Zone (refer to **Figure 1**).
- Associated works within the Block 4 Services Zone (refer to AECOM, 2016 provided in **Attachment 3**):
  - construction of services outside the Stage 1B Basement and within an area that is approximately 8 m wide and is bounded by:
    - the existing Stage 1A basement retention wall to the south;
    - the proposed Stage 1B basement retention wall to the north;
    - the Hickson Road Infrastructure and Services Zone to the east; and
    - the ORWN Services Zone to the west.

  Excavations within the Block 4 Services Zone will extend to a depth of less than approximately 2.7 m bgl (as required for the provision of services from Stage 1A to the proposed Stage 1B basement and construction of a new stormwater pipe).
- Associated works within the ORWN Interim Public Domain:
  - construction of the proposed ORWN Interim Public Domain (Barangaroo Avenue):
    - in the area outside and immediately to the west of the Stage 1B basement; and
    - either above the basement proposed as part of the Crown hotel development or constructed at grade.

  It is understood that excavations within the ORWN Interim Public Domain may extend to a depth of approximately 0.5 m bgl (involving removal of the existing concrete slab).
- Associated works within the Hickson Road Infrastructure and Services Zone:
  - Installation of underground service connections associated with the Stage 1B basement; and
  - Minor road works required to reinstate the existing public road and transition from the existing public road to new roads to be constructed within the footprint of the proposed Stage 1B basement.

  It is understood that excavations within the Hickson Road Infrastructure and Services Zone may extend to a depth of approximately 2.0 m below ground level (bgl).

Importantly, the associated works proposed in the ORWN Interim Public Domain, ORWN Services Zone, Block 4 Services Zone and Hickson Road Infrastructure and Services Zone (collectively referred to as the Associated Works Areas) may be undertaken prior to remediation of these areas.

The works contemplated by SSD 6964, SSD 6965 and SSD 6966 are construction of:

- residential / retail buildings R4A, R4B and R5 above the footprint of the Stage 1B Basement (i.e. within the Stage 1B Basement Area) (refer to **Attachment 4**); and
- associated open space areas, roads, car park ramps and risers and temporary public domain and landscaping works as described for the different Site areas above and assessed herein.

Finally, it is noted that site preparation works, including demolition, remediation and excavation of fill/soil for the Stage 1B basement works, are covered under the previously approved SSD 5897 and will generally be undertaken prior to the works proposed by this SSD 6960.

It is noted that the *Crown Hotel Development RAP* (AECOM, 11 April 2015) has been prepared for part of the Stage 1C area and the area assessed by that report incorporates parts of the ORWN Services Zone and ORWN Interim Public Domain. This letter was originally prepared to:

- enable assessment of the Stage 1B project independently from the Crown Hotel Development works in case the later project did not proceed; and
- assess that portion of the Site which is located outside the boundary of the *Crown Hotel Development RAP* (AECOM, 2015).

The DA for the Crown Hotel Development works has now recently been approved. Notwithstanding, the land uses considered for that project include land uses that are consistent with those proposed for the ORWN Services Zone and ORWN Interim Public Domain (that is, *public open space, landscaping, roads, pedestrian ways and cycle paths, largely built on grade*).

4.0 Objectives

The objectives of this letter are to confirm that the proposed Stage 1B Basement works and associated works (in the ORWN Services Zone, Block 4 Services Zone, ORWN Interim Public Domain and Hickson Road Infrastructure and Services Zone and the Residential / Retail Buildings R4A, R4B and R5:

- are consistent with what was contemplated in the *VMP/Block 4 RAP* (AECOM, 2013b),*Stage 1B Waterfront Public Domain RAP* (AECOM, 2016a) and the *Watermans Quay RAP Addendum* (AECOM, 2016b), and can be appropriately managed by those documents; and
- will enable the relevant consent authority to comply with Clause 7 of *SEPP 55 - Remediation of Land* (1998) as required by Condition 12 of the SEAR's (2 April 2015) in relation to the proposed future use of the land as a Basement with Residential / Retail Buildings and associated open space areas above.

5.0 Site Location

Barangaroo is located on the north western edge of the Sydney Central Business District, bounded by: Sydney Harbour to the west and north; the historic precinct of Millers Point (for the northern half), the Rocks and the Sydney Harbour Bridge approach to the east; and, a range of new developments dominated by large CBD commercial tenants to the south.

The Barangaroo site has been divided into three distinct redevelopment areas (from north to south) - the Barangaroo Reserve, Barangaroo Central and Barangaroo South.

The area considered by SSD 6960 is located:

- within Barangaroo South as shown in **Figure 1** and **2**, **Attachment 1**; and
- on land generally known and identified in the approved Concept Plan MP06_0162 (as modified) as Blocks 4A and 4B and part of the public domain area between those Blocks and Block 5.

6.0 VMP / Block 4 Remedial Action Plan

The *VMP/Block 4 RAP* (AECOM, 2013b) was previously prepared to describe (among other things) remediation works required to facilitate the proposed Block 4 Development Works which include the Stage 1B Basement and associated Residential / Retail Buildings above the Basement.

The *VMP/Block 4 RAP* (AECOM, 2013b) also describes remediation works required to facilitate removal of the current EPA Declaration from (among other areas) Hickson Road, including the Hickson Road Infrastructure and Services Zone, and the Block 4 Services Zone. Notwithstanding, it is understood that remediation of these areas may not be completed prior to the proposed associated works.

The *VMP/Block 4 RAP* (AECOM, 2013b) was approved under delegation by the Minister of Planning as part of Development Application SSD 5897 (dated 10 November 2014).

6.1 Proposed Land Uses

6.1.1 Block 4 Development Area

Section 4.1 of the *VMP/Block 4 RAP* (AECOM, 2013b) describes the Block 4 development land uses as incorporating *a mixture of commercial, retail and high density residential and public open space (incorporating roads, community and related land uses) overlying the Block 4 basement.*

Therefore, the Stage 1B Basement (as proposed by SSD 6960) and Residential / Retail Buildings above the Basement (as proposed by SSD 6964, SSD 6965 and SSD 6966) are consistent with what was envisaged in the *VMP/Block 4 RAP* (AECOM, 2013b).

6.1.2 Associated Works Areas

As described above, the Hickson Road Infrastructure and Services Zone and Block 4 Services Zone (as proposed by SSD 6960) are within the area contemplated for VMP Remediation Works by the *VMP/Block 4 RAP* (AECOM, 2013b).

Section 1.4 of the *VMP/Block 4 RAP* (AECOM, 2013b) describes the land uses for which the areas that will be the subject of VMP Remediation Works will be made suitable for its current form and land use (i.e. a paved open space area).

As such, the construction of services within the Hickson Road Infrastructure and Services Zone and the Block 4 Services Zone is consistent with what was envisaged in the *VMP/Block 4 RAP* (AECOM, 2013b) and the extent of remediation recommended by the *VMP/Block 4 RAP* (AECOM, 2013b) is also applicable to these areas.

The ORWN Services Zone and ORWN Interim Public Domain (as proposed by SSD 6960) are both outside the area contemplated by the *VMP/Block 4 RAP* (AECOM, 2013b). However, part of the ORWN Services Zone is within the area contemplated by the *Stage 1B Waterfront Public Domain RAP* (AECOM, 2016a) (refer to **Section7.0**).

6.2 Stage 1B Basement Works

Section 4.2 of the *VMP/Block 4 RAP* (AECOM, 2013b) anticipates that construction of the Stage 1B Basement will require excavation to a depth of approximately Relative Level (RL) -5.6 m Australian Height Datum (AHD). It is noted that the Stage 1B basement works described by SSD 6960 will require excavation to a depth of approximately RL -13.5 m AHD and RL -16.9 m AHD (as required for tower lift pits, hydrostatic slabs and blinding) and further to facilitate piling works. It is noted that the Stage 1B Crown basement, which is also subject to the *Block 4/VMP RAP* (AECOM, 2013b) but is not part of SSD 6960, will be excavated to a depth of RL -10.3 m AHD.

The depth of remediation required to facilitate the Block 4 Development was based on the considerations described by Section 8.5 of the *VMP/Block 4 RAP* (AECOM, 2013b). In particular:

> *"…the vertical extent of remediation was defined as remediation to the depth of the underlying natural bedrock to a maximum depth of 10 m below ground level (bgl)* (approximately RL -7.5 m AHD). *The vertical extent of remediation is based on consideration of:*
>
> - *locations where Separate Phase Gasworks Waste and Tar (SPGWT) has been reported;*
> - *locations where exceedances of the groundwater Site-Specific Target Criteria (SSTC) and unsaturated soil SSTC have been reported;*
> - *the footprint of historical gasworks structures and infrastructure; and*
> - *the depth to bedrock (noting that the depth to bedrock steadily increases to the west beyond the 10 m bgl rock contour)."*

The potential for the depth of the basement to increase as a result of further design development was specifically contemplated by Section 23.12.1 of the *VMP/Block 4 RAP* (AECOM, 2013b) which states that:

> *"…the additional bulk excavation works that would be required to facilitate construction of basements to greater depths is not considered to affect the preferred remediation strategy. This is because the depth of identified SPGWT/Confirmed Impacted Material requiring remediation in the Block 4 area (typically present at depths shallower than 8 m bgl) is already less than the proposed basement depth*. "

The depth of the excavation required by the proposed Stage 1B Basement works (approximately RL -13.5 m AHD) will result in excavation of bedrock to greater depths than envisaged by the *VMP/Block 4 RAP* (AECOM, 2013b). However, as noted above, the potential for deeper excavation was considered in Section 23.12.1 of the *VMP/Block 4 RAP* (AECOM, 2013b). Therefore, the proposed Stage 1B Basement works are consistent with the preferred remediation strategy detailed in the *VMP/Block 4 RAP* (AECOM, 2013b).

6.3 Staged Remediation Works

Section 1.8 of the *VMP/Block 4 RAP* (AECOM, 2013) anticipated that the development and construction sequence and methodology may require that:

- *remediation of key site areas (for example Block 4, Block 5 and Hickson Road) be completed and validated (including the preparation of Site Audit Statements) separately, in sequence; and*
- *remediation within key site areas (for example within the Hickson Road VMP Remediation Works area) may be staged.*

As described by **Section 8.6** below, parts of the Hickson Road Infrastructure and Services Zone are located within the extent of VMP Remediation Works recommended by the *VMP/Block 4 RAP* (AECOM, 2013b). Further, the Hickson Road Infrastructure and Services Zone construction works may be staged to occur either before or after the VMP Remediation Works. As such, interim remediation within the Hickson Road Infrastructure and Services Zone may be required to make the area suitable for potential future maintenance of the proposed services if these works occur before the VMP Remediation Works. Completion of the potential interim remediation works is considered to be consistent with the staged remediation works anticipated by the *VMP/Block 4 RAP* (AECOM, 2013b).

7.0 Stage 1B Waterfront Public Domain Remedial Action Plan

The *Stage 1B Waterfront Public Domain RAP* (2016a) was previously prepared to describe (among other things) remediation works required to facilitate the proposed development of the Public Domain areas south and west of the proposed Crown Hotel Development Site.

The *Stage 1B Waterfront Public Domain RAP* (2016a) was effectively endorsed by the Site Auditor in the *Site Audit Report, RAP, Barangaroo South, Stage 1B Waterfront Public Domain* (Rambol Environ, February 2016).

The area covered by the *Stage 1B Waterfront Public Domain RAP* (2016a) includes the southern portion of the ORWN Services Zone (i.e. that part of the ORWN Services Zone that is outside the alignment of Stage 1B and the Crown Hotel Development site).

7.1 Proposed Land Uses

In relation to the ORWN Services Zone, Section 1.3 of the *Stage 1B Waterfront Public Domain RAP* (2016a) describes the development land uses as incorporating a mixture of retail buildings (no greater than two storeys) built on grade and with minimal access to soils and public open space, landscaping, roads, pedestrian ways and cycle paths, built on grade. These land uses are consistent with those proposed in the ORWN Services Zone (i.e. roadway with underground services).

7.2 Staged Remediation Works

Section 16.2 (Validation Principles) of the *Stage 1B Waterfront Public Domain RAP* (2016a) anticipated that the development and construction sequence, and methodology may be conducted in a staged manner. Therefore, any staged remediation works can be managed accordingly.

8.0 Consideration of the Presence of Contamination

8.1 Site History

Section 3.2 and 3.2.1 of the *VMP / Block 4 RAP* (AECOM, 2013b) provide a summary of the site history and historical land reclamation works in the vicinity of the Associated Works Areas.

Of note, the ORWN Services Zone and much of the Block 4 Services Zone are located within the footprint of the former Southern Cove. A review of the 1983 and 2004 aerial photographs provided in the ERM (2007) *Environmental Site Assessment* indicates that the historic Southern Cove is the most recent part of the Barangaroo South Development Area to have been infilled. Consequently, the ground conditions beneath the ORWN Services Zone differ from adjacent Barangaroo site areas and it is unlikely that the ORWN Services Zone has been backfilled with materials which originated from the former gasworks located within the Declaration Area (to the east).

8.2 Preliminary Conceptual Site Model

A preliminary Conceptual Site Model (CSM) has been developed for the Associated Works Areas based on the CSM presented in Section 2.0 of the *VMP / Block 4 RAP* (AECOM, 2013b) and the findings of the previous investigations (as summarised in the following sections). The preliminary CSM is summarised in the table below:

Table 2 Preliminary Conceptual Site Model

Consideration	Details
Contaminants of Potential Concern (CoPC)	Based on the findings of the previous investigations, the CoPC may comprise the following: - Heavy metals; - BTEX; - TRH C_6-C_{10} and TRH C_{10}-C_{40}; - PAHs; and - Asbestos.
Groundwater conditions at the Site	Groundwater was generally encountered within fill material at 1.8 m bgl (based on MW40). The groundwater flow direction is likely to be towards the west (ultimately discharging to Darling Harbour). The soil analytical results discussed in relation to the ORWN Services Zone and ORWN interim Public Domain are not anticipated to be adversely affecting groundwater quality within these areas and are not likely to pose a significant risk to the intrusive maintenance worker. Contaminated shallow groundwater and SPGWT has been identified within the Hickson Road Tar Tank (monitoring wells MW7 and MW53).
Potential on-site receptors of contamination	- Construction workers currently using the Associated Works Areas as a staging area for the Stage 1A construction; - Public currently accessing Hickson Road; and - Intrusive maintenance workers installing and maintaining services to a depth of up to 6m bgl (refer to **Section 3.0**). It is assumed that intrusive maintenance workers will wear standard personal protective equipment during the excavation works which will be of a short time duration.
Potential off-site receptors of contamination	The nearest off-site ecological receptor is Darling Harbour (located approximately 30 m to the west of the ORWN Services Zone).
Potential transport mechanisms and exposure pathways for contaminants	- Dermal contact and ingestion with on-site soil and groundwater during intrusive works; - Due to the shallow depth of SPGWT in the groundwater within the Hickson Road Tar Tank (MW7 and MW53), there vapour migration pathway for a part of the Hickson Road area. Soil vapour migration is not likely to present a significant risk in other parts of the site as SPGWT is located at greater depths; - Off-site migration of dissolved phase contaminants (if present) in groundwater; and - Uptake or ingestion of contaminated groundwater or impacted surface water by on- or off-site ecological receptors. Based on the soil results and field observations reported in relation to the ORWN Services Zone and ORWN Interim Public Domain, it is considered unlikely that a significant contaminant exposure pathway is present with the identified receptors. Soil vapour may present a risk to parts of Hickson Road due to the identified presence of SPGWT in the shallow groundwater in the former tar tank.

8.3 ORWN Services Zone

The ORWN Services Zone is located outside the *VMP / Block 4 RAP* (AECOM, 2013b) site boundary and only partly within the area contemplated by the *Stage 1B Waterfront Public Domain RAP* (2016a). Therefore, the results of historical investigations conducted within and in the vicinity of the proposed ORWN Services Zone have been reviewed in consideration of whether, or not, the land is likely to be contaminated.

8.3.1 Stage 1B Waterfront Public Domain RAP

Based on the findings of the *Stage 1B Waterfront Public Domain RAP* (2016a), which covers the ORWN Services Zone, the preferred remediation strategy recommended for the proposed development works in this area was as follows:

- *Additional validation sampling to confirm whether remediation of identified CIM/SPGWT (unsaturated soils) proposed to remain in situ is warranted;*
- *If required, remediation of identified CIM/SPGWT and validation of the remediated areas;*
- *Excavation as required for the installation of underground services, landscaped areas for trees, etc and disposal of excavated material to a NSW EPA licensed landfill (including treatment if required); and*
- *Placement of Suitable Fill as required to protect human health and to achieve proposed finished Site levels.*

The preferred remediation strategy described by the *Stage 1B Waterfront Public Domain RAP* (2016a) will, upon successful implementation as evidenced by the discussed validation program, ensure that the ORWN Services Zone is suitable for the proposed land uses, specifically public open space and an infrastructure services zone.

8.3.2 Historical Investigations – ORWN Services Zone

Soil and groundwater investigations have been historically undertaken within the ORWN Area. These investigations were detailed in the *ORWN Data Gap Investigation* (AECOM, 2010) and summarised in Section 5.11 of the *VMP / Block 4 RAP* (AECOM, 2013b) and Section 5.0 of the *Stage 1B Waterfront Public Domain RAP* (2016a).

As illustrated in **Attachment 4**, the ORWN Services Zone is located directly adjacent to the proposed Stage 1B basement wall and extends approximately 30 m to the west.

Six sampling locations (BH01, BH38, BH39, BH40, BH047 and BH049) within the ORWN Area (refer to the attached **Figure 1**, **Attachment 1**) were advanced within and adjacent to the ORWN Services Zone as part of previous environmental site investigations and are considered to be representative of the materials likely to be present in this ORWN Services Zone.

Groundwater monitoring well MW40/BH40 is located adjacent to the Stage 1B western basement wall, in the vicinity of the ORWN Services Zone. However MW40/BH40 is screened between 14.3 to 20.5 m bgl and, therefore, is not considered to be representative of groundwater quality within the upper 6 m of the soil profile within which the proposed excavations are likely to occur.

Based on a review of the observations and sample analysis results from the six boreholes considered to be representative of the ORWN Services Zone, the following conclusions are made with respect to the presence or otherwise of contamination within the ORWN Services Zone:

- bedrock was not encountered at BH38 to the drilling depth of 20.7 m bgl. Therefore, bedrock is not anticipated to be encountered during the proposed excavation works within the ORWN Services Zone associated with SSD 6960;
- gasworks related wastes were not identified in the fill material. Some chemical odours were noted within the natural sandy clays at a depth of 16.5 m bgl at BH40. No odours were reported in the overlying fill materials. Given the depth of the discussed odorous materials and the comparatively low permeability of the natural sandy clays in which the odorous were reported (and the negligible contaminant flux from natural sandy clays to the overlying fill materials [refer to Section 5.12 of the *VMP/Block 4 RAP* (AECOM, 2013b)]), odorous materials are not anticipated to be encountered during the proposed excavation works;
- the concentrations of contaminants of potential concern (CoPC) reported in the 30 soil samples collected and analysed from the six boreholes were all less than the following soil assessment criteria from the *ASC NEPM* (1999 as amended 2013)[1] which are applicable to the proposed services construction works (refer to **Table T1**, **Attachment 5**):
    - Health Investigation Level 'D' as applicable to a commercial/industrial land use;
    - Health Screening Levels for petroleum hydrocarbons in soil (dermal contact); and
    - Ecological Investigation Levels given the proximity of the ORWN Services Zone to surface water bodies (Darling Harbour).
- PAH concentrations reported in the ten analysed samples were generally reported below the laboratory Limit of Reporting (LOR). The maximum Total PAH concentration (26.1 mg/kg) was reported at

[1] NEPC. 2013. *National Environment Protection (Assessment of Site Contamination) Amendment Measure 2013 (No. 1)*.

BH01_4.0-4.1m and is less than the adopted *ASC NEPM* (NEPC, 2013) criteria. BH01 is located south of the ORWN Services Zone (refer to **Table T1**, **Attachment 5**);

- TPH and BTEX concentrations reported in the eleven analysed samples were all reported below the laboratory Limit of Reporting (refer to **Table T1**, **Attachment 5**). Phenol concentrations were also less than the LOR in the six analysed soil samples;
- Asbestos was not detected in the soils at BH38_2.5-2.7. Bonded asbestos containing materials were not reported during the soil sampling works at the six boreholes;
- The low PAH and TPH/BTEX concentrations were consistent with field observations which indicate that gasworks related wastes are not likely to be present within the upper 6.0 m of the soil profile in the ORWN Services Zone; and
- The above soil analytical results are not anticipated to be adversely affecting groundwater quality within the ORWN Services Zone.

Importantly, the ORWN Services Zone is outside the extent of remediation identified by the *VMP / Block 4 RAP* (AECOM, 2013b) in relation to both the VMP Remediation Works and the Block 4 Development Remediation Works (refer to **Figure 1**, **Attachment 1**). That is, remediation of the area was not considered required to facilitate removal of the NSW EPA Declaration or construction of the Block 4 Basement. The ORWN Services Zone is approximately 60 m south west of the extent of remediation recommended by the *VMP / Block 4 RAP* (AECOM, 2013b).

8.3.3 Conclusions – ORWN Services Zone

As the *Stage 1B Waterfront Public Domain RAP* (2016a) covers the ORWN Services Zone, it is appropriate for the conclusions of that RAP to be applied to this site area. As detailed in Section 16.4.1 of the *Stage 1B Waterfront Public Domain RAP* (2016a) (refer to **Attachment 2**), additional soil validation works (described as the 'Southern Public Domain, Area A unsaturated soil validation works') are required in the southern portion of the ORWN Services Zone. Based on the results of the additional validation sampling, an assessment of whether remediation is required in Area A (Southern Public Domain Area) will be undertaken. These works will be undertaken in consultation with the NSW EPA Accredited Site Auditor and will be detailed in a Progressive Validation Report to be issued to the NSW EPA Accredited Site Auditor.

If Confirmed Impacted Material (CIM) and/or SPGWT is identified by the additional validation sampling, remediation of the identified CIM/SPGWT and validation of the remediated areas will be conducted in consultation with the NSW EPA Accredited Site Auditor.

It is considered that, the information presented above will enable the relevant consent authority to comply with Clause 7 of *SEPP 55 - Remediation of Land* (1998) in relation to the proposed services construction works and public domain land use in the ORWN Services Zone.

8.4 ORWN Interim Public Domain (Barangaroo Avenue)

The ORWN Interim Public Domain is located outside the *VMP / Block 4 RAP* (AECOM, 2013b) and the *Stage 1B Waterfront Public Domain RAP* (2016a) site boundary. Therefore, results of historical investigations conducted within and in the vicinity of the proposed ORWN Interim Public Domain have been reviewed in consideration of whether, or not, the land is likely to be contaminated.

8.4.1 Historical Investigations – ORWN Interim Public Domain (Barangaroo Avenue)

Soil and groundwater investigations have been historically undertaken within the ORWN Area. These investigations were detailed in the *ORWN Data Gap Investigation* (AECOM, 2010) and summarised in Section 5.11 of the *VMP / Block 4 RAP* (AECOM, 2013b).

As illustrated in **Attachment 4**, the ORWN Interim Public Domain is located directly adjacent to the proposed Stage 1B basement wall and extends approximately 20 m to the west.

Eight sampling locations within the ORWN Area (refer to the attached **Figure 1**, **Attachment 1**) were advanced within and adjacent to the ORWN Interim Public Domain as part of previous environmental site investigations and are considered to be representative of the materials likely to be present in this ORWN Interim Public Domain.

Based on a review of the observations and sample analysis results from the eight boreholes considered to be representative of the ORWN Interim Public Domain, the following conclusions are made with respect to the presence or otherwise of contamination within the ORWN Interim Public Domain:

- bedrock was encountered at BH48 at a depth of 14.5 m bgl. Therefore, bedrock is not anticipated to be encountered during the proposed excavation works within the ORWN Interim Public Domain associated with SSD 6960;
- gasworks related wastes were not identified in the fill material. Some chemical odours and tar were noted within the weathered upper surface of the underlying bedrock at a depth of 14.5 m bgl at BH48. No significant odours were reported in the overlying fill materials. Given the depth of the discussed odorous materials and the comparatively low permeability of the natural bedrock in which the odorous were reported (and the negligible contaminant flux from natural sandy clays to the overlying fill materials [refer to Section 5.12 of the *VMP/Block 4 RAP* (AECOM, 2013b)]), odorous materials are not anticipated to be encountered during the proposed excavation works (associated with SSD 6960);
- the concentrations of contaminants of potential concern (CoPC) reported in the 9 soil samples collected and analysed from the eight boreholes (within the upper 2.0 m of the soil profile) were all less than the adopted soil assessment criteria (refer to **Table T2**, **Attachment 6**);
    - PAH concentrations reported in the four analysed samples were generally reported below the laboratory LOR. One exceedance of the Carcinogenic PAHs criteria was reported at location BH063_1.5-1.65 (50.9 mg/kg) but is not considered to pose a significant risk to the construction worker due to the short term nature of these works;
    - TPH and BTEX concentrations reported in the 5 analysed samples were all reported below the laboratory Limit of Reporting (refer to **Table T2**, **Attachment 6**). Phenol concentrations were also less than the LOR in the 3 analysed soil samples; and
    - Asbestos was not detected in the soils at BH47_1.0-1.2. Bonded asbestos containing materials were not reported during the soil sampling works at the 8 boreholes.
- The low PAH and TPH/BTEX concentrations were consistent with field observations which indicate that gasworks related wastes are not likely to be present within the upper 2.0 m of the soil profile within the ORWN Interim Public Domain; and
- The above soil analytical results are not anticipated to be adversely affecting groundwater quality within the ORWN Interim Public Domain.

Importantly, the ORWN Interim Public Domain is outside the extent of remediation identified by the *VMP / Block 4 RAP* (AECOM, 2013b) in relation to both the VMP Remediation Works and the Block 4 Development Remediation Works (refer to **Figure 1**, **Attachment 1**). That is, remediation of the area was not considered required to facilitate removal of the NSW EPA Declaration or construction of the Block 4 Basement. At the closest point, the western portion of the ORWN Interim Public Domain is approximately 40 m south west of the extent of remediation recommended by the *VMP / Block 4 RAP* (AECOM, 2013b).

8.4.2 Conclusions – ORWN Interim Public Domain (Barangaroo Avenue)

Data from within and in the vicinity of the ORWN Interim Public Domain is considered to be adequate for the assessment of whether materials likely to be encountered as part of the proposed public domain construction works are suitable for the proposed public domain land use (roadway).

The materials likely to be encountered within the ORWN Interim Public Domain are considered likely to be suitable for the proposed public domain land use including the proposed excavation for construction and maintenance of a roadway / interim public domain. This includes potential construction of the Barangaroo Avenue roadway on grade (i.e. if the Stage 1C basement is not constructed).

It is considered that the information presented above will enable the relevant consent authority to comply with Clause 7 of *SEPP 55 - Remediation of Land* (1998) in relation to the proposed services construction works in the ORWN Interim Public Domain.

8.5 Block 4 Services Zone

The Block 4 Services Zone is located within the footprint of Block 4 and therefore within the boundary contemplated by the *VMP / Block 4 RAP* (AECOM, 2013b).

An assessment of soil and groundwater conditions within Block 4, which includes the Block 4 Services Zone, and the requirement (or otherwise) for remediation to facilitate removal of the NSW EPA Declaration is presented in

Section 8.5.1 of the *VMP/Block 4 RAP* (AECOM, 2013b). The resultant VMP Remediation Extent is illustrated in **Figure 1**, **Attachment 1**.

With respect to the Block 4 Services Zone, a relatively small portion, toward the eastern end of the area, is located within the VMP Remediation Extent.

The *Watermans Quay RAP Addendum* (AECOM, 2016b) assessed all soil (saturated and unsaturated) and groundwater analytical data within and adjacent to the Block 4 Services Zone. The data was compared to the risk based remediation criteria (Site Specific Target Criteria, SSTC) developed for Block 4 to facilitate proposed land uses consistent with the proposed land uses within the Block 4 Services Zone, specifically:

- **Scenario 3** - unpaved public domain / open space;
- **Scenario 4** - paved public domain / open space; and
- **Scenario 6** - short term ground-intrusive maintenance.

8.5.1 Conclusions – Block 4 Services Zone

Based on the findings of the *Watermans Quay RAP Addendum* (AECOM, 2016b) the following is concluded with respect to the Block 4 Services Zone.

- Validation sampling is required to:
    - Confirm the absence (or otherwise) of SPGWT adjacent to the new alignment of the southern Stage 1B Perimeter Retention Wall (PRW); and
    - Characterise asbestos concentrations within unsaturated soil in the Block 4 Services Zone and facilitate an assessment of resultant risk to human health.
- Subject to the outcome of the above validation sampling, completion of the proposed VMP Remediation Works within the Block 4 Services Zone (as detailed in Section 6.8.1 of the *VMP/Block 4 RAP* [AECOM, 2013c]) will render the Block 4 Services Zone:
    - suitable for the proposed future land uses as described by SSD 6690 (specifically paved recreation landuse as a publically accessible roadway); and
    - protective of the environment.
- The *VMP/Block 4 RAP* (AECOM, 2013c) is appropriate to manage the VMP Remediation Works including remediation of the Block 4 Services Zone and does not require amendment;
- The contingency measures detailed in Sections 23.12.4 and 23.12.5 of the *VMP/Block 4 RAP* (AECOM, 2013c) have been appropriately implemented in relation to the Block 4 Services Zone via the preparation of the *Watermans Quay RAP Addendum* (AECOM, 2016b); and
- Subject to the outcome of the above validation sampling, additional remediation of the Block 4 Services Zone (i.e. in addition to the VMP Remediation Works) is not required for the proposed land uses (as described in **Section 8.5** above.

It is considered that the information presented above and in the *Watermans Quay RAP Addendum* (AECOM, 2016b) will enable the relevant consent authority to comply with Clause 7 of *SEPP 55 - Remediation of Land* (1998) in relation to the proposed services construction works in the Block 4 Services Zone.

8.6 Hickson Road Infrastructure and Services Zone

The Hickson Road Infrastructure and Services Zone is located within the EPA Declaration Area portion of Hickson Road and therefore within the boundary contemplated by the *VMP / Block 4 RAP* (AECOM, 2013b). Refer to **Figure 1**, **Attachment 1**

An assessment of soil and groundwater conditions within the EPA Declaration Area portion of Hickson Road, which includes the Hickson Road Infrastructure and Services Zone, and the requirement (or otherwise) for remediation is presented in Section 8.5.3 of the *VMP/Block 4 RAP* (AECOM, 2013b). The resultant VMP Remediation Extent and noted is illustrated in **Figure 1**, **Attachment 1**.

As outlined in **Figure 1**, **Attachment 1**, the Hickson Road Infrastructure and Services Zone comprises two proposed excavation areas. Of these, the:

- **southern excavation area** (near BH43) which is not located within the VMP Remediation Extent (as detailed in the *VMP/Block 4 RAP* [AECOM, 2013b]); and
- **northern excavation area** (near BH6/MW6 and BH15/MW15) which is located within the VMP Remediation Extent and is located between two below ground features associated with the former gasworks (namely a former Tar Tank and Small Gas Holder as defined in Section 3.2.2 of the *VMP/Block 4 RAP* [AECOM, 2013b]).

Based on this assessment, it is considered that:

- the **southern excavation area** is not located within the VMP Remediation Extent (as defined in Figure 10 and 11 of the *VMP/Block 4 RAP* [AECOM, 2013b]), and therefore the soil and groundwater conditions in this area are considered likely to be suitable for continued commercial/industrial land use including the proposed excavation for construction and maintenance of below ground services and roadways.
    - It is also noted that the bedrock in this area (in the vicinity of BH43) was observed to be present at a depth of 0.57 m bgl; and
    - Consequently, significant volumes of fill material are not likely to be present in this area as the road base has been identified to be approximately 0.4 m thick.
- the **northern excavation area** is located within the VMP Remediation Extent and directly adjacent to historic gasworks related structures and therefore further consideration of the soil and groundwater conditions in this area is required to determine whether remediation is required to facilitate the proposed excavation for construction and maintenance of below ground services and roadways.

Review of the soil and groundwater conditions within the Hickson Road Infrastructure and Services Zone - northern excavation area as presented in Section 8.5.3 of the *VMP/Block 4 RAP* (AECOM, 2013b) indicates that:

- SPGWT and contaminated groundwater has been identified to be present within the former Tar Tank (locations MW7 and MW53); and
- there is a potential for soil vapour migration from shallow, contaminated groundwater likely to be present within the former Tar Tank and the Small Gas Holder to pose a unacceptable risk to intrusive maintenance workers.

As discussed in **Section 6.3**, the Hickson Road Infrastructure and Services Zone construction works may be staged either before or following the VMP Remediation Works.

In consideration of these observations it is concluded that the following interim remediation works are recommended within the northern excavation area if the infrastructure and services works described by this letter are undertaken prior to the Hickson Road Remediation Works (as per the *VMP/Block 4 RAP* [AECOM, 2013b]):

1. the base of excavations within the vicinity of the historic gasworks infrastructure be lined with a High Density Polyethylene (HDPE) liner;
2. suitable, validated fill material be used to backfill around the stormwater pipes to the required finished level. The suitable fill material would need to be compacted appropriately to ensure the integrity of the below ground services and underlying HDPE liner;
3. the unexpected finds protocol described by **Section 9.0** be implemented; and
4. a Validation Report should be prepared for the remediation works to be undertaken within the northern excavation area in accordance with Section 19.12 of the *VMP/Block 4 RAP* (AECOM, 2013b). The Validation Report should be submitted to the NSW EPA Accredited Site Auditor for approval.

These interim remediation works are recommended on the assumption that remediation of that part of Hickson Road that is within the EPA Declared Area, including those areas adjacent to and below the northern excavation area, will subsequently be undertaken in accordance with *VMP/Block 4 RAP* (AECOM, 2013b).

It is considered that the information presented above will enable the relevant consent authority to comply with Clause 7 of *SEPP 55 - Remediation of Land* (1998) in relation to the proposed services construction works in the Hickson Road Infrastructure and Services Zone.

9.0 Unexpected Finds Protocol – Associated Works Areas

The following works will be undertaken to mitigate risks to human health and the environment in the event that contamination is found to be present in association with the associated works within the ORWN Services Zone, Block 4 Services Zone, the ORWN Interim Public Domain, and Hickson Road Infrastructure and Services Zone:

- excavations will be visually inspected by a qualified environmental engineer/scientist;
- an Asbestos Management Plan will be prepared for the excavation works to ensure any asbestos impacted fill material is appropriately managed and disposed of to a licensed landfill facility;
- if the subsurface soils encountered during the excavation are significantly different to those described in **Section 7.0** (i.e. based on visual and olfactory observations), validation soil sampling of the excavation base and walls will be conducted. If required, the validation soil samples will be collected as follows:
    - wall validation samples will be collected at 10 m lineal metre intervals in material identified to be the most impacted (either by visual observations of field screening of samples using a Photoionisation Detector);
    - base validation samples will be collected at 10 m lineal metres along the base of the trench;
    - the soil analytical results will be compared to the *ASC NEPM* (NEPC, 2013) soil criteria for commercial/industrial land use. If these criteria are exceeded a site specific risk assessment could be undertaken to assess the suitability of the material to remain *in situ*; and
    - based on the assessment of the above soil validation results, undertake additional remediation and validation works (as required).
- materials used to backfill the trenches will be validated to ensure they meet the *ASC NEPM* (NEPC, 2013) soil assessment criteria for a commercial/industrial land use; and
- if Virgin Excavated Natural Material (VENM) is to be used for backfilling, a VENM validation certificate will be sought from the source quarry/site.

10.0 Compliance with SEPP 55 (1998)

10.1 Stage 1B Basement Area

The presence, or otherwise, of contamination within the Stage 1B Basement area was considered by the soil and groundwater analytical data obtained by the environmental site investigations listed and summarised in Section 5.0 of the *VMP/Block 4 RAP* (AECOM, 2013b).

The *VMP/Block 4 RAP* (AECOM, 2013b) concluded that following implementation of the preferred remediation strategy described therein that Block 4 will have been "…*remediated to a standard suitable for the proposed development (i.e. suitable for the proposed land uses including a mixture of commercial, retail and high density residential and public open space)"*.

As described by **Section 6.1** and **7.0**, AECOM considers that the Stage 1B Basement and associated works are consistent with the land uses and development work (basement design) anticipated by the *VMP/Block 4 RAP* (AECOM, 2013b).

The *VMP/Block 4 RAP* (AECOM, 2013b) was approved under delegation by the Minister of Planning as part of SSD 5897 (dated 10 November 2014).

10.2 Stage 1B Residential and Retail Buildings

The Stage 1B Residential and Retail Buildings are located within the footprint of the Stage 1B basement. As such, the presence, or otherwise, of contamination within this area was considered in Section 5.0 of the *VMP/Block 4 RAP* (AECOM, 2013b) as described in **Section 10.1** above.

The *VMP/Block 4 RAP* (AECOM, 2013b) concluded that following implementation of the preferred remediation strategy described therein that Block 4 will have been "…*remediated to a standard suitable for the proposed development (i.e. suitable for the proposed land uses including a mixture of commercial, retail and high density residential and public open space)"*.

AECOM considers that the Stage 1B Residential and Retail Buildings are consistent with the land uses and development work anticipated by the *VMP/Block 4 RAP* (AECOM, 2013b).

The *VMP/Block 4 RAP* (AECOM, 2013b) was approved under delegation by the Minister of Planning as part of SSD 5897 (dated 10 November 2014).

10.3 Associated Works - ORWN Services Zone and Interim Public Domain (Barangaroo Avenue)

The ORWN Services Zone is partially located within the footprint of the ORWN Public Domain. As such, the presence, or otherwise, of contamination within this area was considered in **Section 8.0** of the *Stage 1B Waterfront Public Domain RAP* (2016a) as described in **Section 7.0.**

The *Stage 1B Waterfront Public Domain RAP* (2016a) concluded that following implementation of the remediation strategy described therein the area will be for open space including an infrastructure services zone.

The presence of contamination in the ORWN Services Zone (outside the ORWN Public Domain) and Interim Public Domain has been considered in **Section 8.3** and **8.4**. As part of an assessment of compliance with SEPP 55, the presence, or otherwise, of contamination within and in the vicinity of the two areas was considered by reference to soil analytical results from historical investigations detailed in the *ORWN Data Gap Investigation* (AECOM, 2010) and summarised in the *VMP / Block 4 Remedial Action Plan* (AECOM, 2013b) and the *Stage 1B Waterfront Public Domain RAP* (2016a).

Data from within and in the vicinity of the ORWN Services Zone and Interim Public Domain and the preliminary Conceptual Site Model (as described by **Section 8.2**) is considered to be adequate for the assessment of whether materials likely to be encountered as part of the proposed services construction works are suitable for continued commercial/industrial land use (which is consistent with the proposed excavation for construction of services).

It is considered unlikely that the ORWN Services Zone and Interim Public Domain is contaminated such that it would be unsuitable for continued land use including the proposed services construction works. This conclusion is based on consideration of:

- the CoPC concentrations considered representative the ORWN Services Zone and Interim Public Domain were reported to be less than site assessment criteria relevant to the proposed land use;
- field observations which indicate that gasworks related waste are not likely to be excavated during the development works; and
- the remediation extent defined by the *VMP / Block 4 RAP* (AECOM, 2013b).

10.4 Block 4 Services Zone

The presence of contamination in the Block 4 Services Zone has been considered based on the assessment of soil and groundwater conditions as presented in the *Watermans Quay RAP Addendum* (AECOM, 2016b, **Attachment 3**).

Data from the *VMP/Block 4 RAP* (AECOM, 2013b) is generally considered to be adequate for the assessment soil and groundwater conditions in the Block 4 Services Zone and to assess the suitability of these materials for the proposed land use in this area (as described in **Section 6.1**) of whether materials likely to be encountered as part of the proposed services construction works are suitable for the proposed excavation for construction and maintenance of services.

The *Watermans Quay RAP Addendum* (AECOM, 2016b), which covers the Block 4 Services Zone, concludes

- *Validation sampling is required to:*
    - *Confirm the absence (or otherwise) of SPGWT adjacent to the new alignment of the southern Stage 1B PRW; and*
    - *Characterise asbestos concentrations within unsaturated soil in the Study Area and facilitate an assessment of resultant risk to human health.*
- *Subject to the outcome of the above validation sampling, completion of the proposed VMP Remediation Works within the Study Area (as detailed in Section 6.8.1 of the VMP/Block 4 RAP [AECOM, 2013b]) will render the Study Area:*
    - *suitable for the proposed future land uses within the Study Area as described by SSD 6690 (specifically paved recreation landuse as a publically accessible roadway); and*
    - *protective of the environment.*

- *The VMP/Block 4 RAP (AECOM, 2013b) is appropriate to manage the VMP Remediation Works including remediation of the Study Area and does not require amendment;*
- *The contingency measures detailed in Sections 23.12.4 and 23.12.5 of the VMP/Block 4 RAP (AECOM, 2013b) have been appropriately implemented via the preparation of the RAP Addendum; and*
- *Subject to the outcome of the above validation sampling, additional remediation of the Study Area (i.e. in addition to the VMP Remediation Works) is not required for the proposed development land uses described in* ***Section 6.1.1****.*

10.5 Hickson Road Infrastructure and Services Zones

The presence of contamination in the Hickson Road Infrastructure and Services Zones has been considered based on the assessment of soil and groundwater conditions as detailed in Section 8.5.3 of the *VMP/Block 4 RAP* (AECOM, 2013b).

Data from the *VMP/Block 4 RAP* (AECOM, 2013b) is considered to be adequate for the assessment of whether materials likely to be encountered as part of the proposed services construction works are suitable for proposed excavation for construction and maintenance of services.

As discussed in **Section 8.6**, it is recommended that interim remediation works will be required in the **northern excavation area** if the infrastructure and services works described by this letter are undertaken prior to the Hickson Road Remediation Works due to the proximity of the proposed excavation to former gasworks infrastructure which is known to contain contamination. It is considered that the recommended interim remediation works will make the area suitable for intrusive maintenance works associated with construction and maintenance of the proposed services and road works.

11.0 Conclusions

In conclusion, it is AECOM's opinion that:

- The Stage 1B Basement works (as proposed by SSD 6960) and Residential / Retail Buildings R4A, R4B and R5 (as proposed by SSD 6964, SSD 6965 and SSD 6966):
  - are consistent with the land uses and preferred remediation strategy detailed in the *VMP/Block 4 RAP* (AECOM, 2013b) and *Stage 1B Waterfront Public Domain RAP* (2016a) and can be appropriately managed by those documents; and
  - will enable the relevant consent authority to comply with Clause 7 of *SEPP 55 - Remediation of Land* (1998) as required by Condition 12 of the SEAR's (2 April 2015) in relation to the proposed future use of the land as a Basement with Residential / Retail Buildings and associated open space areas above.
- The Associated Works in the Block 4 Services Zone (as proposed by SSD 6960) are consistent with the land uses and preferred remediation strategy detailed in the *VMP/Block 4 RAP* (AECOM, 2013b) and the associated *Watermans Quay RAP Addendum* (AECOM, 2016b) and can be appropriately managed by those documents;
- The information presented in this letter in relation to the Associated Works proposed in the ORWN Services Zone and ORWN Interim Public Domain:
  - will enable the relevant consent authority to comply with Clause 7 of *SEPP 55 - Remediation of Land* (1998) in relation to the proposed services construction works. In particular:
    - § based on the available information, the soil and groundwater within the ORWN Interim Public Domain are unlikely to be contaminated such that they are unsuitable for the proposed services construction;
    - § in the unlikely event that contamination is identified as part of the proposed ORWN Interim Public Domain development works, implementation of the Unexpected Finds Protocol described by **Section 9.0** will mitigate against unacceptable risks to human health and the environment; and
    - § Implementation of the *Stage 1B Waterfront Public Domain RAP* (2016a) will render the ORWN Services Zone suitable for the proposed development works in this area.
- The information presented in this letter in relation to the Associated works proposed in the Hickson Road Infrastructure and Services Zone (as proposed by SSD 6960):

- will enable the relevant consent authority to comply with Clause 7 of *SEPP 55 - Remediation of Land* (1998) in relation to the proposed services construction works. In particular:
  - § with respect to the **northern excavation area,** based on the available information interim remediation works (as described by **Section 8.6**) will be required to mitigate the risk of soil vapour from underlying soil and groundwater contamination from impacting on future intrusive maintenance workers;
  - § with respect to the **southern excavation area**, based on the available information, the soil and groundwater are unlikely to be contaminated such that they are unsuitable for the proposed services construction; and
  - § in the unlikely event that contamination is identified as part of the proposed development works, implementation of the Unexpected Finds Protocol described by **Section 9.0** will mitigate against unacceptable risks to human health and the environment.

12.0 References

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AECOM, 2016b. *VMP/Block 4 Remedial Action Plan Addendum - Part Stage 1B Public Domain (Watermans Quay), Hickson Road, Millers Point, Barangaroo South.* 19 April 2016.

ERM, 2007. *Environmental Site Assessment, East Darling Harbour, Sydney, NSW, Final Report. Environmental Resources Management*. 21 June 2007.

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The *Stage 1B Waterfront Public Domain RAP* (2016a)

Yours faithfully,

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Attachment 1: Site Plans

Attachment 2: AECOM (2016a) *Stage 1B Waterfront Public Domain RAP*

Attachment 3: AECOM (2016b) *Watermans Quay RAP Addendum*

Attachment 4: Lendlease Development Plans

Attachment 5: Table T1 - Applicable ORWN Services Zone Soil Analytical Results

Attachment 6: Table T2 - Applicable ORWN Interim Public Domain Soil Analytical Results

Attachment 1: Site Plans

Figure 1

HICKSON ROAD INFRASTRUCTURE AND SERVICES ZONE - northern excavation area

HICKSON ROAD INFRASTRUCTURE AND SERVICES ZONE - southern excavation area

APPROXIMATE EXTENT OF VMP REMEDIATION WORKS

EXTENT OF STAGE 1B BASEMENT

VMP / BLOCK 4 RAP (AECOM, 2013) BOUNDARY - red dashed line

ORWN INTERIM PUBLIC DOMAIN (BARANGAROO AVE)

ORWN AREA PUBLIC DOMAIN (red line)

BLOCK 4 SERVICES ZONE

ORWS RAP AREA

ORWN SERVICES ZONE

HARBOUR HEAT REJECTION AREA

HICKSON ROAD

BLOCK 5

BLOCK 4

BARANGAROO CENTRAL (PART)

ORWN AREA

30-34 HICKSON ROAD LOT 2 DP 873158

38 HICKSON ROAD LOT 3 DP 873158

SMALL GASHOLDER

METER HOUSE

CONDENSERS

1870 GASHOLDER

PURIFIERS

PURIFYING SHEDS 3

ENGINE HOUSE

1868 RETORT HOUSE EXTENSION

RETORT HOUSE

COFFEY BOREHOLE LOCATION
COFFEY GROUNDWATER WELL LOCATION
ERM BOREHOLE LOCATION
ERM GROUNDWATER MONITORING WELL LOCATION
AECOM BOREHOLE LOCATION
AECOM GROUNDWATER MONITORING WELL LOCATION
AECOM SOIL VAPOUR LOCATION
AECOM INTERTIDAL WELL LOCATION
OTHER REMEDIATION WORKS (NORTH) AREA AND SITE BOUNDARY
DECLARATION AREA BOUNDARY
THE SITE BOUNDARY
APPROXIMATE EXTENT OF FORMER GASWORKS FEATURES
PROPOSED BASEMENT GROUNDWATER RETENTION WALL SYSTEM (BLOCK 4 AND 5)
EXISTING ORWS BASEMENT GROUNDWATER RETENTION WALL SYSTEM
BLOCK 4 AND 5 BOUNDARIES
EXISTING CAISSON WALL

Last modified: 23 Jul 13 - 14:47

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REVISIONS No.	BY	DATE	DESCRIPTION	APPD
04	PAS	23.07.13	FINAL ISSUE	AR
03	PAS	20.06.13	DRAFT ISSUE	AR
02	PAS	18.03.13	DRAFT ISSUE	AR
01	TT	12.09.12	DRAFT ISSUED	DM

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DRAWN	TT	CHECKED	JA
APPROVED	AR	DATE	23.07.13

CONTRACTOR:

DESIGNER: AECOM

AECOM Australia Pty Ltd A.B.N. 20 093 846 925

CLIENT:

STAGE 1B SEPP 55 LETTER, BARANGAROO

FIGURE 1
SITE PLAN AND SAMPLING LOCATION

STATUS: FINAL

DRAWING NO: 60247139-DRG-20-RAPC-F5

REV: 04

AECOM

Attachment 2: AECOM (2016a) *Stage 1B Waterfront Public Domain RAP*

Barangaroo
Lend Lease (Millers Point) Pty Limited
22-Jan-2016
Doc No. 60247139_RPT1

Remedial Action Plan

Barangaroo South Stage 1B Waterfront Public Domain

Remedial Action Plan

Barangaroo South Stage 1B Waterfront Public Domain

Client: Lend Lease (Millers Point) Pty Limited

ABN: 15 127 727 502

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Reviewed by Michael Jones

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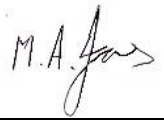
			Name/Position	Signature
1	23 July 2015	Draft for review by LL	Michael Jones Technical Director - Environment	
2	9 September 2015	Final Draft addressing LL comments	Michael Jones Technical Director - Environment	
3	1 October 2015	Final draft addressing LL comments	Michael Jones Technical Director - Environment	
4	21 December 2015	Final draft addressing site auditor comments	Michael Jones Technical Director - Environment	
5	23 December 2015	Final report	Michael Jones Technical Director - Environment	
6	22 January 2016	Final report addressing site auditor comments	Michael Jones Technical Director - Environment	

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List of Figures (Appendix B)

List of Tables (body of report)

Glossary of Terms and Acronyms

Term	Description
AHD	Australian Height Datum
ANZECC	Australian and New Zealand Environment and Conservation Council
ARC	Asbestos Removal Contractor
ARMCANZ	Agriculture and Resource Management Council of Australia and New Zealand
ASLP	Australian Standard Leaching Procedure
ASSMAC	New South Wales Acid Sulfate Soils Management Advisory Committee
As	Arsenic
Ba	Barium
BACM	bonded asbestos containing material
BaP/ B(a)P	Benzo-a-pyrene
BDA	Barangaroo Delivery Authority
BH	Borehole location
BTEX	Benzene, Toluene, Ethyl benzene and Xylene
CBD	Central Business District
Cd	Cadmium
CIM	Confirmed Impacted Material
CLM	Contaminated Land Management
Co	Cobalt
CoC	Chain of Custody
CO_2	Carbon Dioxide
Cr	Chromium
CoPC	Chemicals of Potential Concern
Cu	Copper
CUTEP	Clean Up to the Extent Practicable
DEC	Department of Environment and Conservation NSW (superseded)
DECC	Department of Environment and Climate Change NSW (superseded)
DECCW	Department of Environment, Climate Change and Water NSW (now the NSW OEH)
DGI	Data Gap Investigation
DO	dissolved oxygen
DoP	NSW Department of Planning
DP	Deposited Plan
DQO	Data Quality Objectives
Declaration Site	Declaration Site (Development Works) Remediation Works Area
DSI	Detailed Site Investigation
EC	electrical conductivity

Term	Description
ECS	Emission Control Systems
EE	Excavation Enclosure
EMP	Environment Management Plan
ESCO	Ex-Situ Chemical Oxidation
EPA	Environmental Protection Authority
EPL	Environment Protection License
ESA	Environmental Site Assessment
ESD	Ecologically Sustainable Development
GAC	Generic Assessment Criteria
Hg	Mercury
HHR	Harbour Heat Rejection
HHERA	Human Health and Ecological Risk Assessment
HI	Hazard Index
ISQG	Interim Sediment Quality Guidelines
m bgl	metres below ground level
Mn	Manganese
MW	Monitoring Well Location
MWQC	Marine Water Quality Criteria
LOR	Limit of Reporting
LLMP	Lend Lease (Millers Point) Pty Limited
NATA	National Association of Testing Authorities
NEPC	National Environment Protection Council
NEPM	(National Environmental Protection (Assessment of Site Contamination) Measure
Ni	Nickel
NHMRC	National Health and Medical Research Council
NSW	New South Wales
NSW OEH	New South Wales Office of Environment and Heritage
OHS/OH&S	Occupational Health and Safety
OHSP	Occupational Health and Safety Plan
OPT	Overseas Passenger Terminal
ORWN	Other Remediation Works (North) Area (Stage 1C)
ORWS	Other Remediation Works (South) Area (Stage 1A)
PAH	Polycyclic Aromatic Hydrocarbons
PASS	Potential Acid Sulfate Soils
PDA	Project Delivery Agreement
PID	Photoionisation Detector
PIM	Potential Impacted Material

Term	Description
Pb	Lead
POEO	Protection of the Environment Operations Act 1997 (NSW)
PPE	Personal Protective Equipment
PSI	Preliminary Site Assessment
QA/QC	Quality Assurance/Quality Control
RAP	Remedial Action Plan
RBCL	Risk Based Clean Up Levels
RL	Relative Level
RE	Remediation Enclosure
RWP	Remediation Work Plan
SDS	Safety Data Sheets
SHFA	Sydney Harbour Foreshore Authority
SIL	Soil Investigation Level
S-ESCO	Surfactant Enhanced Ex-Situ Chemical Oxidation
SPA	Sydney Ports Authority
SPGWT	Separate Phase Gasworks Waste and Tar
SPOCAS	Suspension Peroxide Oxidation Combined Acidity & Sulfate
SSESC	Site-specific Ecological Screening Criteria
SSTC	Site Specific Target Criteria
SWL	Standing Water Level
SVM	Site Validation Manager
SVOC	Semi Volatile Organic Compound
TBT	Tributyltin
TCM	Tar Containing Material
TOC	Top of Casing
TPH	Total Petroleum Hydrocarbons
TSC	Terrestrial Soil Criteria
TTM	Total Toxicity of Mixtures
VMP	Voluntary Management Proposal
VOC	Volatile Organic Compound
VP	Validation Plan
VPD	Validation Project Director
UCL	Upper Confidence Level
UCS	Unconfined Compressive Strength
USCS	Unified Soil Classification System
US EPA	United States Environment Protection Agency
VENM	Virgin Excavated Natural Material

Term	Description		
Zn	Zinc		
Units of Measurement			
°C	degrees Celsius	mg	milligrams
cm	centimetre	mS	milli-Siemens
ha	hectare	mV	millivolts
kg	kilogram	ppm	parts per million
km	Kilometre	µg	microgram
m	Metres	%	percent

Executive Summary

Introduction

AECOM Australia Pty Limited (AECOM) was commissioned by Lend Lease (Millers Point) Pty Ltd (Lend Lease) to prepare this Remedial Action Plan (RAP) for the Other Remediation Works North (ORWN) Area/Stage 1B Waterfront Public Domain to be constructed within part of Barangaroo South.

The specific area covered by this RAP, hereafter referred to as "the Site" is presented in **Figure F2 and Figure F3**, **Appendix A**) and comprises the following site areas:

- The proposed Watermans Cove publicly accessible waterway (also known as Globe Harbour or Southern Cove);
- Public Domain areas in two parts here-in referred to as the:
    - southern portion – located east of the proposed Watermans Cove; and
    - northern portion – located north of the proposed Watermans Cove and between the proposed Crown Development Site and Darling Harbour.

It is noted that the term 'Block' in this RAP relates to nominated remediation areas, and is not related to State Environmental Planning Policy (SEPP) block boundaries.

This RAP considers the outcomes of the *ORWN Human Health and Ecological Risk Assessment (HHERA)* (AECOM, 2014) and implements the soil and groundwater Site-Specific Target Criteria (SSTC) which were developed therein.

This RAP has generally been prepared to meet the requirements of:

- *Contaminated Land Management Amendment (CLM) Act* (NSW Govt, 1997a);
- Department of Environment and Conservation (DEC, 2006b) *Guidelines for the NSW Site Auditor Scheme* (2nd edition) (DEC, 2006b);
- Department of Urban Affairs and Planning (DUAP) and NSW EPA. *Managing Land Contamination - Planning Guidelines State Environmental Planning Policy (SEPP) 55 - Remediation of Land* (DUAP and NSW EPA, 1998);
- National Environment Protection Council (NEPC), *National Environment Protection (Assessment of Site Contamination) Measure* (NEPC, 1999) as amended by the:
    - National Environment Protection Council (NEPC), *National Environment Protection (Assessment of Site Contamination) Amendment Measure (NEPAM,* [No. 1] (NEPC, 2013); and
    - New South Wales Environmental Protection Authority (NSW EPA). *Contaminated Sites: Guidelines for Consultants Reporting on Contaminated Sites* (NSW EPA, 1997).

Remediation Objectives

The key remediation objective for the Site is to facilitate the future retail, Public Domain and publicly accessible waterway land-uses proposed for the Site. Specific objectives of the remediation works are:

- To ensure the remediated site is protective of human health in the context of the proposed Public Domain land-uses;
- To ensure the remediated site is protective of the environment (specifically groundwater and the adjacent Darling Harbour), to the extent practicable, by minimising the risk of ongoing contamination; and
- Comply with applicable legislative and policy requirements including the appropriate requirements of the NSW EPA and NSW Department of Planning and Environment (DoPE).

It is noted that material which may require off-site disposal to landfill will require classification in accordance with the NSW EPA (2014) *Waste Classification Guidelines*. Further, it is possible that some material excavated from the Site and designated for off-site disposal may also require treatment prior to off-site disposal.

Scope

The scope of work associated with the preparation of this RAP included:

- Review of available data from previous environmental investigations undertaken at the Site and in adjacent areas to assess the potential for contamination at the Site;
- Confirm the extent of any required remediation works based on consideration of the outcomes of the *Human Health and Ecological Risk Assessment, Stage 1C Development (ORWN), Barangaroo South* (here-in referred to as the *ORWN HHERA*) (AECOM, 2014);
- Undertake an assessment of the potential remediation approaches and technologies;
- Selection of preferred remediation methodology(s) to remediate the Site;
- Outline how the remediation works will be undertaken to meet the remediation objectives, taking into consideration the information review and technical assessment; and
- Develop procedures to demonstrate that the remediation works have been undertaken to satisfy the remediation objectives.

Preferred Remediation Strategy

Confirmed Impacted Material (CIM, soil or groundwater) has not been identified within the Site based on the previous intrusive investigations undertaken within the Site. However, it should be noted that additional validation works are required in Area A (Southern Public Domain Area) to appropriately characterise the unsaturated soils and to further assess the potential presence of CIM which may warrant remediation.

Notwithstanding, concentrations of contaminants are present within the Site which may require specific management practices to mitigate potential risks to construction workers, the public and environment.

Based on the available information, the preferred remediation strategy recommended for the proposed Site development works is:

- Additional validation sampling to confirm whether remediation of identified CIM/SPGWT (unsaturated soils) proposed to remain in situ is warranted;
- If required, remediation of identified CIM/SPGWT and validation of the remediated areas;
- Excavation as required for the installation of underground services, landscaped areas for trees, etc and disposal of excavated material to a NSW EPA licensed landfill (including treatment if required); and
- Placement of Suitable Fill as required to protect human health and to achieve proposed finished Site levels.

Conclusions

It is concluded that:

- Based on the VMP Remediation Works being completed as described by the *VMP/Block 4 RAP* (AECOM, 2013c), any residual gasworks contamination that might remain *in situ* within the Site will not represent an unacceptable risk to the environment; and
- The preferred remediation strategy described by this RAP will, upon successful implementation as evidenced by the prescribed validation program, ensure that the Site is suitable for the proposed land uses, specifically a mixed use comprising retail, public open space and the creation of a publicly accessible waterway connected to Darling Harbour or any combination of the above.

1.0 Introduction

AECOM Australia Pty Limited (AECOM) was commissioned by Lend Lease (Millers Point) Pty Ltd (Lend Lease) to prepare this Remedial Action Plan (RAP) for the Other Remediation Works North (ORWN) Area/Stage 1B Waterfront Public Domain to be constructed within part of Barangaroo South.

The specific area covered by this RAP, hereafter referred to as "the Site" is presented in **Figure F2 and Figure F3**, **Appendix A**) and comprises the following site areas:

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  - southern portion – located east of the proposed Watermans Cove; and
  - northern portion – located north of the proposed Watermans Cove and between the proposed Crown Development Site and Darling Harbour.

It is noted that the term 'Block' in this RAP relates to nominated remediation areas, and is not related to State Environmental Planning Policy (SEPP) block boundaries.

This RAP considers the outcomes of the *ORWN Human Health and Ecological Risk Assessment (HHERA)* (AECOM, 2014) and implements the soil and groundwater Site-Specific Target Criteria (SSTC) which were developed therein.

This RAP has generally been prepared to meet the requirements of:

- *Contaminated Land Management Amendment (CLM) Act* (NSW Govt, 1997a);
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- Department of Urban Affairs and Planning (DUAP) and NSW EPA. *Managing Land Contamination - Planning Guidelines State Environmental Planning Policy (SEPP) 55 - Remediation of Land* (DUAP and NSW EPA, 1998);
- National Environment Protection Council (NEPC), *National Environment Protection (Assessment of Site Contamination) Measure* (NEPC, 1999) as amended by the:
  - National Environment Protection Council (NEPC), *National Environment Protection (Assessment of Site Contamination) Amendment Measure (NEPAM,* [No. 1] (NEPC, 2013); and
- New South Wales Environmental Protection Authority (NSW EPA). *Contaminated Sites: Guidelines for Consultants Reporting on Contaminated Sites* (NSW EPA, 1997).

1.1 Objectives

The key remediation objective for the Site is to facilitate the future retail, Public Domain and publicly accessible waterway land-uses proposed for the Site. Specific objectives of the remediation works are:

- To ensure the remediated site is protective of human health in the context of the proposed Public Domain land-uses;
- To ensure the remediated site is protective of the environment (specifically groundwater and the adjacent Darling Harbour), to the extent practicable, by minimising the risk of ongoing contamination; and
- Comply with applicable legislative and policy requirements including the appropriate requirements of the NSW EPA and NSW Department of Planning and Environment (DoPE).

It is noted that material which may require off-site disposal to landfill will require classification in accordance with the NSW EPA (2014) *Waste Classification Guidelines*. Further, it is possible that some material excavated from the Site and designated for off-site disposal may also require treatment prior to off-site disposal.

1.2 Scope

The scope of work associated with the preparation of this RAP included:

- Review of available data from previous environmental investigations undertaken at the Site and in adjacent areas to assess the potential for contamination at the Site;
- Confirm the extent of any required remediation works based on consideration of the outcomes of the *Human Health and Ecological Risk Assessment, Stage 1C Development (ORWN), Barangaroo South* (here-in referred to as the *ORWN HHERA*) (AECOM, 2014);
- Undertake an assessment of the potential remediation approaches and technologies;
- Selection of preferred remediation methodology(s) to remediate the Site;
- Outline how the remediation works will be undertaken to meet the remediation objectives, taking into consideration the information review and technical assessment; and
- Develop procedures to demonstrate that the remediation works have been undertaken to satisfy the remediation objectives.

1.3 Future Development and Land Use

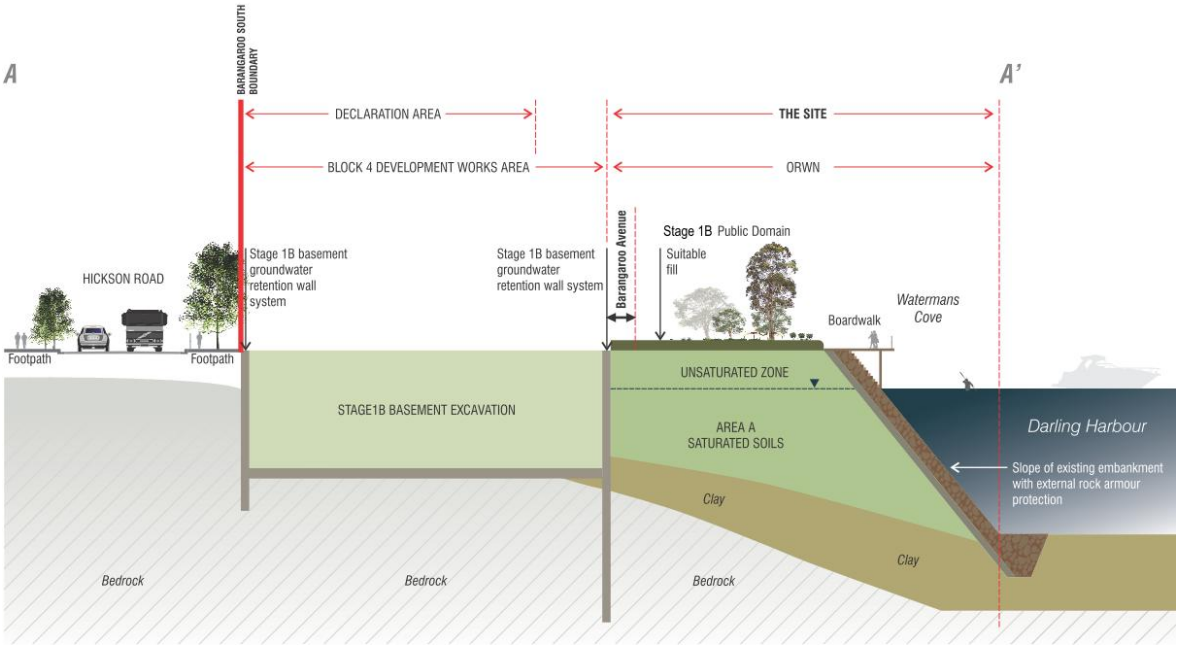
Based on the proposed development concept for the Site, it is understood that the proposed land use across the Site will comprise mixed land use comprising retail, public open space and the creation of a publicly accessible waterway connected to Darling Harbour. Potential proposed land uses include (refer to **Figure F3, Appendix B**):

- Retail buildings (no greater than two storeys) built on grade and with minimal access to soils;
- A publicly accessible waterway in the western portion of the Site (referred to as Watermans Cove); and
- Public open space, landscaping, roads, pedestrian ways and cycle paths, built on grade. This includes two parts:
    - the southern portion – located east of the proposed Watermans Cove; and
    - the northern portion – located north of the proposed Watermans Cove and between the proposed Crown Development Site and Darling Harbour.

Further detail is provided in **Section 4.0**.

The proposed land uses associated with the Site and assessed in this RAP are illustrated in **Figure 1** below (the alignment of this cross-section is shown on **Figure F3**, **Appendix B**):

Figure 1 Schematic Cross Section A-A' (not to scale)



The various land uses / material types associated with the proposed land uses (as shown in **Figure 1**) are:

- **Area A** – material to remain *in situ* beneath the Public Domain and outside the groundwater retention wall systems associated with Stage 1A, 1B and 1C. Area A will have potential hydraulic connection with Darling Harbour. Limited or no excavation is anticipated in Area A; and
- **Area B** – materials potentially removed as part of the service installation and landscaping works within the Public Domain and that will be removed from Site to landfill.

It is understood that materials that may be excavated for service installation and landscaping works will not be reused onsite. If reuse of materials is required, an Addendum this RAP will be prepared and submitted to the NSW EPA Accredited Site Auditor for approval.

It is possible that the final details and configuration of proposed land uses within the Site will be revised by Lend Lease as part of the continued development design. However, the proposed land uses will remain generally consistent with those described within this RAP.

If the final development design is changed in a way which affects the assumptions of the *ORWN HHERA* (AECOM, 2014) and this RAP, an Addendum will be prepared, as required, and submitted to the NSW EPA Accredited Site Auditor for approval.

1.4 Remediation of Adjacent Areas

Separate RAPs have been prepared to describe the remediation required in relation to those areas of Barangaroo South that are adjacent to the Site. These documents are (refer to **Figure F2**, **Appendix B**):

- AECOM. *Amended Remedial Action Plan, Barangaroo - Other Remediation Works (South) Area*. 7 July (AECOM, 2011a). The *Amended ORWS RAP* relates to Blocks 1 to 3 of the Stage 1 Development area, outside the NSW EPA Declaration Area and located south of the Site;
- AECOM. *Addendum to ORWS Amended Remedial Action Plan, Harbour Heat Rejection (HHR) System Inlet Area, Barangaroo South*. 10 October (here after referred to as the '*HHR Addendum to the ORWS Amended RAP*') (AECOM, 2012a). This *Addendum* was prepared to facilitate the development and construction of the HHR System Inlet Area located south of the Site. For clarity, the HHR System Inlet Area is not part of the Site for the purpose of this *RAP*; and

- AECOM. *Remedial Action Plan, NSW EPA Declared Remediation Site 21122 and Block 4 (Stage 1B) Development Works, Barangaroo, Millers Point, NSW* (hereafter referred to as the '*VMP/Block 4 RAP*'). 24 July (AECOM, 2013c). The *VMP/Block 4 RAP* (AECOM, 2013c) is applicable to the Stage 1B basement located immediately adjacent to the east boundary of part of the Site. The objectives of the *VMP/Block 4 RAP* was as follows:
    - To enable the NSW EPA's declaration of the Declaration Area as a Remediation Site (Declaration Number 21122; Area Number 3221) to be revoked; and
    - To ensure that Block 4 (Stage 1B basement) is remediated to a standard suitable for the proposed development in Block 4.
- AECOM. *Stage 1C Hotel Development Remedial Action Plan, Barangaroo South*. (AECOM, 2015 – prepared for Crown Resorts Pty Limited). This *RAP* was prepared to facilitate remediation of the Crown Development Site, located immediately north and east of part of the Site.

A separate RAP (prepared for the Barangaroo Delivery Authority [BDA] by JBS Environmental) has been prepared for Barangaroo Central (located directly north of part of the Site) to identify remediation works required to facilitate the Barangaroo Central development works.

2.0 Assessment and Approval Process

The planning regime to guide the future redevelopment of the overall Barangaroo site is established by the:

- Planning provisions of Schedule 3 Part 12 of the *State Environmental Planning Policy (Major Development)*, 2005; and
- *Barangaroo Concept Plan (Concept Plan 06_0162)* as approved on 9 February 2007 and modified on 25 September 2007, 16 February 2009 and 16 December 2010.

A "site-wide" *Overarching RAP* has been prepared by ERM (Final, June 2010) for the BDA, and provides an overarching conceptual remediation framework for the whole of Barangaroo. The *Overarching RAP* allows for the provision of separate, detailed RAPs for site portions, of which this RAP is one.

2.1 Project Applications

Remediation works as described by this RAP will be subject to assessment and determination by the Minister for Planning as State Significant Development under Part 4 of the *EP&A Act*. As such, an application(s) will be made to the NSW Department of Planning and Environment (DP&E) for, potentially among other things, remediation works within the Site. An Environmental Impact Statement(s) (EIS) will be prepared to address these assessment requirements, in support of the application and to seek planning approval. AECOM has prepared this RAP for Lend Lease as part of the future EIS.

2.2 Legislation Relevant to Remediation Works

The NSW EPA administers a number of Acts and legislative instruments relevant to the remediation works. These include:

- *Contaminated Land Management (CLM) Act* (NSW Govt, 1997a);
- *CLM Amendment Act* (NSW Govt, 2008);
- Department of Environment and Conservation (DEC, 2006b) *Guidelines for the NSW Site Auditor Scheme* (2nd edition) (DEC, 2006b);
- *The Protection of the Environment Operations (POEO) Act,* (NSW Govt, 1997b), in particular, licensing obligations under that Act;
- DUAP and NSW EPA. *Managing Land Contamination: Planning Guidelines, State Environmental Planning Policy (SEPP) 55 - Remediation of Land.* (DUAP and NSW EPA, 1998)

2.2.1 CLM Act (1997, as amended)

The *CLM Act* (NSW Govt, 1997a) is the primary Act under which contaminated land is regulated by the NSW EPA. Relevant legislation relating to the *CLM Act* (NSW Govt, 1997a) includes the *Contaminated Land Management Regulation* (2008), which commenced on 1 September 2008.

This section addresses the following aspects of the *Act*:

- Determination and suitability of a contaminated site for a proposed use including the generation of remediation criteria;
- Existing orders and regulatory instruments applicable to the Site; and
- Voluntary remediation proposals and agreements.

The *Guidelines for the NSW Site Auditor's Scheme (The Auditor Guidelines)* (DEC, 2006b) were prepared by the Department of Environment and Conservation (DEC, now known as the NSW EPA) under the *CLM Act* (NSW Govt, 1997a). *The Auditor Guidelines* (DEC, 2006b) describe a decision process for assessing urban redevelopment sites that should be followed by contaminated land consultants. *The Auditor Guidelines* (DEC, 2006b) prescribe soil investigation levels (SILs), which are the concentrations of particular contaminants above which further investigation and evaluation (such as through completion of a quantitative risk assessment) are required.

The substances for which SILs have been prescribed do not include all of the Contaminants of Potential Concern (CoPC) identified at the Site. *The Auditor Guidelines* (DEC, 2006b) make the following provision for such circumstances:

"…where SILs are not available for particular contaminants, or assessment of contaminants against SILs at a particular site is inconclusive… The auditor must check whether the risk assessment is in accordance with the NEPM [National Environmental Protection (Assessment of Site Contamination) Measures] and any relevant guidelines made or approved by DEC. The auditor must also check that any human health risk assessment satisfies all the requirements in the checklist in Appendix VII. The auditor must check that all site-specific risk assessments are scientifically valid and that the site-specific criteria recommended by the consultant are appropriate to protect public health and the environment."

Adoption of the SILs is generally considered inappropriate for remediation works as this may result in unnecessary increased remediation effort and cost. As such, where site investigations indicate that the SILs are exceeded, it is considered appropriate to adopt a health-based and ecological risk assessment approach in determining suitable criteria for the identified CoPC.

In accordance with the *ERM RAP* (ERM, 2010), a Tier 2 and Tier 3 Human Risk assessment and a qualitative ecological risk assessment was prepared to set Site-specific clean up criteria. The *ORWN HHERA* (AECOM, 2014) was prepared to derive site-specific clean up criteria for the future intended ORWN development works (including the Crown Development Works), which will include a mixture of hotel, commercial and high density residential, public open space and underground parking. The risk assessment process, by which the site-specific criteria were derived for the Site, is summarised in **Section 7.2**.

The *CLM Act* (NSW Govt, 1997a) also sets out requirements for site audits. The *CLM Act* (NSW Govt, 1997a) requires a site audit to be undertaken under certain circumstances, such as if the landuse is proposed to be changed, as is the case with the Site. In consideration of this requirement, it is understood that a Site Audit Statement will be prepared by a NSW EPA Accredited Site Auditor for the Site. The SAS will confirm whether the Site has been remediated to a standard suitable for the proposed land uses (refer to **Section 1.3**).

It is noted that the majority of the provisions in the *CLM Amendment Act* (NSW Govt, 2008) received assent on 10 December 2008. The purpose of the amendments was to allow contaminated sites to be cleaned up more efficiently while reinforcing the 'polluter pays' principle. The key amendments to the *CLM Act* (NSW Govt, 1997a) included:

- introducing new powers to enable the NSW EPA (then a part of DECCW) to require certain persons to carry out a preliminary investigation of site contamination;
- amalgamation of the investigation and remediation stages into a single 'management' stage that can cover investigation, remediation or both;
- removing the concept of 'significant risk of harm';
- enabling the NSW EPA to declare land to be 'significantly contaminated land' if it has reason to believe that land is contaminated and the contamination is significant enough to warrant regulation;
- enabling management orders to be issued to any one or more persons who are responsible for the contamination of land;
- enabling the NSW EPA to issue a management order or to withdraw its approval of a voluntary management proposal that has not delivered a satisfactory outcome in managing contamination;
- provision of a more objective basis for the duty to notify the NSW EPA of contaminated land based on criteria to be listed in new guidelines; and
- requiring land owners and persons carrying out certain activities to notify the NSW EPA of contamination when it becomes aware of that contamination.

2.2.2 POEO Act (1997)

Section 48 of the *POEO Act* (NSW Govt, 1997b) requires a person to obtain a licence from the NSW EPA before carrying out any of the premises-based activities described in Schedule 1 of that *Act*.

Clause 15 of Schedule 1 includes the following activity:

"contaminated soil treatment", meaning the onsite or off site treatment of contaminated soil (including, in either case, incineration or storage of contaminated soil but excluding excavation for treatment at another site).

(2) The activity to which this clause applies is declared to be a scheduled activity if:

(a) in any case, it has the capacity to treat more than 1,000 cubic metres per year of contaminated soil received from off site, or

(b) where it treats contaminated soil originating exclusively on site, it has a capacity:

(i) to incinerate more than 1,000 cubic metres per year of contaminated soil, or

(ii) to treat (otherwise than by incineration) and store more than 30,000 cubic metres of contaminated soil, or

(iii) to disturb more than an aggregate area of 3 hectares of contaminated soil.

The excavation works for the Site, which will involve management of contaminated[1] soil originating from the Site, is unlikely to require the treatment of more than 30,000 m^3 of contaminated soil and will not disturb more than 3 hectares of contaminated soil. Notwithstanding, a Variation of the existing Environment Protection License (EPL) for the Barangaroo site may be required under the *POEO Act* (NSW Govt, 1997b) depending on the quantity of treatment and disturbance of contaminated soil required in association with other parts of the Barangaroo site.

2.2.3 State Environmental Planning Policy 55 (1998)

SEPP 55 – Remediation of Land (1998) specifies when remediation work will require Development Consent (i.e. Category 1 remediation work).

Clause 9 of SEPP 55 defines Category 1 remediation works as:

- Designated development; or
- Being carried out or to be carried out on land declared to be critical habitat; or
- Likely to have significant effect on a critical habitat or a threatened species, population or ecological community; or
- Development for which another State environmental policy or regional environmental plan requires development consent; or
- Carried out or to be carried out in an area or zone to which any classifications to the following effect apply under an environmental planning instrument.
    - coastal protection;
    - conservation or heritage conservation;
    - habitat area, habitat protection area, habitat or wildlife corridor;
    - environment protection;
    - escarpment, escarpment protection or escarpment preservation;
    - floodway;
    - littoral rainforest;
    - nature reserve;
    - scenic area or scenic protection; and
    - wetland.
- is “carried out or to be carried out on any land in a manner that does not comply with a policy made under the contaminated land planning guidelines by the council for any local government area in which the land is situated”.

All other remediation work may be carried out without development consent and is known as Category 2 remediation work.

[1] Contamination is defined in accordance with the CLM Act (1997 as amended) as *the presence in, on or under the land of a substance at a concentration above the concentration at which the substance is normally present in, on or under (respectively) land in the same locality, being a presence that presents a risk of harm to human health or any other aspect of the environment*. As described by Section 8.0, the concentrations of substances in soil and groundwater at the Site are not considered to represent a risk of harm to human health or the environment.

It is noted that the *Barangaroo Independent Remediation Review Panel Report* (8 December 2011) prepared by the Barangaroo Independent Remediation Review Panel concluded the approach to remediation for the project was being undertaken with '*consideration of contamination and the objective of SEPP 55* (1998) *has been appropriately provided for in the determination of approvals'*.

As required by the *Barangaroo Independent Remediation Review Panel Report* (2011), the City of Sydney Council will be notified of the proposed remediation works.

Based on previous intrusive investigations undertaken at the Site, this RAP concludes that remediation may not be required to make the Site suitable for the proposed development (refer **Section 8.0**). As such, categorisation of the proposed works in accordance with Clause 7(1) of SEPP55 is not required. However, in the event that contamination requiring remediation is identified during the required Area A additional validation works and/or the proposed development, it would be remediated in accordance with the contingency measures described by this RAP (refer **Section 20.5**) and would be categorised as Category 1 Remediation Works in accordance with SEPP55.

2.2.4 National Environment Protection (Assessment of Site Contamination) Measure (1999, as amended)

The *National Environment Protection (Assessment of Site Contamination) Measure* (*NEPM*) (NEPC, 1999) has previously been endorsed by the NSW EPA under Section 105 of the *CLM Act* (1997) as amended. The purpose of the NEPM is to '*establish a nationally-consistent approach to the assessment of site contamination to ensure sound environmental management practices by the community which includes regulators, site assessors, contaminated land auditors, land owners, developers and industry*'.

The *NEPM* (1999) has recently been amended by the *National Environment (Assessment of Site Contamination) Amendment Measure* (*NEPAM*), (NEPC, 2013) which was made by the Council of Australian Governments Standing Council on Environment and Waste on 11 April 2013. The *NEPM* (NEPC, 1999)) as amended by the *NEPM* (NEPC, 2013) (here-in referred to as 'the *NEPM* [1999] as amended') has subsequently also been approved by the NSW EPA under Section 105 of the *CLM Act* (NSW Govt, 1997a) as amended on 11 June 2013.

3.0 Site Identification and History

3.1 Site Identification

The Site identification details are provided in **Table 1** below.

Table 1 Site Identification Details

Item	Description
Site Owner	The BDA
Client	Lend Lease
Site Address	Hickson Road (Sussex Street), Barangaroo, NSW 2000
Legal Description (Lot and DP)	Lot 209 in Deposited Plan 1211553
County and Parish	County of Cumberland, Parish of Saint Phillip
Local Government Authority	City of Sydney
Current Zoning	Western part of Site: Zone RE1 Public Recreation
Current Land Use	Unused (note that some parts of the Site are temporarily being used as a staging area for construction works in the ORWS Area). Partial access for public recreation (walking and bike riding) (specifically the harbour walk).
Intended Future Land Use	Mixed use including retail (no greater than two storeys with minimal access to soil), public open space and publicly accessible waterway.
Site Area**	Approximately 4,500 m²
Approximate Average Current Elevation	Relative Level 2 - 3 m Australian Height Datum (AHD)
Site Location	**Figure F1** of **Appendix B**.
Site Layout	**Figure F2** of **Appendix B**.

Notes: ** Derived from CAD plans provided by Crown.
AHD – Australian Height Datum
[a] City of Sydney 2005. *Sydney Local Environmental Plan 2005*, Gazetted 9 December 2005, as amended.
[b] – NSW Department of Planning 2007. Appendix 4. In: *State Environmental Planning Policy (Major Projects) Amendment (Barangaroo), 16 December 2010.*

3.2 Site History

The history of the Millers Point area in which the Site is located, has been detailed in the publication *Land at Millers Pont Ownership and Usage* (Broomham, 2007). It is understood that the study was commissioned by the former Gasworks owners (Jemena) and focuses on that portion of the Barangaroo Stage 1 Development area in which the former gasworks was located. The historic layout of the gasworks infrastructure (previously located off-site to the east on the Declaration Area) is detailed in **Figure F2** and **Figure F4**. AECOM considers the information associated with the former gasworks is relevant to understanding the development history of the broader Stage 1 Development area and potential for Site contamination.

The following summarises historic information presented in Broomham (2007) and ERM (2007, 2008). Those historic activities which relate directly to the Site (which previously formed part of the historic Southern Cove) and/or other parts of Barangaroo are specifically noted.

- **1788-1839**: During early colonial times the shoreline was extended and a wharf and a cottage were constructed near the southern boundary of the original subdivision.

- **1839:** The Declaration Area (off Site to the east) was occupied by the Australian Gas Light Company (AGL)] in 1839. The gasworks were extended in 1869 to include a retort house and gasholder 100 feet (approximately 30 metres) in diameter. The gasworks were located at the eastern boundary of Barangaroo and extended across Hickson Road. The remainder of Barangaroo was used for shipping and manufacturing activities.
- **1882**: AGL acquired an additional land on the north side of the gasworks (off Site to the east) and constructed an additional retort house, demolished the first two gas holders and replaced them with a larger 152 feet (approximately 46 metres) diameter gas holder. A tramway system and hydraulic lift was also constructed to transport coke to a depot in Kent Street.
- **1897**: AGL purchased a small piece of land on the northern boundary of the former gasworks site (off Site to the east) to extend the site 40 feet to the north (Broomham, 2007).
- **1899**: A building that housed a carburetted water gas plant was constructed (off Site to the east).
- **1908**: Wharf frontages to the north of the gasworks were dredged to make way for the rat-proof sea wall (off Site to the north).
- **1912**: The Minister for Public Works of the State of NSW and Sydney Harbour Trust Commissioners (SHTC) owned part of the Declaration Area (part of Lot 3 in DP 876514, off Site to the east) between 1912 and 1930. However, it is understood that AGL continued to occupy the gasworks site until 1921 (ERM, 2007 and URS (2001).
- **1918**: Production at the gasworks was terminated at the Declaration Area (off Site to the east).
- **1921**: SHTC gained possession of the gasworks site (off Site to the east).
- **Mid 1920s**: The following activities occurred at the Declaration Area (off Site to the east), in the mid-1920s:
    - Portions of the gasworks (gasholder and purifier beds) were demolished between 1922 and 1925. The former gasholder tanks were backfilled (ERM, 2007 and URS (2001).
    - Hickson Road was constructed through the former gasworks site. At those locations where no rock foundation was identified, a 4-inch (approximately 10 cm) thick foundation of blue metal followed by an 8 inch (approximately 20 cm) thick foundation of concrete was present. A 6-inch (approximately 15 cm) thick foundation of concrete was placed in those locations where a rock foundation was identified;
    - New jetties and cross-wharf sections of new berths required the complete dismantling of the AGL wharf and excavation into a significant part of the former gasworks;
    - The former gasworks was covered with workshops, including blacksmiths, plumbers, carpenters and a motor garage at the northern end; and
    - There was a SHTC depot located on the western side of Hickson Road.
- **Late 1930s**: MSB painted creosote on the wharf piles (located across Barangaroo Stage 1) to protect them against insects. Part of the Declaration Area was transferred to MSB after the SHTC was dissolved in 1936;
- **1951**: Five finger wharfs with approximately a dozen east-west oriented narrow warehouse buildings were present on the western edge of Barangaroo Stage 1 (likely to have included a portion of the Site).
- **1960s**: The wharfs were reconstructed across the Site. This included the construction of parallel berths with large cargo-moving areas, demolition and removal of some old wharf structures and formation of new sea walls by sinking caissons filled with concrete.
- **1968**: By 1968 the area behind (east of) the sea wall was in-filled (with unclassified fill) and the area was now a continuous wharf. These works occurred across the western portion of Block 4 and 5 (including part of the Site).
- **1970s and 1980s**: The wharves across the Barangaroo Stage 1 site, including the Site, remained utilised for port activities. The 1972 aerial photograph indicated the finger wharfs had been filled in and the Declaration Area comprised a sealed area with two large warehouses, on the northern and western boundary. The Southern Cove is still operative.
- **1988**: **The** Southern Cove, which is likely to have included parts of the Site, was filled.
- **1995**: The longshore wharves at the Barangaroo Stage 1 site were leased to Patrick Stevedores No 2 until 2006. The Sydney Ports Corporation (SPC) was also established in 1995.

- **1999:** The SHFA was formed under the Sydney Harbour Foreshore Authority Act 1998 to consolidate the work and functions of City West Development Corporation, Darling Harbour Authority and Sydney Cove Authority. Lots 3 and 5 of DP 876514 were transferred to SHFA in 2007. Wharf 8 Overseas Passenger Terminal constructed within the Site.
- **2007**: The Declaration Area (off Site to the east) was declared an Investigation Area by the NSW EPA.
- **2008**: The wharf west side of Barangaroo was vacated and warehouses demolished in preparation for development.
- **2009**: The Declaration Area (off Site to the east) is declared a Remediation Site by the NSW EPA.
- **2011**: The Declaration Area (off Site to the east) (excluding Hickson Road) and the Block 4 Public Domain (part of which includes the Site) was used as part of the construction site supporting the Barangaroo South Stage 1A basement construction (within the ORWS Area).

3.2.1 Filling History

Based on a review of historic aerial photographs and maps of Barangaroo, the history of filling may be summarised as follows.

- **1836 to 1888**: there appeared to be some limited filling around Millers Point towards Darling and Sydney Harbours (north of the Site);
- **1888 to 1897**: filling occurred into Darling Harbour in the area in the vicinity of the gas works site and there were several finger wharves constructed at the southern end of Barangaroo (likely to have included parts of the Site);
- **1897 to 1951**: further filling around Millers Point (to the north) and four finger wharfs were constructed in the central portion of Barangaroo (between Millers Point and the gas works site) (north of the Site);
- **1951 to 1968**: the southern-most portion of Barangaroo (the current Stage 1A construction site) was filled in to the current eastern extent of the Darling Harbour shoreline;
- **1968 to 1986**: the area between the historic Southern Cove (including the Site) and Millers Point, was filled in after the finger wharves were demolished;
- **1986 to 1988**: the historic Southern Cove, which is likely to have included parts of the Site, was filled in; and
- **1988 to present**: no more significant filling occurred.

It should be noted that, notwithstanding the filling history that can be inferred from the above site history, it is difficult to identify, based on observations from the site investigations, distinct differences in fill type relative to the historical filling sequence at the Site. The fill history within the former Southern Cove is known to be different to other parts of Barangaroo and is discussed in **Section 6.5.2**.

3.2.2 Historic Gasworks Features (located Off Site to the East)

As detailed in the *VMP/Block 4 RAP* (AECOM, 2013c), the former AGL (now Jemena) gasworks was located east of the Site (within the Declaration Area occupying most of Block 4 and 5) and extended to the area now occupied by Hickson Road (refer to **Figure F4**). It is noted that no historic gasworks infrastructure has been identified beneath the Site.

It is understood that URS (2001) estimated that the footprint occupied by the former gasworks[2] in the discussed offsite areas was approximately 5,420 m^2. The following infrastructure is understood to have been present within this footprint:

- Retort House;
- Meter House;
- Tar tank;
- Engine House;
- Gasholders; and
- Purifier Beds.

[2] AECOM did not have access to the URS (2001) report and is unable to confirm whether this area refers to the entire gasworks site or only the gasworks infrastructure.

Previous investigations and remediation works (undertaken at The Bond site on Hickson Road) have identified that existing gasworks infrastructure extend across Hickson Road, including part of the annulus of the former main gasholder, a smaller secondary gasholder and a tar tank (Coffey, 2008).

3.2.3 Historic Southern Cove Embankment

As described by **Section 6.1**, part of the Site is located within the footprint of the historic Southern Cove. The historic Southern Cove was reclaimed by:

- Construction an earthen embankment at the western extent of the historic Southern Cove at the boundary with Darling Harbour. The slope of the embankment is approximately 1(V) to 2(H) on the Harbour side and is protected from wave action with a 1,200 mm thick armour layer and a 600 mm thick fill layer. The top of the embankment is at Relative Level 2.90 m AHD (approximately 0.5 m bgl);
- Construction of concrete piles to support an approximately 25 metre wide suspended concrete slab extending across the western portion of the historic Southern Cove, above the western slope of the embankment; and
- Placement of uncontrolled fill material behind the embankment on the eastern side to reclaim the historic southern cove and support the existing concrete surface slab. The fill characteristics in this area are discussed in **Section 6.5**.

As discussed in **Section 4.1**, the proposed development works do not include removal of the historic Southern Cove embankment which will continue to be appropriately protected by the existing 1,200 mm thick rock armour layer.

4.0 Future Development Works

4.1 Future Proposed Land Uses

The proposed development works at the Site incorporates a mixture of retail (no greater than two storeys with minimal access to soil), public open space and a publicly accessible waterway. The proposed land uses associated with the proposed Site development works are illustrated in **Figure 1** (refer to **Section 1.3**) and **Figure F3** in **Appendix B**.

4.1.1 Watermans Cove

Construction of the proposed Watermans Cove will include the following features:

- A publicly accessible waterway open to Darling Harbour; and
- A broad stepped area providing access to the water from the Public Domain.

The construction of the proposed Watermans Cove will be limited to removal of some of the existing suspended concrete slab that was constructed over the western end of the reclaimed historic Southern Cove. The existing suspended slab is supported by piles spaced at approximately 5m intervals and, where possible, will be retained as part of the development works. Importantly, the proposed development works will not include removal of the historic Southern Cove embankment which will continue to be appropriately protected by the 1,200 mm thick rock armour layer. Based on this design, the depth of water at the edge of the proposed Watermans Cove would be such that contact with sediments is extremely unlikely (i.e. due to the physical presence of the rock armour layer and the depth of water at the edge of Watermans Cove). For the avoidance of doubt, no excavation of fill materials is proposed as part of the construction of Watermans Cove.

4.1.2 Public Domain Areas

The Site includes two distinct areas that will be developed for Public Domain land use including public open space, landscaping, roads, pedestrian ways and cycle paths, built on grade. The two areas are the (refer to **Figure F3**):

- Southern Public Domain Area - located east of the proposed Watermans Cove; and
- Northern Public Domain Area - located north of the proposed Watermans Cove and between the proposed Crown Development Site and Darling Harbour.

Development of the two Public Domain areas will be largely accomplished by construction at grade with only limited requirement for excavation to accommodate below ground utilities and foundations.

It is unlikely that materials excavated during the development works will be reused onsite. However this RAP accommodates the reuse of excavated material in case this is required on the Site. If reuse of excavated materials is required, an Addendum to this RAP will be prepared and submitted to the NSW EPA Accredited Site Auditor for approval.

The development works will involve the raising of Public Domain areas by the placement of 'Suitable Fill' (refer to **Section 7.2.2**).

The northern portion of Area A (located between the proposed Crown Development Site and Darling Harbour) is located directly above the existing caisson wall. Lend lease has advised that the existing concrete slab rests directly onto top of the caisson wall which has a concrete slab on the top. Consequently, no fill material is thought to be present between the existing slab and the top of the caisson wall. The caisson wall is known to be filled with dredged sediments / sand from Darling Harbour and therefore is unlikely to represent a significant contamination risk to the Site. Assessment of soil and groundwater conditions within the existing caisson wall are not considered to be required and, given the access constraints in this area, are not likely to be feasible.

The southern portion of Area A (located east of the proposed Watermans Cove) is immediately adjacent to the Harbour Heat Rejection (HHR) System Inlet Area which was the subject of the separate *HHR Addendum to ORWS Amended RAP* (AECOM, 2012a) (refer to **Section 1.4**) and will eventually be integrated into the Waterfront Public Domain area. It is understood that construction of the HHR System Inlet Area has been completed and that Coffey[3] prepared a validation report which concluded that remediation had been completed in accordance with the *HHR Addendum to ORWS Amended RAP* (AECOM, 2012a) and the HHR System Inlet Area did not *present an unacceptable ecological risk, or risk to human health*. It is understood that the existing hardstand within the southern portion of Area A is likely to be retained (with the exception of areas where limited excavation for excavation is required to accommodate below ground utilities and foundations) with Suitable Fill placed above it to achieve the required Site finished surface levels.

4.2 Development Design Finalisation

As noted in **Section 1.3**, it is possible that the final details and the proposed configuration of the proposed Site development works will be revised as part of the continued development design. However, the proposed land uses for the Site - that is a mixture of retail (with minimal access to soil), public open space and a publicly accessible waterway - will remain generally consistent with that described within this RAP.

If the design is changed in a way that affects the assumptions detailed herein (refer to **Section 7.2.2**):

- Contingency measures may be considered. **Section 20.0** presents contingency measures designed to address modification of the development design (for example, if the historic Southern Cove embankment requires excavation); and/or
- An Addendum to this RAP will be prepared and submitted to the NSW EPA Accredited Site Auditor for approval.

[3] Coffey. 2015. *Project Validation Report #9 – Harbour Heat Rejection System Inlet Area Validation, ORWS Area, Barangaroo South*. 17 April

5.0 Previous Investigations

A number of previous investigations have been completed in respect of the Site. It is noted that these investigations also included parts of the Barangaroo Stage 1 Development not included in the Site that is considered by this RAP (refer to **Table 2**).

Further detail regarding these site investigations is provided in Section 2.6 of the *ORWN HHERA* (AECOM, 2014).

Table 2 Previous Investigations

Date of Publication	Consultant	Report Title and Key Issues
January, 1986	ARUP Geotechnics	Upgrading Wharf 7/8 Darling Harbour, Geotechnical Site Investigation – detail of rock/soil design parameters, geotechnical analysis and recommendations on foundations for proposed development of Wharves 7 and 8.
June, 1996	Noel Arnold & Associates Pty Ltd	*Initial Environmental Assessment, Sydney Ports Corporation, Darling Harbour Berths 3-8 Hickson Road, Darling Harbour* (NA&A, 1996) – details results of an initial contamination assessment and provides options for remedial management of the site. Known and potential contamination was not determined to be a risk to the ongoing use of the site by the then occupant providing subsurface materials were not disturbed. Impact was identified in the area of the former gas works.
March, 1998	Coffey Partners International Pty Ltd	*Wharf 8 Darling Harbour Environmental Soil Quality Assessment* (Coffey, 1998) – A limited site assessment including soil sampling at Wharf 8 to identify contamination and provide options for disposal of excavated soil associated with proposed development. The Environmental Site Assessment (ESA) reported low level polycyclic aromatic hydrocarbons (PAH) contamination and identified material required for off-site disposal that would likely require industrial or hazardous waste classification.
July, 2001	URS Australia Pty Ltd	*Contamination Review for Darling Harbour – Berths 3/8* (URS, 2001) – Comprised a review of the contamination issues collated from 11 reports produced between 1993 and 2001. The review identified soil and groundwater contamination associated with the former gas works, including off-site migration and soil contamination associated with current vehicle maintenance operations.
August, 2006	Jeffery and Katauskas Pty Ltd	*Geotechnical Investigation for Proposed Redevelopment of Wharves 3-8 at Hickson Road, Darling Harbour East, NSW* (J&K, 2006) - Geotechnical investigation intended to identify the subsurface conditions of the site in preparation for the proposed redevelopment.
June, 2007	ERM Australia Pty Ltd	*Environmental Site Assessment, East Darling Harbour, Sydney, NSW Final Report – Revision 1* – ESA (ERM, 2008) intended to identify and report the environmental site conditions in preparation for the development planning. Works included the completion of a Stage 1 Investigation and Stage 2 ESA comprising drilling and sampling of soils and groundwater at 150 locations (inclusive of Lots 1, 2 , 4 and Northern portion of Lot 5). Chemicals of potential concern (CoPC) were identified in groundwater in the vicinity of the former gas works.
May 2008	Coffey Environments Pty Ltd	*Preliminary environmental investigation at 30-38 Hickson Road,* (Coffey 2008) - conducted for the City of Sydney Council. Included the drilling and sampling of 15 boreholes and the installation of 6 groundwater monitoring wells. Area of investigation included Hickson Road and the courtyard area between 30 and 38 Hickson Road.

Date of Publication	Consultant	Report Title and Key Issues
July, 2008	ERM Australia Pty Ltd	*Additional Investigation Works at Barangaroo, Hickson Road, Millers Point, NSW – Revision 3* (ERM, 2008a) – intended to address data gaps remaining following the Stage 2 ESA and included an additional 55 boreholes and construction of 13 monitoring wells across the site (inclusive of Lots 1, 2 , 4 and Northern portion of Lot 5). The report identified the former gas works and reclaimed areas between the finger wharves as key areas of concern. Exceedences of assessment criteria for soil were identified for lead, total petroleum hydrocarbons (TPH), PAH, benzene, toluene, ethylbenzene, xylenes (BTEX) and sulphate. The highest levels were identified in the vicinity of the former gas works and included the identification of phase separated hydrocarbons (PSH) in monitoring well (MW)204D located within the gas works footprint.
August, 2008	ERM Australia Pty Ltd	*Preliminary Sediment Screening Works at East Darling Harbour, Adjacent to Barangaroo, NSW, Draft, Rev 03* (ERM, 2008b) – preliminary sediment screening works were conducted at East Darling Harbour to identify potential migration of contamination off the site to sediments in Darling Harbour. Sediments cores were collected from the harbour adjacent to the site along 7 transects. Screening identified PAH, tributyl tin (TBT) and metals exceeding Australian and New Zealand Environment Conservation Council guidelines (ANZECC, 2000) and elevated levels of organochlorine pesticides (OCPs) and TPH C_{10}-C_{36}.
May 2010	AECOM	*Data Gap Investigation, Other Remediation Works (South) Area Hickson Road, Millers Point NSW* (AECOM, 2010a). The purpose of the data gap investigation (DGI) was to reduce uncertainties which existed in the data set, to assess the characteristics of soil and groundwater underlying the Site, provide additional data for a quantitative HHERA and facilitate the development of an RAP and RWP (remediation work plan) describing the remediation strategy to be implemented by LL as part of its proposed Stage 1 Development of the Barangaroo Precinct (AECOM, 2010a).
September 2010	AECOM	Data Gap Investigation, EPA Declaration Area (Parts of Barangaroo Site and Hickson Road), Millers Point NSW (AECOM, 2010b).
October 2010	AECOM	Data Gap Investigation, Other Remediation Works (North) Area, Hickson Road, Millers Point NSW (AECOM, 2010c).
November 2010	AECOM	Groundwater Discharge Study, Stage 1 Barangaroo Development, Hickson Road, Darling Harbour, NSW (AECOM, 2010d).
January 2011	AECOM	In-situ Validation (ORWS) (AECOM, 2011a).
January 2012	AECOM	In-situ Waste Classification, Blocks 1-3 ORWS, Barangaroo (AECOM, 2012a).
March 2012	AECOM	Supplementary Data Gap Investigation, EPA Declaration Area (Parts of Barangaroo Site and Hickson Road), Millers Point NSW (AECOM, 2012b).

6.0 Site Condition and Surrounding Environment

6.1 Current Land Use

The Site covers two irregularly shaped areas of approximately 0.45 ha. The location of the Site is presented on **Figure F1** and the Site layout is illustrated in **Figure F2**.

At the time of this report the Site was occupied by Lend Lease as a support for the construction of the adjacent Stage 1A development, located to the south of the Site. The Site contained a Stage 1A temporary access road, the western portion of a concrete batching plant and plant and equipment storage areas.

6.2 Surrounding Land Use

The Site is surrounded by the following land uses:

- North: the proposed Crown Hotel Development site and the Barangaroo Central Temporary Public Domain and beyond that Headland Park (which is being developed for open space land use);
- South: the Barangaroo South Stage 1A development (under construction for commercial, residential and open space land use), followed by Shelley Street and then commercial buildings;
- East: the proposed Crown Hotel Development site and Barangaroo South Stage 1B (Block 4) area, followed by Hickson Road and then residential and commercial multistorey buildings; and
- West: Darling Harbour.

6.3 Topography and Drainage

The topography of the Site is relatively flat having been the subject of significant reclamation works for its previous use as a stevedoring facility. The closest surface water body to the Site is Darling Harbour, located directly adjacent to the Site and which will flow into the proposed Watermans Cove. The Site is surfaced with hardstand (concrete and bitumen).

The stormwater runoff from the Site is currently captured on-site and treated by Lend Lease's on-site water treatment plant and then discharged to Sydney Harbour under an environmental protection licence (EPL).

6.4 Separate Phase Gasworks Waste and Tar (SPGWT)

For the purposes of this report, SPGWT refers to:

- Tar Containing Materials (TCM), as per the definition described below:
  - Greater than 10% visible coal tar (where coal tar is a phase separated hydrocarbon by-product from coal gasification); and/or
  - Contaminant concentrations exceeding the following limits:
    - Polycyclic Aromatic Hydrocarbons (PAHs) - 2,000 mg/kg; or
    - Benzo(a)Pyrene (B(a)P) - 150 mg/kg.
- Dense Non Aqueous Phase Liquids (DNAPLs).

The above TCM definition was originally proposed by AECOM and adopted by Lend Lease/the BDA to define TCM at the Site, particularly in the context of material that is unsuitable for reuse (in conjunction with the site-specific risk based criteria which were derived in the *ORWN HHERA* [AECOM, 2014]).

It is noted that the term SPGWT has not been used in the previous site investigation reports where such materials were variably referred to as tar, coal tar, etc.

The *ORWN HHERA* (AECOM, 2014) notes that the *Guidelines for the Assessment and Management of Groundwater Contamination* (DEC, 2007) requires that:

- "Where light NAPLs (LNAPLs) or dense NAPLs (DNAPLs) are present in the subsurface they must be removed or treated as much as practicable".

Consequently, in accordance with NSW EPA policy and guidelines, and the remediation goals recommended by the *ORWN HHERA* (AECOM, 2014), all SPGWT identified on the Site and in adjacent off Site areas is required to be remediated to the extent practicable.

6.5 Geology

Part of the Site is located within the footprint of the historic Southern Cove which was previously bound by a caisson wall. A review of the 1983 and 2004 aerial photographs (ERM, 2007) indicates that the historic Southern Cove is the most recent part of the Barangaroo South Development Area to have been infilled. Consequently, the ground conditions beneath the proposed Watermans Cove and southern portion of the Public Domain differ to some degree from adjacent Barangaroo site areas. In particular:

- there is no caisson wall present along the western boundary of the historic Southern Cove (adjacent to Darling Harbour). Instead, there is a rock armoured earthern embankment (refer to **Section 3.2.3**); and
- the concrete slab over the western portion of the historic Southern Cove, west of the above rock revetment (i.e. generally west of sampling locations borehole (BH38 and BH39), is supported by columns and does not rest directly on fill.

The above findings appear to be confirmed by the 2004 aerial photograph which shows a newer concrete slab along the western perimeter (i.e. directly adjacent to Darling Harbour) of the historical Southern Cove footprint. This newer concrete slab appears to be approximately 25m wide and parallel to the Darling Harbour western Site boundary (as shown on **Figure F4**). This historic information indicates that, due to the later backfilling works conducted within the historic Southern Cove area, it is unlikely that this area has been backfilled with materials which originated from the former gasworks located to the east of the Site within the Declaration Area.

Field observations during the various AECOM site investigations have also indicated that a void is present beneath the newer western concrete slab and that seawater moves freely beneath it. Consequently, no boreholes have been advanced in this area (refer to **Figure F4**).

6.5.1 Regional Geology

Reference to the *1:100, 000 Geological Survey of NSW (Sydney) Sheet 9130 (Ed 1), 1983* indicates that the stratigraphy of the Site comprises man-made fill material, marine clays and Hawkesbury Sandstone.

Various intrusive and geotechnical investigations have been undertaken within Barangaroo South and surrounding area. The *Barangaroo Stage 1 Development Geotechnical Report (Coffey, 2010)* described the following sub surface units present across Barangaroo:

- Fill: heterogeneous fill consisting of mainly of crushed sandstone with inclusions of brick, concrete, timber, glass and slag. The fill becomes progressively deeper from east to west and the base of the fill has been interpreted as highly irregular.
- Estuarine sediments: Dark grey to black silty and sandy clays containing shells and organic material were typically observed across the southern and eastern portion of the Barangaroo South. Organic peaty clay layers were also present in areas. The estuarine sediments were identified at two distinct horizons at 4 to 6 m bgl and 11 to 14 m bgl with thicknesses of 1 to 2 m.
- Alluvial sediments: firm silty sands, clayey sands and stiff sandy clay sourced from weathered sandstone were identified at depths of 5 m bgl in the east and greater than 16 m bgl in the west with thickness ranging from 3 to 10 m.
- Residual soil: hard silty clay and sandy clay encountered at depths greater than 13 m bgs in some locations with thicknesses of up to 1.5 m.
- Sandstone: extremely low strength and extremely highly weathered sandstone grading to high strength sandstone generally encountered shallow in the east and slopes down to the west.

- Dolerite Dyke (The Pittman Dyke): a near vertical extremely weathered dyke consisting of very stiff to hard pale grey/white kaolinitic clay runs east-west through the northern portion of the Barangaroo South development at depths from 5 to 14 m bgl.

6.5.2 Site Geology

As detailed in **Section 3.2**, the site history indicates that the historic Southern Cove was the most recent part of the Barangaroo South Development Area to have been infilled. Therefore, it is considered unlikely that the materials placed in this area would have originated from the former gasworks located to the east of the Site.

Based on the available investigation date, it is considered relevant and appropriate to characterise that part of the Site associated with the proposed Watermans Cove and southern Public Domain area based on soil analytical data collected within the entire historic Southern Cove area.

The following descriptions are predominantly based on soil investigation results from areas within the historic Southern Cove. Notable differences associated with the northern Public Domain (located between the proposed Crown Development site and Darling Harbour) are also noted where relevant.

Fill material

The depth of the fill material/marine sediment interface within the Site area ranges from 13.0 metres below ground level (m bgl) in the eastern portion (BH407) to 23.6 m bgl in the northwest corner (BH017). As such, the depth of fill material increases towards the northwest corner of the Site.

A variety of fill types was observed during the soil sampling activities. A significant proportion of sandstone gravels/fragments and sandstone boulder/floaters were noted in the borehole logs. Due to the timing of the back filling of the historic Southern Cove (as supported by the review of the aerial photographs, refer to **Section 3.1**) it is likely that the material used to fill this area did not originate from the former gasworks site and was imported from an unknown offsite location.

The northern Public Domain area of the Site forms the western edge of Barangaroo South and is underlain by the historic Caisson Wall which is comprised of large reinforced concrete boxes filled with dredged sediments / sand from Darling Harbour.

While some sections of the historic caisson wall (which formed the northern, eastern and southern boundaries of the historic Southern Cove) will be removed as part of the proposed Crown development and Stage 1B basement construction, it is not proposed to remove any additional sections as part of the proposed development works at the Site.

Natural materials

The natural marine sediments underlying fill materials at the Site generally comprise a sandy clay/clayey sand with some horizons of silty clay, clay and sand. The thickness of the marine sediment within the Site ranges between 2.0 m in the southeast corner (BH41) to greater than 9.5 m in the southwest corner of the (BH049). Bedrock was not encountered in BH049 to the maximum drilling depth of 27.5 m bgl.

Bedrock was encountered at depths ranging between 17.5 m bgl in the southeast corner (BH41) and greater than 27.5 m bgl in the southwest corner (BH049) of the Site. The depth of the marine sediments and bedrock is consistent with the conceptual site model for the broader Barangaroo South site – that is, bedrock dips/slopes to the north and west and has been eroded prior to the deposition of the overlying marine sediments.

6.6 Hydrogeology

Groundwater occurs at the Site as an unconfined aquifer within the fill materials and natural sediments and is also expected to be present as a fractured bedrock aquifer within the underlying sandstone.

Previous investigations have encountered groundwater within the fill material at less than three metres depth. Groundwater at the Site is expected to ultimately flow towards and discharge to Darling Harbour, although the effect of tidal influence is expected to influence groundwater flow.

Data gap investigations conducted within the Declaration Area and ORWN Area (AECOM 2010b and AECOM 2010c, respectively) concluded the following in regards to the groundwater regime:

- Groundwater was present beneath the historic Southern Cove within the fill materials and natural sediments;

- Monitoring of water levels confirmed that groundwater underlying the historic Southern Cove is tidally influenced, with the influence extending as far east (inland) as Hickson Road. The amplitude of tidal induced groundwater level fluctuations reduced with distance from the Harbour;
- The groundwater flow path was likely to be complicated by the presence of variable fill materials and subsurface structures (including a rock revetment at the western edge of the historic Southern Cove and a caisson wall along the perimeter of the historic Southern Cove) associated with the historic Southern Cove;
- Hydraulic conductivities were variable across the historic Southern Cove and were dependent on localised lithology;
- A search of the NSW Department of Natural Resources (DNR) groundwater bore data base as reported in ERM (2007) indicated that there were 32 registered groundwater bores within a 4 kilometre (km) radius of the Site. Groundwater bore information indicated that the bores were registered for either recreation, irrigation or monitoring purposes; and
- As detailed in the *Groundwater Discharge Study Stage 1 Barangaroo Development* (AECOM, 2010d) and concluded in the *ORWN HHERA* (AECOM, 2014), contaminant flux from the underlying marine sediments was reported to be negligible, with a discharge component estimated at 1.6 m^3/day, due to the low hydraulic conductivity and gradient. Groundwater discharge occurring via the basal Hawkesbury Sandstone was also not considered significant in the context of contributing site-derived contaminant flux to Darling Harbour. Further discussion is provided in **Section 6.8**.

6.7 Site Contamination

6.7.1 Soil

Total concentrations

The results of the soil total concentration analysis are presented in **Table T3** and **T4** of **Appendix A**.

Total PAHs (including Benzo[a]pyrene) were generally reported to be non-detect in the Site's fill material. A Total PAH concentration of 288 mg/kg was reported at a depth of 16-.5 to 16.7 at BH40 located within the marine sediments on the eastern Site boundary.

Heavy metals (arsenic, cadmium, chromium, copper, lead, nickel, mercury and zinc) in the saturated and unsaturated soils were reported at generally low concentrations and less than the adopted site investigation criteria across the Site and in adjacent areas.

TPH C_6-C_9 was reported to be non-detect in all analysed unsaturated and saturated soil samples at the Site and in adjacent areas. Heavy end TPH fractions (TPH C_{15}-C_{28} [560 mg/kg] and TPH C_{29}-C_{36} [200 mg/kg]) were reported in the marine clays at a depth of 14.5-14.7 at BH46 (located offsite to the north).

All BTEX concentrations in the unsaturated soils were reported to be non-detect. BTEX was detected in the marine sediments at location BH40 with a maximum concentration of benzene reported at a depth of 16.5-16.7 m bgl (5.4 mg/kg).

Concentrations of phenols and SVOC were typically reported below the laboratory LOR.

Potential Gasworks Impacts

Table T7, **Appendix A** summarises field observations of potential gasworks related impacts in the ORWN soils (including the Site).

A review of the borehole logs and analytical data from the Site and in adjacent areas indicates that impacted materials, likely to be attributable to the former gas works site, are located within the marine sediments at approximately 16.5 m bgl depth at sampling location BH40 (located on the eastern Site boundary). These impacts are present within the natural sandy clay where there is negligible contaminant flux (refer to **Section 6.8**).

Asbestos Impacts

One sample (BH38_2.5-2.7) was analysed for asbestos from within the Site and was reported to be non-detect for asbestos in soil. No visual evidence of bonded fibre cement or possible asbestos fibres was observed by AECOM during the *ORWN DGI* (AECOM, 2010b).

ERM (ERM, 2008) previously analysed a total of 39 samples across Barangaroo and detected chrysotile and amosite asbestos in a single location (BH203_1.5, located offsite in Block 4).

Greater than 1000 samples were analysed and/or visually inspected for the presence of ACM as part of Stage 1A basement excavations works in the adjacent ORWS Area (AECOM, 2013a). ACM was identified to be widespread within excavated material within the ORWS Area (AECOM, 2013d) therefore it is assumed that there is significant potential for bonded ACM to be present within fill materials within the Site.

AECOM has been advised by Lend Lease that it identified a significant volume of bonded ACM during shallow excavation works required for a new sewerage pump out pit within Stage 1C (northeast and adjacent to the Site). The pit was constructed for a New Amenities Area associated with the construction compound supporting the adjacent Stage 1A development works. Lend Lease estimated that the excavation measured approximately 3 x 3m and 2m deep with a volume of approximately 20 m^3. Lend Lease reported that it observed between 20 and 30 bonded ACM fragments in the small stockpile formed from this excavation and that the fragments measured in the order of 40 x 60mm x 6mm thick.

The Stockpile Verification Certificate (New Amenities Area) prepared by Noel Arnold and Associates (3 January 2013) indicates that the excavated material from the New Amenities Area was added to SP225 which had a total volume of approximately 1,000 m^3. Approximately 100 fragments of bonded ACM were identified within stockpile SP225 and the stockpile was classified as Special Waste (asbestos). Analysis of the fibre cement sheet fragments confirmed chrysotile, amosite and crocidolite asbestos to be present within the fragments.

Based on information provided to AECOM, the location from which the material stockpiled in SP225 originated appears to be east of the historic investigation location BH191 (offsite in the Stage 1C area, as shown in **Figure F4**).

6.7.2 Groundwater

Groundwater is present beneath the Site within the fill materials and underlying natural material. Groundwater was encountered at in the ORWN Area at depths ranging from 1.823 to 2.975 m bgl (AECOM, 2010c).

The groundwater level gauging within the Site produced variable results (as expected based on tidal fluctuation), with no distinct flow direction ascertained. The reported variability is related to tidal fluctuations, the nature and distribution of fill materials and the presence of subsurface structures (including the caisson wall associated with the historic Southern Cove).

BTEX, TPH, VOCs and SVOCs (including PAHs and phenols) concentrations were generally reported below the LOR in groundwater present in the fill material across the Site and in adjacent areas.

Heavy metals (in particular, arsenic, cobalt, manganese and nickel), benzene and ethylbenzene in groundwater were reported above the adopted site investigation criteria across the Site and in adjacent areas.

The groundwater results are presented in **Table T6** of **Appendix A**.

6.8 Consideration of Contamination at Depth within Natural Marine Clays and Sediments

Groundwater Discharge Study (AECOM, 2010c)

The *GDS* (AECOM, 2010c) was prepared to inform the *VMP HHERA* (AECOM, 2012c) with respect to the interaction of groundwater from Barangaroo South (including the Site) with Darling Harbour and the potential for contaminant mass flux due to mixing of seawater prior to discharge.

Relative to that occurring from the fill sequence, groundwater discharge volumes and therefore contaminant mass flux from the marine sediments was considered to be negligible from a hydrogeological perspective. Groundwater discharge occurring via the basal Hawkesbury Sandstone was not considered significant in the context of contaminant flux due to very low values of permeability reported for this formation in the literature.

A summary of the *GDS* (AECOM, 2010c) is presented in **Section 2.6.8** of the *ORWN HHERA* (AECOM, 2014).

Contaminant Mass Flux Study (AECOM, 2012b)

AECOM undertook a *Contaminant Mass Flux Study* (AECOM, 2012b) to assess the significance of contaminant mass flux and discharge in the natural soil, marine sediments and groundwater underlying the Site.

The study is presented as part of the *VMP Remediation Extent* report (AECOM, 2013d) and concluded that:

- Lithology and hydraulic conductivity data indicate that groundwater flow in the underlying natural soil and marine sediments is very low and in the order 0.4 metre per year, with contaminant velocities likely to be at least an order of magnitude lower due to attenuation (sorption, biological degradation, etc.);
- The effect of the twice daily tide provides changes in hydraulic head that further reduce the migration of groundwater and hence the contaminants;
- Mass discharge modelling indicates that both the mass and impact from the natural soil and marine sediments underlying the Site to the receiving water are insignificant and could not be measured due to the low expected concentrations; and
- The lines of evidence assessed indicate that there is not a significant flux and discharge of contamination from the natural soil and marine sediments underlying the Site into Darling Harbour.

Additional Groundwater Modelling study (AECOM, 2013b)

AECOM also undertook an *Additional Groundwater Modelling* study (AECOM, 2013b) which is similarly presented as part of the *VMP Remediation Extent* report (AECOM, 2013d). The objective of the supplementary study was to assess: (a) the decrease in contaminant flux that could be expected to result from the proposed remediation extent; and (b) potential impacts to water quality in Darling Harbour from the contamination that will remain *in situ* in fill material and marine sediment as an outcome of the proposed remediation extent.

The study concluded:

- A significant (between 250% and 380%) improvement in contaminant mass flux would be expected to be realised by the remediation proposed by the *VMP Remediation Extent* report (AECOM, 2013d);
- Less than 1% of the calculated contaminant mass flux to Darling Harbour from residual contamination remaining after the proposed remediation extent would be expected to be associated with contamination within the marine sediment; and
- Groundwater quality in fill discharging to Darling Harbour would be expected to improve over time. Contaminant mass flux from contamination that will remain *in situ* (both on Site and off Site) following the proposed remediation for the protection of human health.

6.9 Potentially Sensitive Receptors

6.9.1 Ecological

The nearest receptor for groundwater and surface water coming from the Site is considered to be Darling Harbour which will connect with the proposed Watermans Cove in the western part of the Site.

No other environmentally sensitive receptors have been identified.

6.9.2 Human Health

Potential human exposure to CoPC in impacted soil/fill materials and/or groundwater may occur via the following potential exposure pathways:

- Direct dermal contact with impacted materials;
- Incidental ingestion of impacted materials;
- Inhalation of volatile CoPC; and
- Inhalation of potential contaminants of concern sorbed to air-borne particulates.

The following potential human receptors have been identified:

- Workers engaged in future remediation / redevelopment of the Site;
- Workers on the Site entering confined spaces or exposed to subsurface materials during maintenance work;
- Future residents, workers and public inhabiting or visiting the Site; and
- Off-site workers conducting construction, road or other sub-surface works in the vicinity of the Site.

Section 5.7 of the *ORWN HHERA* (AECOM, 2014) stated that a *separate assessment of potential risks to human health from exposure to sediments and surface water within the potential Southern Cove* [now referred to as Watermans Cove] *has not been undertaken. This is because, in the event that construction of the potential Southern Cove requires excavation of existing fill, the material at the new surface of the potential Southern Cove will be required to meet the ANZECC (2000) Interim Sediment Quality Guidelines (ISQG), which are considered to be suitably protective of incidental recreational exposures for humans and the surface water will be of the same composition and makeup of Darling Harbour. It is also considered that any future design within Southern Cove will prevent direct contact with sediments under normal exposures.*

For further detail regarding the exposure pathways and potential human receptors for each of the considered land use scenarios refer to the *ORWN HHERA* (AECOM, 2014).

7.0 Remediation Criteria

7.1 Soil and Groundwater Generic Assessment Criteria

The current Generic Assessment Criteria used in NSW to evaluate possible human health risk from soil analytical results are based on the:

- *Guidelines for the NSW Site Auditor Scheme* (DEC, 2006b);
- *Guidelines for Assessing Service Station Sites* (NSW EPA, 1994); and
- *National Environment Protection (Assessment of Site Contamination) Measure* (National Environment Protection Council [NEPC]) as amended (NEPC, 2013).

These guidelines present a range of Health-Based Soil Investigation Levels (SILs), sensitive land use thresholds and expected background concentration ranges for urban redevelopment sites in NSW.

SILs are not available for all CoPCs identified at the Site and are generally considered inappropriate and potentially unnecessarily conservative for remediation works. Therefore, as described by the *ORWN HHERA* (AECOM, 2014) it is necessary and appropriate to adopt a site-specific health-based approach to determining:

- Whether CoPC concentrations identified at the Site represent a risk to human health; and
- SSTC for soil and groundwater to define the remediation required for the Site to be protective of human health.

7.2 Development of Site-Specific Target Criteria (SSTC)

The following sections summarise development of the soil and groundwater SSTC for the protection of human health at the Site as detailed in the *ORWN HHERA* (AECOM, 2014). The objective of the *ORWN HHERA* (AECOM, 2014) was to:

- develop human health SSTC for soil and groundwater for use in defining the remediation end-point for the Site, where the remediation end-point is defined as that required to render the Site suitable for use following redevelopment; and
- assess the risk to ecological receptors that the Site will represent based on the assumption that the remediation works described by the *VMP/Block 4 RAP* (AECOM, 2013c) are undertaken.

The remediation end-point is defined as that required to render the Site suitable for use following redevelopment. For the purposes of this RAP, a 'suitable for use' remediation endpoint is considered to be that required to ensure that unacceptable risks to human health or the environment will not occur.

As described by Section 5 of the *ORWN HHERA* (AECOM, 2014), 14 potential exposure scenarios were considered within the *ORWN HHERA* (AECOM, 2014) based on the proposed development concepts. In particular:

- Scenarios 1 to 8 were based on generic land uses and were generally based on plans supplied by Lend Lease in relation to the ORWS basement design (refer to **Section 7.2.1** for further discussion); and
- Scenarios 9 to 14 were based on information that is specific to the proposed Crown Hotel Development provided by Crown. Scenarios 9 to 14 are not applicable to the Site and, as such, are not discussed further herein.

7.2.1 SSTC Exposure Scenarios

The exposure scenarios that are relevant to the proposed development works for the Site as described by **Section 4.1** are:

- Scenario 3 – Unpaved Recreation;
- Scenario 4 – Paved Recreation;
- Scenario 5 – Commercial Slab on Grade (to a maximum of 2 storeys); and
- Scenario 6 - Short term ground-intrusive maintenance (with potential to contact groundwater).

Table 3 below summarises the land use scenarios and assumptions as discussed in Section 5.3.7 of the *ORWN HHERA* (AECOM, 2014).

Table 3 Summary of Relevant Land Use Scenarios Considered in the *ORWN HHERA* (AECOM, 2014)

Scenario Number	Name and Description	Most Sensitive Human Receptor	General Assumptions
3	Unpaved Recreation Generic public domain area with no concrete/hardstand paving, but 50 cm of clean fill at surface.	Adult and Child Recreational Users. Assumed to be exposed 2 hr/day, 365 days/year, for 70 years.	Open Space with no Concrete Surface Covering. Assumed that areas are landscaped with at least 50 cm of Suitable Fill overlying contaminated soil. Assume that there is significant oxygen movement through the top 2 m of soil based on the oxygen measurements collected during the soil gas sampling. Groundwater (GW) depth assumed to be 2 m bgl.
4	Paved Recreation Generic public Domain area with concrete/hardstand paving. It has been assumed that paved recreation areas will also be covered in a 0.5m thick layer of Suitable Fill to accommodate changes in paved and unpaved recreation areas that might occur in the future.	Adult and Child Recreational Users. Assumed to be exposed 2 hr/day, 365 days/year, for 70 years.	Open Space with Concrete surface covering. Assume that there is significant oxygen movement through the top 2 m of the soil based on the oxygen measurements collected during the soil gas sampling. Concrete assumed to be minimum 15 cm thick and to have a crack fraction of 0.001 (to account for higher cracking possible in surface covering).
5	Commercial Slab on Ground (limited to 2 storeys) Generic typical commercial slab on ground scenario for public domain area where basement car park is not present.	Adult worker. Exposed up to 8 hr/day, 240 days/year, for 30 years. Scenario also protective of child who may visit premises on a less frequent basis.	Assumes typical slab on grade commercial premises at ground level. Assumes a maximum building height of 2 storeys. To account for potential coffee shop, convenience store, restaurant, etc., that could be constructed within the Public Domain.
6	Intrusive Maintenance – potential contact with groundwater Generic short term intrusive maintenance scenario, e.g. for maintenance of utility services.	Adult worker. 8 hrs/day, 15 days/year for 1 year. Direct contact with groundwater contact may occur due to shallow water – no more than 1 hour per day. Vapour may be derived from pooled groundwater or from exposed soils in trench.	Post development, short term maintenance work may be required. Assumed not to exceed 3 working weeks per year by same worker.

7.2.2 Derivation of SSTCs and Key Assumptions

The SSTC for soil and groundwater derived in the *ORWN HHERA* (AECOM, 2014) were developed to provide human health risk-based concentrations that can be used as remediation criteria applicable to areas of the Site based on the proposed land uses. That is, if all CoPC concentrations in samples are below the applicable SSTC, then further assessment of the health risks would not be warranted.

Further details of how the SSTC have been derived are provided in the *ORWN HHERA* (AECOM, 2014).

The assumptions used in the derivation of the soil and groundwater SSTCs are detailed in Section 1.3 and Section 5.3.4 of the *ORWN HHERA* (AECOM, 2014). The key assumptions are summarised following.

Soil and Groundwater:

- The SSTC were developed based on the Site conditions and chemicals of potential concern (CoPC) detected during the Site investigations detailed within this report;
- The SSTC were based on the development concepts and design assumptions provided by Lend Lease at the time of completion of the *ORWN HHERA* (AECOM, 2014);
- The SSTC developed for Scenario 3 (Unpaved Recreation) and Scenario 4 (Paved Recreation) were based on the assumption that the area would be covered by a minimum of 0.5 m of Suitable Fill or 0.15 m of concrete, respectively (refer to **Table 3**). Notwithstanding, the *ORWN HHERA* (AECOM, 2014) recommended that both unpaved and paved recreation areas be covered by a minimum of 0.5 m of Suitable Fill. This was to accommodate potential changes from paved recreation areas to unpaved recreation areas that may occur in the future. Suitable Fill is defined as:
    - Virgin excavated natural material (VENM);
    - Soil which contains contaminant concentrations below the TSC (developed for the maintenance of plant health and human health); and
    - Soil which is visually free of bonded ACM (refer to **Section 7.2.3**).
- There are significant biodegradation processes occurring within sub-surface soils based on measured oxygen concentrations beneath the sub-surface. To account for these biodegradation processes, a 10-fold factor (Davis, 2009) has been adopted in the derivation of SSTC for soils in paved and unpaved areas of the Site, where biodegradation processes are considered to be significant;
- The development of SSTCs has accounted for the presence of mixtures of chemicals at the Site within the same media. In particular, risks associated with mixtures of chemicals have been modelled by applying proportional risks as follows: BTEX (HI 0.25 each), PAH (HI 0.2), TPH (HI 0.25 total for aliphatic and aromatic per fraction), all other chemicals HI = 1;
- Chemicals are assumed to be volatile if Henry's Law constant is greater than 1×10^{-5} atm-m^3/mole (USEPA, 2004) and vapour pressure greater than 1mmHg at room temperature (NEPC 2013);
- The current theoretical estimation of vapour concentrations within indoor and outdoor air is based on partitioning modelling which has been demonstrated to overestimate concentrations between 10-1,000 fold. To account for this conservatism, an adjustment factor of 10 has been applied to all modelled soil results for benzene, toluene, ethylbenzene and xylenes (BTEX), Total Petroleum Hydrocarbons (TPH) C_6-C_9 and C_{10}-C_{16}; and
- The VMP Remediation Works described by the *VMP/Block 4 RAP* (AECOM, 2013c) are completed. Based on the *VMP Remediation Extent* report (AECOM, 2013d), if the remediation works described by the *VMP/Block 4 RAP* (AECOM, 2013c) are completed, it is considered that any residual gasworks contamination that might remain *in situ* within the Site will not represent an unacceptable risk to the environment. Further discussion on addressing the risk to the environment is provided in **Section 7.4**.

7.2.3 Asbestos SSTCs

As described by the *ORWS Asbestos HHERA* (AECOM, 2013a), asbestos reported to be present in soils within the ORWS Area is predominately bonded ACM and the potential for asbestos fibre (AF) generation is considered to be minimal.

It has been assumed that asbestos which may be present within the Site is likely to be similar – that is predominantly bonded ACM.

The asbestos SSTCs adopted by the *ORWN HHERA* (AECOM, 2014) are summarised by **Table 4** below. The asbestos SSTCs are to be applied in addition to other applicable SSTCs and Terrestrial Soil Criteria (TSC), in the case of Suitable Fill, that have also been developed in the *ORWN HHERA* (AECOM, 2014).

Table 4 Summary of Asbestos SSTC

Exposure Scenario	Asbestos Site Specific Target Criteria
Intrusive Maintenance Worker [2]	0.05 % w/w [1]
Suitable Fill [3]	No Visible Asbestos

Notes:

1) To be measured in accordance with the methodology described by Schedule B2 of the *NEPM* (NEPC, 2013);
2) The intrusive maintenance worker exposure scenario is applicable to soil in areas used for paved recreation, unpaved recreation and commercial slab on grade construction either with or without contact with groundwater (i.e. Scenario 6) at depths:
   a) below the Suitable Fill to be placed at the ground surface / immediately below hardstand at the ground surface;
   b) up to approximately 2.0 m below the existing surface level (i.e. within unsaturated soils); and
   c) above the groundwater table.
3) **Section 7.2.2** of this RAP requires 'Suitable Fill' be placed in paved and unpaved recreation areas for the purpose of protecting Human Health. Further, as described by Section **4.1.2**, the development of Public Domain areas within the Site will involve raising the surface level using Suitable Fill. The same SSTC will be applied to the entire thickness of Suitable Fill.

The asbestos SSTCs detailed above will be applicable to those parts of the Site to be used as Public Domain in which either:

- an intrusive maintenance worker may be exposed to bonded ACM in soil as part of future maintenance works associated with the completed development (i.e. the Area A unsaturated soil); or
- a recreational user may be exposed to bonded ACM in surface soils (specifically Suitable Fill placed in the top 0.5 m bgs) in areas used for unpaved recreation.

7.3 Remediation Criteria for the Protection of Human Health

7.3.1 Derivation of Remediation Criteria

The SSTCs that are applicable to the proposed landuse scenarios are presented in **Table 5** below and based on the land use scenarios illustrated in **Figure 1**, **Section 1.3**). The SSTCs have been selected based on the Area A land use scenario which includes material to remain *in situ* and potentially in hydraulic connection with Darling Harbour, where limited or no excavation will be required.

Given more than one SSTC is applicable to Area A, the lowest (i.e. most conservative) SSTC has been adopted to appropriately assess soil and groundwater quality across the Site (refer to **Table 5** below). The hybrid Area A Remediation Criteria are detailed in **Table T1** and **T2** (that is where more than one SSTC is applicable, the lowest SSTC has been adopted for each CoPC).

As described by **Section 1.3**, material is unlikely to be reused at the Site. Notwithstanding, soil SSTC-B are presented in **Table T1** to provide acceptance criteria that are applicable to:

- the (unlikely) event that some of the excavated material is considered suitable for reuse on Site; and
- the import of fill to the Site (refer to **Section 15.0**).

As described by **Table 5**, the soil SSTC-B are based on the lowest (i.e. most conservative) SSTC derived for the applicable exposure scenarios. If the reuse of Area B material is required, it will be described in an Addendum to this RAP and submitted to the NSW EPA Accredited Site Auditor for approval.

No remediation criteria are proposed for the proposed Watermans Cove area as the proposed development works do not include removal of the historic Southern Cove embankment which will continue to be appropriately protected by the existing 1,200 mm thick rock armour layer (refer to **Section 3.2.3**).

Table 5 Landuse and Applicable SSTCs

Area	Proposed Land Use	Applicable SSTCs
Area A (located outside the adjacent basements)	ORWN Area Public Domain - Limited or No Excavation Area outside the basement groundwater retention wall system and in hydraulic connection with Darling Harbour	Soil SSTC-A: - SSTC for Scenario 3 – Unpaved Recreation[1, 2] - SSTC for Scenario 4 – Paved Recreation[1, 2] - SSTC for Scenario 5 – Commercial Slab on Grade (to a maximum of 2 storeys) - SSTC for Scenario 6 –Intrusive Maintenance Worker[3]
		Groundwater SSTC-A: - SSTC for Scenario 3 - Unpaved Recreation[1, 2] - SSTC for Scenario 4 - Paved Recreation[1, 2] - SSTC for Scenario 5 – Commercial Slab on Grade (to a maximum of 2 storeys) - SSTC for Scenario 6 –Intrusive Maintenance Worker
Excavated soils from the Site potentially reused in Area A – if required Imported material to the site NB – Excavated material is unlikely to be reused at the Site.	Unsaturated soil reused below 0.5m of Suitable Fill in the ORWN Area Public Domain	Soil SSTC-B: - SSTC for Scenario 3 – Unpaved Recreation[1, 2] - SSTC for Scenario 4 – Paved Recreation[1, 2] - SSTC for Scenario 5 – Commercial Slab on Grade (to a maximum of 2 storeys) - SSTC for Scenario 6 –Intrusive Maintenance Worker [3]

Notes: [1] asbestos SSTC will also apply for unpaved and paved recreation scenarios in Area A (refer to **Section 7.2.3**).
[2] the Terrestrial Soil Criteria will also apply to landscaped areas in Area A (refer to **Section 7.5**)
[3] asbestos SSTC will also apply for intrusive maintenance workers in Area A (refer to **Section 7.2.3**).

7.3.2 Summary of Remediation Criteria

The soil and groundwater SSTCs derived from the *ORWN HHERA* (AECOM, 2014) are detailed in **Table T1** and **T2**, **Appendix A**.

To assess whether soil or groundwater CoPC concentrations at the Site are representative of CIM and would warrant remediation, the soil and groundwater analytical data from the Site is compared to the relevant SSTCs in **Appendix A** as follows:

- **Table T3**: Area A – Soil Analytical Results – Unsaturated;
- **Table T4**: Area A – Soil Analytical Results – Saturated; and
- **Table T5**: Groundwater Analytical Results.

The soil and groundwater analytical data from Area A and an assessment of whether or not they are representative of CIM is provided in **Section 8.2**.

7.3.3 Remediation Goals

The remediation goals for the protection of human health, as recommended by the *ORWN HHERA* (AECOM, 2014) are:

- As a primary goal, removal / remediation of SPGWT (as defined in **Section 6.4**) to the extent practicable; and
- As a secondary goal, removal / remediation, to the extent practicable, of Confirmed Impacted Material (CIM), which is defined as:
  - Unsaturated soil concentrations exceeding the soil SSTCs; and
  - Unsaturated and saturated soil concentrations that are considered to be the source of groundwater concentrations exceeding the groundwater SSTCs.

The process for assessing the extent of remediation (if required) based on the identification of SPGWT and CIM is summarised in the following sections.

The outcomes of this process are documented in **Section 8.2**.

7.4 Remediation Criteria for Protection of the Environment

As detailed in Section 7.11 of the *ORWN HHERA* (AECOM, 2014), the *VMP Remediation Extent* report (AECOM, 2013d) considers that if the *VMP/Block 4 RAP* (AECOM, 2013c) is implemented, residual gasworks related contamination remaining *in situ* down hydraulic gradient of the Declaration Area (including the Site) will not represent an unacceptable risk to the environment.

The *ORWN HHERA* (AECOM, 2014) also considered that non-gasworks related CoPC (namely copper, zinc, cobalt and cadmium) would not present an unacceptable risk to the environment. This conclusion was based on the following considerations:

- The concentrations of the non-gasworks related CoPC relative to the adopted marine water quality criteria (MWQC) and the number, frequency, variability and location of those results which were reported to be greater than the MWQC (refer to **Table T9**). In particular, consideration was given to whether the reported result was representative of groundwater quality within marine sediments (from which it has been demonstrated there is negligible contaminant flux).
- The proposed remedial strategy presented within the *VMP Remediation Extent* report (AECOM, 2013d) and *VMP/Block 4 RAP* (AECOM, 2013c) includes: (a) historical infrastructure source removal; and, (b) removal of secondary sources of contamination, such as SPGWT, which are both up-gradient sources of contamination on the Site.
- The groundwater retention wall system to be constructed as part of the proposed Block 4 Development Works will effectively cut off groundwater movement from up-gradient sources to the Site. It is considered that the up-gradient sources are a significant contributor to the groundwater quality within those wells screened within the fill materials.
- The proposed adjacent Crown development (located to the north and east of the Site) will incorporate a basement, similar to that proposed as part of the Block 4 Development Works, contained within a groundwater retention wall system which will be keyed into bedrock. The groundwater retention wall system will reduce groundwater migration and potential contaminant flux from that area in which the basement is constructed.
- Results of the *Groundwater Discharge Study* (GDS) (AECOM, 2010c), which concludes that there is a five-fold mixing and dilution of groundwater within the unconfined aquifer prior to discharge through the tidal prism to Darling Harbour. The current Ecological Risk Assessment (refer to Section 7.0 of the *ORWN HHERA* (AECOM, 2014)) has not adjusted the groundwater concentrations to reflect dilution, and therefore it is considered that concentrations reported within groundwater at the Site will undergo additional dilution prior to discharge to the nearest environmental receptor, Darling Harbour.
- Additional remediation works (as might be required to achieve a greater degree of environment protection), would be impracticable, cost prohibitive and inconsistent with the principles of Ecologically Sustainable Development (ESD). That is, the net cost to the environment of undertaking the additional works would be greater than the environment benefit realised from the additional work at the Site (AECOM, 2013d).

Based on the above multiple lines of evidence, the *ORWN HHERA* (AECOM, 2014) concluded that residual metals contamination reported within groundwater wells screened within the fill materials will not pose a risk to the environment and that the quality of groundwater in fill within the Site will improve over time following the proposed remedial works in the Declaration Area and Block 4. It is therefore considered that the risks to identified environmental receptors at the Site are low and acceptable. Based on these conclusions, risk to the environment is not considered any further in this RAP while the focus of any required remediation works is focussed on the appropriate protection of human health.

7.5 Terrestrial Soil Criteria (Protection of Future Plantings)

The *ORWN HHERA* (AECOM, 2014) assumes that areas of the Site to be used for unpaved recreation land uses will be covered in a minimum of 0.5 m of Suitable Fill. The potential for phytotoxicity to trees and other vegetation planted within the suitable soil cover as part of the future development was addressed by:

- derivation of Terrestrial Soil Criteria (TSC) that will both maintain soil and plant health and be protective of human health under the proposed land use; and
- increasing the depth of suitable soil in specific areas as required to accommodate the current and future potential planting of different species and sizes at the Site.

TSC were developed in the *Declaration Site HHERA* (AECOM, 2011b) and adopted by the *ORWN HHERA* (AECOM, 2014) to define material that is appropriate for use as Suitable Fill placed in areas of the Site to be used for unpaved recreation land use (refer to **Section 4.1.2**).

The TSC are detailed in **Table T8**, **Appendix A**.

7.6 Potential Reuse of Excavated Material

As discussed in **Section 1.3**, it is understood that it is unlikely that Lend Lease will reuse material excavated from the Site (i.e. including excavation works which may be required for the installation of underground services, landscaped areas for trees, etc) which may be required as part of the proposed development works (i.e. to raise site levels within Public Domain areas).

The potential for Resource Recovery Exemptions may be considered in accordance with *Guidelines on Resource Recovery Exemptions (Land Application)* (DECC, 2008).

8.0 Extent of Remediation

The results of soil and groundwater samples analysed as part of previous intrusive investigations within the Site are presented in **Tables T3** to **T9** in **Appendix A** and compared against the applicable SSTCs (refer to **Section 7.0**). A summary of this comparison is provided in the following sections in the context of the following area:

- **Area A** - material to remain *in situ* and potentially in hydraulic connection with the Harbour;

As described by **Section 1.3**, excavated material is unlikely to be reused at the Site. If this alternative is required, it will be described in an Addendum to this RAP and submitted to the NSW EPA Accredited Site Auditor for approval.

The borehole and groundwater monitoring well locations are presented on **Figure F4**.

The summary tables presented in **Appendix A** are as follows:

- **Table T1**: Soil Remediation Criteria
- **Table T2**: Groundwater Remediation Criteria
- **Table T3**: Area A - Soil Analytical Results - Unsaturated
- **Table T4**: Area A - Soil Analytical Results - Saturated
- **Table T5**: Area A - Asbestos Analytical Results - Saturated
- **Table T6**: Groundwater Analytical Results
- **Table T7**: Summary of Field Observations of Gasworks Related Impacts
- **Table T8**: Terrestrial Soil Criteria
- **Table T9**: Marine Water Quality Criteria

It is noted that due to the size of the Site and the fact that some of the existing offsite monitoring wells are located close to but outside the Site, all groundwater monitoring results from the Site and adjacent areas have been compared to both the groundwater SSTC-A (refer to **Section 7.2.1**).

8.1 Area A (Northern Public Domain Area)

It is noted that the northern portion of Area A (proposed Northern Public Domain Area located between the proposed Crown Development Site and Darling Harbour) is located directly above the existing caisson wall. Lend lease has advised that the existing concrete slab rests directly onto top of the caisson wall which has a concrete slab on the top. Consequently, no fill material is thought to be present between the existing slab and the top of the caisson wall. The caisson wall is known to be filled with dredged sediments / sand from Darling Harbour and therefore is unlikely to represent a significant contamination risk to the Site. Assessment of soil and groundwater conditions within the existing caisson wall are not considered to be required and, given the access constraints in this area, are not likely to be feasible. Consequently, the Northern Public Domain Area is not considered further herein.

8.2 Area A (Southern Public Domain Area)

8.2.1 Separate Phase Gasworks Waste and Tar

SPGWT was not identified in Area A (Southern Portion) by the previous investigations (refer to **Section 5.0** and **6.5.2**).

8.2.2 Unsaturated Soil Analytical Results

The presence of CIM in the Area A unsaturated soils was assessed using soil analytical data from boreholes drilled as part of the previous investigations (refer to **Table T3**) and including some boreholes located near the Area A boundary which are likely to be representative of CoPC concentrations on the Area A boundary (refer to **Figure F4**).

The boreholes considered included sampling locations BH01, BH38, BH39 and BH049 (located on Site) and BH017, BH035, BH40/MW40, BH46, BH047/MW09 and BH116/MW22 (located adjacent to, but considered representative of the Site).

All CoPC concentrations were reported to be less than the relevant soil SSTC-A. In addition, key CoPC (including BTEX, TPH, PAHs and phenols) were generally reported at concentrations below the laboratory limit of reporting (LOR).

Asbestos was not analysed in samples from the Area A unsaturated soils. As described by **Section 6.7**, ACM was identified to be widespread within excavated material within the ORWS Area (AECOM, 2013d) therefore it is assumed that there is significant potential for bonded ACM to be present within fill materials within Area A.

As discussed in **Section 6.7.1**, a significant volume of bonded ACM was identified during shallow excavation works required for a new sewerage pump out pit within Stage 1C (northeast and adjacent to the Site). Consequently, it is possible that ACM is present in the Site's unsaturated soils.

8.2.3 Saturated Soil Analytical Results

The analytical data from soil samples considered to be representative of Area A saturated soils are detailed in **Table T4**. As discussed in **Section 7.2.2**, soil SSTCs have not been derived for saturated soils. Therefore, the assessment of whether CIM is present within saturated soils in Area A is based on comparison of groundwater CoPC concentrations to the relevant groundwater SSTC-A (refer to **Section 8.2.5**).

One sample (BH38_2.5-2.7) was analysed for asbestos from the saturated soils at the Site and was reported to be non-detect for asbestos in soil (refer to **Table T5**).

8.2.4 Comparison to ANZECC (2000) Interim Sediment Quality Guidelines

Due to the proximity of Area A to the proposed Watermans Cove and as recommended by the *ORWN HHERA* (AECOM, 2014), the Area A saturated soil results were also compared to the ANZECC (2000) *Interim Sediment Quality Guidelines* – High (ISQG-High, refer to **Table T4**).

The soil results (including CoPC heavy metals and PAH compounds) were generally less than the ANZECC (2000) ISQG-High. Those PAH exceedances of the ANZECC (2000) ISQG-High are reported at depth (i.e. generally greater than 16 m bgl) and are not likely to impact on future benthic organisms in the proposed Watermans Cove. Based on these results, the materials beneath the rock armour on the historic Southern Cove embankment are considered to be suitable for the proposed land use in this area (i.e. proposed Watermans Cove).

8.2.5 Groundwater Analytical Results

The results for groundwater monitoring events within Area A between 2006 and 2010 are presented in **Table T6**. The groundwater monitoring wells considered representative of Area A are MW09/BH047, MW22/BH116 and MW40/BH40 (refer to **Figure F4**). All CoPC concentrations were reported to be less than the groundwater SSTC-A in these wells.

8.2.6 Area A – Identification of CIM

The results of the soil and groundwater analytical results within Area A, as discussed in **Section 8.2.1** to **8.2.5**, were all less than the soil and groundwater SSTC-A. As such, no CIM warranting remediation was identified within Area A.

8.2.7 Area A – Extent of Remediation

Based on the available data within Area A, CIM has not been identified in Area A. However, only limited soil analytical results are available for soil in the unsaturated zone (i.e. the Southern Public Domain Area). Therefore, additional validation sampling of the soils in the unsaturated zone of Area A (southern portion) should be conducted to ensure the sampling density is sufficient to appropriately characterise this material (refer to **Section 16.4.1**).

Based on the findings of this additional validation sampling, an assessment of whether CIM is present within Area A unsaturated soils (Southern Public Domain Area) will be undertaken in consultation with the NSW EPA Accredited Site Auditor. If required, remediation and subsequent validation works will be undertaken in the Area A unsaturated soil.

8.3 Material Potentially Excavated during Limited Excavations

As described by **Section 1.3**, only limited excavations are likely to be required in the unsaturated soils in the Public Domain and reuse of the material onsite is unlikely.

8.3.1 Tar Containing Material

SPGWT was not identified within Area B by the previous investigations (refer to **Section 5.0** and **6.5.2**).

8.3.2 Soil Analytical Results

Soil analytical data from the unsaturated soils (refer to **Table T3**) were compared to the SSTC-B for potential onsite reuse. All CoPC concentrations were reported to be less than the SSTC-B.

Additional soil validation works for asbestos will be required in accordance with Schedule B2 of the *NEPM* [NEPC, 2013]) to allow comparison against the SSTC-A for asbestos (refer to **Section 7.2.3**).

8.3.3 Area B – Preliminary Waste Classification

The Area B unsaturated soil results were compared to the NSW EPA (2014) *Waste Classification Guidelines* to provide an indication of the potential classification of materials to be disposed of to landfill. The Area B results indicate that the material generally contains concentrations less than the laboratory limit of reporting for TPH, PAH and BTEX concentrations and heavy metals concentrations are relatively low and would meet the Contaminant Threshold 1 values for General Solid Waste in the NSW EPA (2014) *Waste Classification Guidelines*

Based on the discussion above, asbestos analysis of soil samples is required to confirm the waste classification for materials excavated from this area. Data collected during excavation of the Stage 1A (located offsite to the south) basement indicates that there is a significant potential for asbestos to be present in the Area B materials. Consequently, it is considered probable that asbestos will also be encountered during any excavation works at the Site and the majority of the Area B material may be classified as Special Waste (containing asbestos).

Based on total CoPC concentrations (only) and excluding the potential presence of asbestos, it is likely that the majority of the excavated material would be classified as General Solid Waste in accordance with the NSW EPA (2014) *Waste Classification Guidelines*.

Additional sample analysis will be required to fully characterise the any unsaturated material to be excavated as part of any Limited Excavations prior to landfill disposal. Due to the likely space restrictions on the Site during the proposed development works and to avoid the requirement for onsite stockpiling, it is considered likely that the additional waste classification required to confirm these preliminary waste classifications in accordance with the NSW EPA (2014) *Waste Classification Guidelines* would be undertaken *in situ*.

Given that these waste classification works relate to material being removed from the Site for landfill disposal and do not affect the future proposed land uses, these additional works are not discussed further herein.

9.0 Remedial Technology Assessment

9.1 Introduction

As described by **Section 8.0**, CIM has not been identified within the Site based on the previous intrusive investigations undertaken within the Site and it is considered unlikely that specific soil and/or groundwater remediation will be required. As such, a specific remedial technology assessment has not been undertaken for this RAP.

9.2 Contingency Assessment

It is possible that unexpected CIM may be identified in unsaturated soils within Area A (Southern Public Domain Area) during:

- Additional validation works which are required to characterise the Area A unsaturated soil; and
- The proposed development works - i.e. limited excavation works which may be required for the installation of underground services, planting of trees in landscaped areas, etc.

It is also noted that material from the excavation works may require treatment prior to disposal to landfill.

Section 20.5 presents contingency actions that will be implemented in the event that:

- CIM requiring remediation is unexpectedly identified during the additional validation sampling and/or construction works and/or
- treatment of material removed as part of the excavation works as necessary to facilitate disposal to landfill.

The selection of remedial technologies that might be implemented as part of the contingency actions described by **Section 20.5** would be based on the Remedial Technology Assessment previously presented in Section 10 of the *VMP/Block 4 RAP* (AECOM, 2013c). This approach is considered valid because the key parameters adopted for assessment of the remediation technology options are largely consistent between the *VMP/Block 4 RAP* (AECOM, 2013c) and this RAP.

10.0 Preferred Remediation Strategy

As described by **Section 8.0**, CIM has not been identified within the Site based on the previous intrusive investigations undertaken within the Site. However, additional validation works are required in the Area A (Southern Public Domain Area) to appropriately characterise the unsaturated soils and to further assess the potential presence of CIM which may warrant remediation.

Notwithstanding, concentrations of contaminants are present within the Site which may require specific management practices to mitigate potential risks to construction workers, the public and environment.

Based on the available information, the preferred strategy for remediation of soil encountered as part of the proposed development works should be focussed on:

- The additional validation works required in the Southern Public Domain Area to appropriately characterise the unsaturated soils and to assess whether remediation of any identified CIM is required;
- Subject to the findings of the discussed additional validation works, excavation works in the Area A (southern portion located east of Watermans Cove) which may be required for the installation of underground services, planting of trees in landscaped areas, etc) refer to **Section 16.4.1**; and
- Offsite disposal of material that is excavated from the Limited Excavations to a NSW EPA licensed landfill (including treatment if required).

10.1 Area A - Preferred Remediation Strategy

10.1.1 Strategy Summary

As discussed in **Section 8.2**, no CIM warranting remediation or management has been identified in Area A (Southern Public Domain Area). However, additional validation sampling is required in this area from unsaturated soil to demonstrate this (refer to **Section 16.4.1**).

The preferred remediation strategy for Area A is:

- Collection of additional soil samples in Area A (Southern Public Domain Area) to adequately characterise unsaturated soil quality and to assess for the presence of CIM (refer to **Section 16.4.1**);
- If the results of the additional soil validation program confirm that the concentrations of CoPCs in the Area A unsaturated soil (southern portion) are:
  - less than the soil SSTC-A, no further remedial works will be required; or
  - greater than the soil SSTC-A, implementation of the contingency measures described by **Section 20.5**;
- Site establishment and preparatory works (refer to **Section 12.0**);
- Excavation works as required for the proposed development works (likely to be small volumes only related to the installation of underground services and planting of trees in landscaped areas, refer to **Section 4.1**);
- Physical separation of recyclable and oversize material, including timber, rock, concrete, steel and brick, from other material (as required to optimise landfill disposal);
- Placement of Suitable Fill as required to protect human health (refer to **Section 7.2.2**) and to achieve proposed finished Site levels;
- Treatment of excavated Area A material (if required) to facilitate off-site disposal to licensed landfill (refer to **Section 20.6**);
- Off-site disposal of excavated Area A material to licensed landfill, subject to classification in accordance with the NSW EPA (2014) *Waste Classification Guidelines*;
- Retention of all remaining Area A material *in situ*);
- Validation in accordance with **Section 16.4.1**;

10.1.2 Reasons for Strategy Selection

Feasibility

- It is anticipated, based on the available data that remediation of Area A may not be required. Notwithstanding, additional validation sampling is required to demonstrate that CIM is not present in unsaturated soils in Area A (Southern Public Domain Area);
- If (limited) materials are excavated from Area A, it is considered unlikely that they will be reused as part of the proposed development works;
- If required for landfill disposal, ex-situ stabilisation/solidification is likely to be the most practical, cost effective, and established remediation technology for management of the excavated material based on the type of contaminants identified in the previous investigations (refer to contingency **Section 20.5**);
- The Area A footprint will be developed for retail purposes and public open space. Excavation of this area is not necessarily required to facilitate this end land use;
- Retention of Area A material in-situ is considered the most practical and cost effective remediation technology for materials not otherwise requiring excavation as part of the development based on the type of contaminants anticipated and the risk they represent to human health and the environment; and
- Retention of material *in situ* has been successfully implemented on a number of previously remediated foreshore sites around Sydney Harbour.

Sustainability

The nominated strategy is considered a sustainable solution to management of the Area A material because:

- CIM has not currently been identified in this area;
- The retention of material in-situ in conjunction with excavation works as required by the proposed development works will:
    - minimise earthworks, materials handling, separation, dewatering and drying requirements, therefore minimising emissions from diesel operated equipment and machinery and the overall carbon footprint for the development;
    - minimise fugitive emissions and odours from handling of contaminated material, therefore minimising the risk of adverse stakeholder concerns. It will minimise the quantities of material that requires off-site disposal to landfill; and
    - appropriately manage the risks the Area A material without unnecessary and resource intensive excavation works.

10.2 Limited Excavations – Preferred Remediation Strategy

10.2.1 Strategy Summary

Lend Lease has advised that material excavated from the Site is not likely to be reused onsite. If reuse of Area B materials is required, an Addendum to this RAP will be prepared and submitted to the NSW EPA Accredited Site Auditor for approval.

Accordingly, the preferred remediation strategy for the proposed development works involves ex-situ remediation works as follows:

- Site establishment and preparatory works (refer to **Section 12.0**);
- Excavation of all Area B material as required for any excavation works. If asbestos containing material is encountered during the excavation of Area B material it will be managed in accordance with **Section 13.8**;
- Physical separation of recyclable and oversize material, including timber, rock, concrete, steel and brick, from other material (as required to optimise landfill disposal);
- Treatment of excavated Area B material (if required) to facilitate off-site disposal to licensed landfill; and
- Off-site disposal of excavated Area B material to licensed landfill, subject to classification in accordance with the NSW EPA (2014) *Waste Classification Guidelines*.

10.2.2 Reasons for Strategy Selection

Feasibility

- If required for landfill disposal, ex-situ stabilisation/solidification is likely to be the most practical, cost effective, and established remediation technology for management of the excavated material based on the type of contaminants identified in the previous investigations (refer to **Section 20.5**); and
- Removal of material as part of any excavation works minimise future risks to human health and the environment from residual CoPC concentrations remaining within the Site.

Sustainability

The nominated option of ex-situ remediation (if required) is considered a sustainable solution due to the following considerations:

- It will utilise equipment and infrastructure already required for excavation works associated with the proposed development works, therefore minimising duplication and maximising utilisation of the required equipment;
- It maximises the opportunity for recycling and reuse of material through segregation of oversize materials, timber and steel, etc; and
- It will minimise the carbon footprint of the remediation project.

11.0 Remediation Works Overview

11.1 General Works Program Overview

The following sections do not include consideration of planning requirements which are described in **Section 2.2.2**. The planning process will necessarily be concluded prior to execution of the remediation works.

As described by **Section 1.3**, the proposed Lend Lease development plans are is still to be finalised and may be subject further development. Consequently, this may affect the nature of the proposed excavation works described herein and how these works are staged across the Site. Notwithstanding, the proposed land uses (that is a mixed land use comprising retail, public open space and the creation of a publicly accessible waterway connected to Darling Harbour) will remain generally consistent with that described this RAP.

11.2 Project Schedule

The proposed Site development works (refer to **Section 4.1**) will be scheduled under the following tasks:

- Approvals process, including concept, project and development approval and Immobilisation Approval (obtained from the NSW EPA for soil stabilisation works), if required for off-site disposal of excavated soil to landfill (refer to **Section 13.7.9**);
- Preparation of management plans (refer to **Section 12.1.2**);
- Site establishment and preparatory works (refer to **Section 12.0**);
- Validation sampling to characterise Area A unsaturated soils (Southern Public Domain Area). Note that it is possible that the validation sampling could be completed prior to the commencement of other remediation or development works;
- Remediation of any CIM identified in the Area A unsaturated soils by the additional validation sampling (as required, refer to **Section 16.4.1**);
- Tracking of all excavated materials in accordance with the Materials Tracking Procedure (refer to **Section 13.7.2**);
- Validation to demonstrate compliance with the requirements of this RAP;
- Reporting; and
- Decommissioning and demobilisation.

11.3 Remediation Works

Summary detail of the proposed remediation works to be completed is provided following:

- Additional Validation Sampling of the unsaturated soil in Area A (refer to **Section 16.4.1**). The validation sampling program should include a qualitative assessment of odour.
- Site establishment and preparatory woks. As described by **Section 12.0** these may include:
    - *In situ* waste classification;
    - Establishment of odour control structures to facilitate excavation; and
    - Establishment of infrastructure for ex-situ treatment of excavated material to facilitate offsite disposal to landfill.
- Selective excavation, in accordance with the *in situ* waste classification (if completed) of:
    - CIM identified by the aforementioned validation sampling program; and
    - Fill material required as part of the development works.

      The selective excavation process should include, as appropriate to optimise waste classification, physical separation of recyclable and oversize material, including timber, rock, concrete, steel and brick from potentially contaminated material;

- Ex-situ stabilisation/solidification of excavated material, as required, to facilitate off-site disposal to landfill (subject to an Immobilisation Approval from NSW EPA);
- Off-site disposal of excavated material to licensed landfill, subject to classification in accordance with the NSW EPA (2014) *Waste Classification Guidelines*;
- Tracking of all excavated materials in accordance with the Materials Tracking Procedure (refer to **Section 13.7.2**);
- Placement of Suitable Fill as required to protect human health (refer to **Section 7.2.2**) and to achieve proposed finished Site levels; and
- Validation (progressive and concurrent with remediation excavation and treatment) to demonstrate compliance with the requirements of this RAP.

12.0 Site Establishment

12.1 Work to be Completed Prior to Site Establishment

12.1.1 Planning Approvals

The assessment and approvals process for the proposed management works are described by **Section 2.0**.

Approvals and licences required to facilitate the required excavation works will include:

- If required, an Immobilisation Approval from the NSW EPA, if the ex-situ treatment of soil is required prior to off-site disposal to landfill;
- A variation to the existing Environment Protection License (EPL, as required) to facilitate the proposed management works. For example:
    - Discharge of treated groundwater from the wastewater treatment system to Darling Harbour (refer to **Section 14.3**);
    - Emissions from odour control structures (if required) as part of the excavation works; and
    - If ex-situ treatment of material is required for disposal to landfill - refer to **Section 20.7**.
- A Trade Waste Licence from Sydney Water for disposal to sewer (if required); and
- Consent from an appropriately licenced landfill(s) to receive waste generated by the remediation works.

12.1.2 Project Documentation

Prior to site establishment, all plans, programs, certificates and other documents necessary for the commencement of work will be completed. These documents will include, but not be limited to the following:

Table 6 Project Documentation

Report Title	Approval Party	Approval Prerequisite	Relevant Section of this Report
Occupational Health and Safety (OH&S) Plan	Lend Lease	Site Establishment	**Section 18.0**
Community Consultation Plan	Lend Lease	Site Establishment	**Section 19.0**
Environmental Management Plan	Lend Lease and NSW DoPI	Site Establishment	**Section 17.0**
Project Management Plan	Lend Lease	Site Establishment	**-**
Quality Management Plan	Lend Lease	Site Establishment	**-**
Asbestos Management Plan	Lend Lease	Site Establishment	**Section 7.2.3** and **Section 13.8**
Emergency Response and Contingency Plan	Lend Lease	Site Establishment	**Section 20.10.6**)
Construction Environmental Management Plan (including an Unexpected Finds Protocol)	Lend Lease	Site Establishment	**-**
Remedial Work Plan (including Excavation Plans)	Lend Lease	Site Establishment	**Section 13.3**
Validation SAQP	Site Auditor	Site Establishment	**Section 16.2.1**

Notwithstanding the above plans, an appropriate level of information is detailed in this RAP regarding whether the Site can be made suitable for the proposed land uses (i.e. including retail, public open space and a publicly accessible waterway).

In addition, the following will be undertaken:

- Preparation of a detailed work program and logic diagram;
- Submission of all WorkCover Authority notifications;
- Commissioning and Mobilisation of Plant; and
- Preparatory works required for utilities connections and supply agreements.

12.2 Site Preparation

If required, works to be undertaken prior to the excavation works include:

- Establishment of site offices;
- Demolition of existing infrastructure and removal of concrete pavements, where required;
- Establishment of exclusion zones;
- Establishment of the environment control measures, plant and supporting infrastructure as required for the excavation Works.

If appropriate based on consideration of estimated excavation volumes, space limitations during construction, observations from additional validation sampling and experience from excavation elsewhere on Barangaroo South, site preparation works may also include:

- Assessment of excavated soil against the NSW EPA (2014) *Waste Classification Guidelines* to facilitate *in situ* waste classification prior to commencement of excavation works. The strategy to be adopted for the *in situ* waste classification of excavated will be developed in consultation with and subject to endorsement by the NSW EPA;
- Construction of odour control structures (refer to **Appendix D**) and associated structures (if required) (potentially including an Emissions Control System [ECS] if required) for control of odours and fugitive emissions from the proposed remediation and /or development works.

12.3 Site Facilities and Procedures

Site facilities required for the excavation works will be established in compliance with the relevant regulations. These facilities will be connected to appropriate utilities as required. All connections and reticulations will be carried out by licensed and qualified personnel in accordance with statutory requirements and standards.

If required, it is proposed that ex-situ treatment of excavated material excavated during the excavation works will be undertaken in an appropriately licenced off-site facility prior to disposal to landfill (if required). In the unlikely event that on-site treatment is preferred, an on-site treatment facility (potentially including an Remediation Enclosure [RE] and associated ECS, if required) will be established at a central location (approved by the BDA) and coordinated with the remediation works to be undertaken within the adjacent areas.

Other activities will involve the set-up of site offices, fencing, decontamination stations, environmental control measures and other associated facilities including:

- Wheel wash zones at the entrance and exit points;
- Stores, work sheds, lunchrooms and changing areas for the use of subcontractors and consultants;
- Temporary site sheds, first aid and emergency facilities, bathroom facilities and decontamination units; and
- Any additional site facilities to facilitate work in other areas of the Site, or in areas requiring additional safety measures.

Where possible, and dependent on staging and sequencing of the remediation works to be undertaken within the adjacent Block 4 (as described by the *VMP/Block 4 RAP* (AECOM, 2013c)), the facilities provided as part of the Block 4 Development Remediation Works / VMP Remediation Works will be used to avoid duplication of remedial facilities.

12.3.1 Exclusion Zones

Exclusion Zones are areas of the Site that will be outlined in the occupational health and safety plan (OHSP) that either require additional protective measures or may require the adoption of additional OH&S requirements and work practices. Exclusion Zones may also include other areas affected by emissions from the works being undertaken at any point in time. All Exclusion Zones will incorporate a buffer area along the boundary of the zone.

The boundaries of the Exclusion Zones will be defined by fencing and safety signs erected at regular intervals around each exclusion zone warning of the boundary of the exclusion zone, the nature of the hazard associated with it and access restrictions that apply for entry into the zone. Access of personnel into and out of the Exclusion Zones, will be controlled at a Decontamination Station, and will depend on the personnel classification. The location and extent of Exclusion Zones will be detailed in the OHSP and outlined in the Site-Specific Safety Induction.

12.4 Site Access and Security

12.4.1 General

Only authorised personnel and equipment will be allowed into the exclusion zones and other areas associated with the excavation works. Access will be strictly controlled throughout the course of the excavation works using the following procedures.

12.4.2 Working Hours

It is anticipated that construction and demobilisation hours would be between the hours of 7am and 6pm Monday to Friday, and 7am to 5pm Saturdays. No construction work would occur on Sundays and Public Holidays.

Operation hours for the excavation activities would be between 7am to 5pm, six days per week.

12.4.3 Site Haul Roads & Parking Areas

Existing concreted areas will be utilised as haul roads to the extent practicable. Traffic movements on Site and within the broader Barangaroo South site will be directed around areas that are the subject of excavation and/or remediation works to the extent practicable.

12.4.4 Site Access

The primary access route to the Site will be via Hickson Road (to be confirmed as part of the application process and determined as part of the site staging). The entry point will control access to and around the Site during the excavation works.

All site personnel entering and leaving the excavation works will be required to pass through the clean/dirty zone and the decontamination station.

12.4.5 OHS Signage

Signage will be installed at the Site entrance detailing the location of the site offices, excavation works, decontamination units, first aid facilities and parking. Traffic restrictions will be installed to limit access to the safety of site visitors.

Signage at the main gate will include after-hours contact details.

As detailed in **Section 12.3.1**, additional signage will be erected along Exclusion Zone boundaries to restrict access to these areas to authorised personnel only.

12.4.6 Fencing

Security fencing, constructed as part of the Stage 1A development works is already in position around the perimeter of Barangaroo South (refer to **Section 6.1**).

Additional fencing will be erected where necessary to secure other portions of the Site.

12.4.7 Control of Site Entry and Exit

Entry to excavation and related work areas will be controlled through the use of a sign-on/sign-off log system at the main gate. Only authorised personnel will be allowed into the excavation works area.

Personnel will gain access to the excavation works area only after they have:

- Attended and completed a site safety induction briefing (applicable to all site workers and visitors);
- Are wearing all applicable PPE as detailed in the OHSP; and
- Been inducted into the OHSP.

All construction vehicles and delivery vehicles will enter the Site through the nominated main gate.

In the event of an emergency and the need for emergency services personnel to access the Site, the Site access process may be expedited. In these situations, which require the need to minimise delays in accessing injured site personnel, prior arrangement will be made for special Site access procedures. However, given the nature of the excavation works, all PPE and decontamination protocols will remain in effect at all times.

An Emergency Response Plan will be developed prior to site establishment detailing the specific procedures relating to site emergencies (refer to **Section 20.10.6**).

13.0 General Excavation and Materials Management

13.1 Background

This section describes management works associated with the proposed excavation works. As discussed in **Section 8.0**, CIM warranting remediation or management has not been identified at the Site.

Additional validation sampling is required from unsaturated soils to demonstrate this (refer to **Section 8.2.7**). Therefore, it is possible that CIM (that is soil containing contaminant concentrations exceeding the SSTC-A) may be identified as an outcome of this additional validation sampling and that remediation of unsaturated soils.

In addition, concentrations of contaminants (that do not require remediation) are known to be present within the Site which may require specific management practices to mitigate potential risks to construction workers, the public and environment.

The following general excavation and material management activities are described as part of the following sections:

- Control and minimisation of emissions from the excavation area (refer also to **Section 17.3**);
- Control and treatment of water from the Area B excavations (**Section 13.5** and **Section 14.0**);
- If required, excavation of the SPGWT and CIM (**Section 13.3** and **Section 13.6**); and
- Loading of excavated materials for transport (**Section 13.7**).

It is noted that any potentially contaminated spoil removed as part of construction of any required piling works associated with the proposed land uses will also be managed in accordance with this RAP.

13.2 Pre Treatment of Materials

Prior to excavation of materials, some preparation and pre-treatment of material may be necessary as summarised in **Section 13.7.3**.

13.3 Excavation Planning

The materials to be excavated are expected to comprise heterogeneous fill materials, soil and demolition rubble.

All excavation works will be undertaken in accordance with the following procedures, in sequence:

- Prior to commencement of excavations on each work shift, all necessary environmental, OH&S measures and related equipment will be established and all worker PPE and respiratory controls will be checked to ensure they are in full working order in accordance with the OH&S Management Plans;
- All excavation plant operators, haulage operators and supervisors will be made familiar with the excavation strategy, and all workers will be made aware of their responsibilities prior to the commencement of each shift;
- Stockpile areas (if required) will be prepared with adequate capacity to receive the contaminated materials after excavation prior to the commencement of excavation;
- Exclusion zones will be set up around the active remediation works areas and as required;
- All truck haulage roads will be made suitable for transportation and haulage of the excavated materials; and
- All personnel, vehicles and equipment leaving the excavation will be properly decontaminated in accordance with the EMP.

13.4 Excavation Operations

Excavations will be regularly inspected by a suitably experienced environmental engineer or scientist to confirm that the visual and olfactory characteristics of the excavated materials are consistent with expectations. These regular inspections will also serve to identify hotspots of SPGWT and/or CIM that may not otherwise have been identified by the previous site investigations / additional validation sampling (refer to **Section 16.4**).

Odorous materials will be managed as per the requirements of **Section 17.3**.

Asbestos containing materials will be managed in accordance with the requirements of **Section 13.8**.

If CIM is identified by the additional validation works (refer to **Section 16.4.1**) the CIM will be selectively excavated (if required) as described by **Section 20.5**. All excavated CIM will be kept separate from other materials. Depending on the level of contamination in the excavated CIM, it will be either:

- transferred to the ex-situ treatment facility (as described by **Section 12.3**), the ex-situ treatment facility is likely to be located off-site) for treatment; or
- transferred directly offsite to a NSW EPA licensed landfill facility, in accordance with the appropriate waste tracking requirements (refer to **Section 13.7.2**).

If encountered as an unexpected find, SPGWT will be similarly selectively excavated and kept separate from other materials. All SPGWT will be transferred to the offsite ex-situ treatment facility (as described by **Section 12.3**) for treatment prior to disposal offsite to a NSW EPA licensed landfill facility in accordance with the appropriate waste tracking requirements (refer to **Section 13.7.2**).

13.5 Dewatering of Excavations

De-watering will be undertaken if required as part the excavation program.

Management of water and groundwater that may accumulate within excavations will be undertaken in accordance with the procedures outlined in **Section 14.0**.

13.6 Excavation Support

Due to the anticipated shallow nature of the Limited Excavations within the Area A unsaturated soils, engineered excavation support is not likely to be required. Excavation slopes will be appropriately benched or sloped to mitigate potential unstable excavations.

13.7 Materials Handling

13.7.1 Background

This section outlines the procedures for materials handling following excavation, specific procedures relating to materials tracking and the required environmental controls.

13.7.2 Materials Tracking

All materials handled during the excavation works will be tracked in order to allow verification of the correct movement and handling. The system will track materials from cradle-to-grave, and will provide detailed information on the location and quantity of all material movements both on and off-site, so that the material being handled can be identified and accounted for. The tracking system shall include accurate tracking of stockpiles throughout the entire material handling stage and will include confirmation of stockpile locations via registered survey. This is to reduce the risk of cross-contamination between stockpiles.

As part of this process, accurate records shall be kept to ensure that backfilling of excavations (where required) only occurs following the successful validation of the subject materials. Plans will be made with respect to the extent of each excavation. A register of all analytical results for stockpiles and excavations will be maintained throughout the validation works.

13.7.3 Material Preparation

Excavated materials may require preparation prior to transport to stockpiles, the offsite ex-situ treatment facility and/or off-site licenced landfill.

Material preparation may include, but not be limited to:

- Mixing of wet material *in-situ* (i.e. within the excavation area) to make the material spadeable. This may be achieved by either mixing with other soils or by addition of fly ash, lime or cement (with appropriate volatile emission and odour controls as described below);
- Drainage and drying of saturated excavated materials. This will require installation of appropriate measures to control run off; and
- Screening of material to separate oversize and/or materials suitable for recycling (e.g. steel, concrete footings/historic sea walls, brick and rock fill, timber piles, construction and demolition waste). Physical separation will be achieved by a combination of:
    - Manual separation using excavators fitted with grabs or skeleton buckets; and
    - Screens.

Odorous materials will be managed as per the requirements of **Section 17.3**.

It is recognised that the proposed approach to material preparation (in particular the addition of lime and or cement) may result in increased volatile emissions and/or odour generation. In consideration of this, where preparation of materials with potential for volatile or odorous emissions is required, the management and mitigation measures described in **Section 17.3** will be implemented.

13.7.4 Crushing/Shredding of Materials

The crushing of oversize excavated materials may be necessary to ensure that the excavated materials can be: recycled (in the case of concrete and brick demolition rubble); reused (if required); or treated in the ex-situ treatment facility.

13.7.5 On-site Transportation of Materials

Materials at the Site will be excavated, handled, moved, treated and stockpiled in a manner designed to minimise exposure to the environment. The following materials handling requirements will be developed for trucks transporting materials within the Site:

- Trucks carrying excavated materials will be covered and decontaminated in a wheel wash facility before exiting the excavation area;
- Trucks will proceed directly to the stockpile area, ex-situ treatment facility, as appropriate, along the predetermined haul roads;
- Trucks carrying contaminated materials will not be permitted to drive over areas of the Site which have previously been excavated, validated or reinstated;
- Trucks will be decontaminated in accordance with the environmental management plan (EMP);
- Empty trucks will return directly to the excavation area are along predetermined haul roads; and
- The validated excavation will be effectively isolated from contaminated areas of the Site by the use of physical means such as the placement of clean material bunds, temporary fences and by use of signage.

13.7.6 Off-site Transportation of Materials

The following materials handling requirements will be developed for trucks transporting materials off the Site:

- Trucks carrying excavated materials will be covered and decontaminated in the wheel wash facility before exiting the Site;
- Trucks will not wait in the streets surrounding the Site or within the CBD; and
- Trucks will exit the Site through predetermined exit points on Hickson Road and will follow a predetermined transport route to the destination (landfill or other) via Sussex Street, Anzac Bridge and the City West Link or across the Harbour Bridge.

In the unlikely event that hazardous waste is required to be transported off-site for the purpose of treatment, prior to disposal to landfill, the procedures detailed in the following Addendum to the *VMP/Block 4 RAP* (AECOM, 2013c) will be adopted to the extent that they are applicable. It is noted that while the Addendum was prepared for the Block 4 remediation works, the methodology would be similar for works at the Site:

- AECOM, 2015. *Addendum to the Remedial Action Plan, NSW EPA Declared Remediation Site 21122 and Block 4 (Stage 1b) Development Works, Barangaroo, Millers Point, NSW - Offsite Treatment/Transport of Contaminated Material*. 18 May.

13.7.7 Stockpiling of Materials

13.7.7.1 Stockpile Locations

Materials requiring stockpiling will be placed within a designated stockpile area. The location of stockpiles will be confirmed via registered survey as part of the Materials Tracking System.

Where practical, further *in situ* testing of material may be undertaken prior to excavation, to pre-classify materials and minimise interim stockpiling requirements.

13.7.7.2 Stockpile Area Preparation

During site establishment, stockpile areas will be prepared using the following methods:

- Noting that the majority of the ORWN Area is covered by an existing hardstand surface, works will be undertaken initially to clear the area of rubbish, rubble, structures and vegetation;
- Diversion drains and bunds will be constructed around the perimeter of the stockpile areas. Additional sediment and erosion control measures including silt fencing and hay bales will be installed where necessary (refer to **Section 14.1**);
- Signs will be erected at the entrance to the stockpile area and at locations around the stockpile specifying individual stockpile numbers and the type of materials stored; and
- Buffer zones will be established around each stockpile area to enable access to the stockpiles and minimise impacts of the stockpile area on the surrounding facilities.

13.7.7.3 Stockpile Construction and Maintenance

The drainage, sediment and erosion control measures installed within stockpiling areas at the commencement of the project will be maintained, repaired and replaced where necessary for the duration of the stockpiling activities.

Where necessary, long term soil stockpiles on-site will be covered or stabilised with spray grass seeding or other suitable measures to reduce dust generation and erosion.

Measures will be taken to reduce the generation of dust from stockpiles through the use of wetting and covers (refer to **Section 17.3**). If required, run-off will be managed by the use of surface bunding, silt fences and drainage diversions (refer to **Section 14.1**).

If stockpiling of SPGWT or odorous material is required, the stockpiles will be managed as follows:

- The SPGWT will be stockpiled separately to all other materials and clearly identified with signage;
- If required, odour suppressant sprays or foams will be sprayed onto stockpile surfaces to mitigate odours during construction of the stockpile;
- The SPGWT will be securely covered with a high density polyethylene (HDPE) liner and surface water controls will be constructed around the perimeter (as required for all stockpiled materials); and
- Daily monitoring of the SPGWT stockpile will be undertaken and will include qualitative assessment of odour around the perimeter of the stockpile.

All stockpiles will be maintained in a tidy and safe condition with stable batter slopes.

13.7.8 Classification of Treated Materials

If required, following treatment of materials within the ex-situ treatment facility, materials will be classified for off-site disposal in accordance with the NSW EPA (2014) *Waste Classification Guidelines* and the requirements of the Immobilisation Approval (if any) (refer to **Section 13.7.9**).

13.7.9 Waste Classification for Off-site Disposal

All material requiring off-site disposal will be assessed for off-site disposal to landfill in accordance with the NSW EPA (2014) *Waste Classification Guidelines* or Part 4 of those guidelines in the case of potential acid sulphate soils (PASS) and acid sulphate soils (ASS).

In situ waste classification works may be undertaken to pre-classify materials prior to the excavation works (refer to **Section 13.7.7.1**).

If treatment of excavated material is required to facilitate offsite disposal, an Immobilisation Approval will be sought from the NSW EPA prior to offsite disposal.

13.8 Management of Asbestos Containing Materials

Based on information obtained during the Stage 1A basement bulk excavation works (located south of the Site) the identification of bonded ACM during excavation works associated with the Site development works is considered probable. As discussed in **Section 6.7.1**, it has been assumed that ACM is likely to be present at the Site.

All bonded ACM impacted material will be managed in accordance with an Asbestos Management Plan (refer to **Section 12.1.2**).

Identified bonded ACM which requires removal from the Site will be collected and disposed of by a licensed Asbestos Removal Contractor (ARC) in accordance with the requirements of the following:

- *NSW Work Health and Safety Act* (2011);
- *NSW Work Health and Safety Regulation* (2011);
- *Code of Practice: How to Safely Remove Asbestos,* Safe Work Australia (2011); and
- *Code of Practice: How to manage and control asbestos in the workplace,* Safe Work Australia (2011).

If required, the bonded ACM removal works would be undertaken as follows:

- The excavation contractor would establish appropriate barriers and signage around the area where bonded ACM has been identified;
- The bonded ACM will be suitably removed from the Site by an ARC;
- Airborne asbestos fibre monitoring will be undertaken around the working area during the works to confirm that the bonded ACM is being removed in an appropriately controlled manner;
- An ARC will conduct a visual inspection of the affected area to confirm that it is free of visible ACM fragments; and
- A clearance certificate will be prepared to document these works.

The requirements for validation of materials to remain *in situ* are described by **Section 16.4.1**. Any works required to remove unexpected CIM based on the presence of asbestos concentrations exceeding the SSTC-A for asbestos, as identified by the additional validation works (refer to **Section 20.5.1**) will be managed in accordance with the Asbestos Management Plan.

Additional works (if any) required for management of bonded ACM identified in residual soils for the protection of construction workers will be determined by the Asbestos Management Plan.

The Asbestos Management Plan and all works associated with or potentially associated with disturbance of asbestos will include consideration of construction worker protection and the following independent report commissioned and endorsed by the NSW EPA:

- Associate Professor Tim Driscoll, Sydney School of Public Health, Sydney Medical School, University of Sydney (March 2013). *The Use of Asbestos-Contaminated Soils on Barangaroo, Report to the Environment Protection Authority.*

13.9 Material Fate

13.9.1 Recycling

The recycling of excavated materials will be maximised to the extent practicable. Where possible, materials won from the screening of excavated materials will be assessed for their recycling suitability as follows:

- Steel materials will be transported to appropriate off-site steel recyclers;
- Concrete, brick and rock may be crushed to create fill for use in other areas of the development (as required) and for construction of haul roads or recycled off-site; and
- Timber will be recycled off-site, where possible.

13.9.2 Imported Materials

Where imported material is used for reinstatement purposes, the material will be placed in accordance with specific geotechnical requirements which will be dependent on the area of reinstatement. The geotechnical requirements will be determined as part of the Technical Specifications for the development.

13.9.3 General Solid Waste

Materials requiring off-site disposal and classified as General Solid Waste in accordance with the NSW EPA (2014) *Waste Classification Guidelines* will be transported off-site and disposed of at a landfill licensed to accept General Solid Waste.

13.9.4 Restricted Solid Waste

Materials requiring off-site disposal and classified as Restricted Solid Waste in accordance with the NSW EPA (2014) *Waste Classification Guidelines* will be transported off-site and disposed of at a landfill licensed to accept Restricted Solid Waste.

If treatment of excavated material is required to facilitate offsite disposal, an Immobilisation Approval will be sought from the NSW EPA prior to off-site disposal.

14.0 Management of Water

14.1 Surface Water Management Methods

14.1.1 Surface Water Management from Undisturbed Areas

Clean water will be generated from surface water collected from remediated and undisturbed areas of the Site. Undisturbed surface water runoff will continue to follow existing drainage patterns, unless diversion from active site areas is warranted. Surface water drainage will also be arranged so that surface water run-off from disturbed or contaminated areas does not enter remediated or undisturbed areas.

Clean water collected from undisturbed areas will be retained on-site and used to the maximum extent possible for dust suppression. Excess clean water will be stored, treated (if required) and discharged in accordance with the discharge conditions established for the Barangaroo South site. It is understood that formal discharge criteria for surface waters from Barangaroo South have been negotiated with the NSW EPA and included as a condition of the POEO license for the Barangaroo South project. It is anticipated that the discharge of surface waters from the Site will be managed as part of the existing process established for Barangaroo South.

14.1.2 Surface Water Management from Disturbed Areas

Surface water management from disturbed site areas is critical to successful management of the Site and reduction of cross contamination issues and to prevent impact to the Harbour. Successful management of Site water is also essential for materials handling and management.

Surface water flows and stormwater will be managed by segregating clean water from impacted water and preventing the inflow of surface water to excavation areas using surface bunds, silt fences and drainage diversions. The preferred hierarchy for management of water on-site is as follows:

- Minimise volume of contaminated water during the works wherever possible by directing surface water away from excavations, depressions, pits and stockpiles by the construction of drainage works such as bunds and diversion drains. These measures will minimise the flow of clean water into other areas of the Site that contain contaminated materials;
- Recycling water where possible by using on-site as dust suppression for other site operations including wheel washing and truck washing. To ensure that the use of recycled water does not impact on surrounding areas, the following data will be obtained prior to undertaking these activities:
    - Chemical data which demonstrates that the water to be recycled complies with the reuse criteria, including consideration of potential for odour generation;
    - Definition of the area where the water is to be discharged;
    - Details of environmental protection measures installed to ensure that the use of recycled water will have no adverse environmental impact;
    - Appropriate tracking of recycled water reused at the Site; and
    - Discharge with or without treatment (if required, using a temporary WTP or some other water treatment facility), in accordance with the discharge conditions established for the Barangaroo South site.

14.2 Groundwater Water Management Methods

Groundwater encountered during excavation will require management. Dewatering and control of groundwater infiltration will also be required.

Groundwater collected from the excavations will be transferred to a temporary WTP, prior to discharge in accordance with the discharge conditions established for the Barangaroo South site.

If required, limited contaminated water may be disposed off-Site with use of truck tankers and/or disposed to sewer (with or without treatment) in accordance with a Sydney Water trade waste licence.

14.3 Wastewater Treatment System

As described above, a temporary WTP may be utilised for the excavation works to the extent practicable in accordance with the existing conditions established for the Barangaroo South site. It is understood that a temporary WTP may also be used for other remediation and development works within Barangaroo South. This approach will avoid unnecessary duplication of infrastructure.

To the extent that this is not practicable, a Site specific wastewater treatment system will be established for the excavation works and is likely to consist of at least the following process units:

- Pumps and a buffer storage for transferring flows to the plant;
- Dissolved Air Flotation unit for the removal of fats, oils, greases and hydrocarbons which might also include a coagulant and surfactant dosing to assist with solids removal;
- A chemical dosing step to adjust the pH and promote chelation and precipitation of heavy metal complexes;
- Reaction & mixing vessels to facilitate the metals removal process providing flow buffering and adequate reaction times;
- Activated carbon filtration, as required to polish specific residual or trace contaminants from the groundwater and ensure compliance with specific trade waste requirements;
- Sludge handling and/or sludge thickening equipment (or at least a tank, sludge separator) to minimise the residuals that require disposal off-site; and
- Effluent balancing storage (in holding tank) prior to pumping to the transfer sump.

Duty / standby pumps (variable speed drives) will control the pumped outflow to Darling Harbour, following approval of a variation to the existing EPL to the Sydney Water sewerage system or stormwater if appropriate testing is conducted and approvals obtained (refer to **Section 12.1.2**).

14.4 Groundwater Monitoring

As described by **Section 8.0**, CIM has not been identified within the Site based on the previous intrusive investigations undertaken within and adjacent to the Site. This assessment has included consideration of groundwater quality within the Site. As an outcome it has been determined that existing groundwater quality at the Site does not represent an unacceptable risk to human health or the environment.

Groundwater monitoring is not considered warranted as part of or following the proposed development and remediation works for the following reasons:

- the groundwater concentrations reported in or adjacent to the Site (MW09, MW22 and MW40, are all less than the groundwater SSTC-A (refer to **Table T6**);
- the groundwater concentrations reported for key CoPCs in or adjacent to the Site (MW09, MW22 and MW40) are generally less that the laboratory LOR and MWQC (refer to **Table T5**);
- as detailed in Section 7.11 of the *ORWN HHERA* (AECOM, 2014), the *VMP Remediation Extent* report (AECOM, 2013d) considers that if the VMP Remediation Works described by the *VMP/Block 4 RAP* (AECOM, 2013c) are implemented, residual gasworks related contamination remaining *in situ* down hydraulic gradient of the Declaration Area (including within the Site) will not represent an unacceptable risk to the environment; and
- as detailed in **Section 7.4**, the *ORWN HHERA* (AECOM, 2014) also considers that residual concentrations of non-gasworks related contamination remaining within the Site do not represent an unacceptable risk to the environment.

15.0 Imported Materials

The Lend Lease development plans for the proposed development works (refer to **Appendix C**) includes raising the surface level of the Public Domain area by approximately 1.0 m to an approximate RL of 3.2 m AHD. As described by **Section 1.3**, it is understood that it is unlikely that Area B excavated material will be reused within the Public Domain. Therefore, it is expected that importation of backfill material to the Site will be required.

Materials imported to the Site will be required to meet the environmental and geotechnical requirements specified for the particular end use.

It is expected that materials imported to the Site as part of the development (including material to be used for landscaping and surface material) will generally meet the requirements of:

- Virgin Excavated Natural Material (VENM) in accordance with the NSW EPA (2014) *Waste Classification Guidelines*;
- Excavated Natural Material (ENM) in accordance with the *Protection of the Environment Operations (Waste Regulation 2005 – General Exemption under part 6, Clause 51 and 51A* (2012);
- the TSC (refer to **Section 7.5**); and
- the soil SSTC-B (refer to **Section 7.3.1** and **Table T1**).

The frequency of validation sampling will be dependent on the source of the fill material. If the material is brought onto the Site from a quarry, and the material is homogeneous, validation will consist of:

- a certificate warranting that the material is VENM or demonstrating the physical and chemical quality of the fill, including supporting test data; and
- visual confirmation that the material is free from contamination as it is imported to the Site.

If the imported material cannot be certified as VENM or clean quarry material, the following works will occur:

- Site inspection of the source site and the reporting of these findings in the relevant validation reports;
- Visual inspection of the imported material upon arrival/stockpiling at the Site to confirm it is consistent with the material observed at the source site and is free from contamination (including visual evidence of asbestos impacts);
- Collection and analysis of one sample per $100m^3$ or a minimum of 3 samples per source. This sampling density may be decreased depending on the quantity of material to be imported from a given source and the initial laboratory analytical results. Any change in sampling density will be determined in consultation with the NSW EPA Accredited Site Auditor;
- Visual confirmation that the material is free from contamination as it is imported to the Site.

Whenever possible, samples will be collected from the source location, prior to import of the material to the Site.

All soil samples will be analysed for the following suite of potential contaminants:

- Metals (As, Cd, Cr, Cu, Ni, Pb, Zn and Hg);
- PAHs and phenols;
- TPH/BTEX;
- OPPs and OCPs;
- PCBs; and
- Asbestos - measured in accordance with Australian Standard 4964 (2004): *Method for the Qualitative Identification of Asbestos in Bulk Samples*.

16.0 Validation Strategy

This section outlines the proposed validation strategy and protocols required to demonstrate that the management strategies detailed herein have achieved the remediation objectives.

16.1 Remediation Goals

As detailed in **Section 7.3**, the Remediation Goals for the protection of human health, as recommended by the *ORWN HHERA* (AECOM, 2014) are:

- As a primary goal, removal / remediation of SPGWT (as defined in **Section 6.4**) to the extent practicable; and
- As a secondary goal, removal / remediation, to the extent practicable, of Confirmed Impacted Material (CIM), which is defined as:
  - Unsaturated soil concentrations exceeding the soil SSTCs; and
  - Unsaturated and saturated soil concentrations that are considered to be the source of groundwater concentrations exceeding the groundwater SSTCs.

16.2 Validation Principles

The *ORWN HHERA* (AECOM, 2014) recommends that soil validation data be assessed in accordance with the *NEPM* (NEPC, 1999 as amended 2013). This will involve demonstrating that relevant SSTCs for the proposed land uses that will form part of the Public Domain development works have been achieved through the:

- use of systematic sampling patterns;
- collection of an appropriate number of samples for estimation of the arithmetic average concentration of contaminant(s) within relevant environmental media and exposure areas; and
- estimation of the 95% upper confidence limit (UCL) of the arithmetic average concentration for soils.

Where applicable, the above statistical analysis will be applied to separate areas of the Site if staged bulk excavation and validation works are to be conducted.

All soil materials to be retained on-site must comply with the soil SSTCs, as discussed in **Section 7.3** and presented in **Table T1**.

It is likely that validation of the proposed management strategies at the Site will be conducted progressively. Consequently, 'Progressive Validation Reports' may be prepared to detail different elements of the validation works. These reports will subsequently be incorporated into a 'Final Validation Report' to be prepared following implementation of all elements of the proposed management strategies.

16.2.1 Validation Planning

As discussed in **Section 12.1.2**, a Validation SAQP will be prepared by a suitably qualified environmental consultant for the bulk excavation works (as required) and will be implemented for the duration of the soil validation testing program. The Validation SAQP will include a description of how the statistical analysis recommended by the *ORWN HHERA* (AECOM, 2014) will be adopted by the soil validation testing program.

An SAQP will also be prepared for the required additional validation sampling works (refer to **Section 20.5.1**).

The two SAQPs will be endorsed by NSW EPA Accredited Site Auditor.

If new guidelines/legislation are introduced or endorsed by NSW EPA during the course of the excavation and validation works, consideration will be given to modifying the validation program in consultation with the NSW EPA Accredited Site Auditor.

The NSW EPA Accredited Site Auditor will be invited to undertake regular site inspections during the Public Domain development works.

16.2.2 Groundwater

The *ORWN HHERA* (AECOM, 2014) recommends that groundwater validation data from: (a) individual groundwater monitoring wells be compared against the relevant SSTCs; and (b) individual groundwater

monitoring wells on the down-hydraulic gradient Site boundary be compared against the MWQC (refer to **Table T9**).

Notwithstanding, as described by **Section 14.4**, groundwater monitoring during or after the Public Domain development works is not considered to be warranted because the previous groundwater concentrations reported within and adjacent to the Site are not considered to represent an unacceptable risk to human health or the environment. Validation of groundwater at the Site is therefore not considered further by this RAP.

16.3 Validation of HHERA Assumptions

An important element of the validation process will be confirmation that the key assumptions regarding the proposed development and on which the *ORWN HHERA* (AECOM, 2014) was based (as described in **Section 7.2.2**) have been or will be implemented.

To this end, validation will include review of appropriate documents confirming that the key assumptions either have been or will be constructed. Appropriate documentation may include:

- "Issue for Construction" Drawings that verify that the key elements of the proposed development relied on by the *ORWN HHERA* (AECOM, 2014) will be constructed; and/or
- "As Constructed" Drawings that document that the key elements of the proposed development relied on by the *ORWN HHERA* (AECOM, 2014) have been constructed.

Validation of the HHERA assumptions will likely be reported in a Progressive Validation Report to be issued to the NSW EPA Accredited Site Auditor.

16.3.1 As Constructed Survey and Inspection

Validation will include an as constructed survey of the final extent of excavations undertaken at the Site, including the alignment of Watermans Cove relative to the Site and the western embankment of the historic Southern Cove.

Where applicable (for example, in cases where as constructed features can be confirmed through inspection), validation will include an inspection of specific key as constructed elements of the development.

16.3.2 Potential Design Changes

This review will also assess any potential implications of changes to the final design of the proposed Public Domain areas and the Watermans Cove (for example to confirm that the existing rock armour which forms the upper surface of the historic Southern Cove embankment remains in place, refer to **Section 3.2.3**). Any significant changes to the final development plans will be assessed via the contingency measures detailed in **Section 20.0**. The details of the above review will be included in the Site Validation Report (refer to **Section 16.8**).

If the final development design is changed in a way that affects the assumptions of the *ORWN HHERA* (AECOM, 2014) and this RAP, the contingency measures detailed in **Section 20.0** will be adopted. In the event that either report requires revision, they would be issued to the NSW EPA Accredited Site Auditor for approval.

16.4 Soil Validation

Soil validation works will require validation of:

- Area A (Southern Public Domain Area):
  - Additional validation sampling of unsaturated soils to more fully characterise this material for comparison with the soil SSTC-A (including the asbestos SSTCs); and
  - If required, validation sampling of excavated areas (walls and base) where remediation works have been conducted to remove any identified CIM.
- If required by the contingency measures described by **Section 20.0**:
  - Validation of materials requiring treatment as suitable for disposal to landfill; and/or
  - Validation of areas used for treatment and/or stockpiling at completion of the works.

All validation sampling works will be conducted by a qualified environmental engineer/scientist with experience working on contaminated sites.

All validation soil samples detailed in the following Sections will be discrete soil samples only. That is, composited soil samples will not be used for validation purposes.

16.4.1 Area A (Southern Public Domain Area) – Additional Validation Works

As described by **Section 8.2.7**, only limited soil analytical results are available for the Area A unsaturated soils (i.e. the Southern Public Domain Area). Therefore, additional validation testing of unsaturated soils is required to ensure that the unsaturated soils are appropriately characterised and do not contain CIM or SPGWT.

As discussed in **Section 8.0**, validation of the northern portion of Area A (located between the proposed Crown Development Site and Darling Harbour) is not considered to be required as the area is underlain by the historic existing caisson wall.

The additional validation testing in Area A (Southern Public Domain Area) will be undertaken in accordance with the NSW EPA Accredited Site Auditor endorsed Validation SAQP (refer to **Section 16.2.1**). In preparing the Validation SAQP, consideration will be given to the range of historic land uses to which Area A (southern portion) was subjected – many of which have a relatively low risk of having resulted in contamination. In particular, much of Area A (Southern Public Domain Area) is located over the reclaimed historic Southern Cove. Of particular relevance to development of the Validation SAQP within the Area A unsaturated soils (refer also to **Section 4.1**):

- The eastern portion of the reclaimed historic Southern Cove has been reported (based on the limited available data) to have been reclaimed with a large proportion of sandstone cobbles and boulders. In addition, due to the timing of the backfilling in this area it is considered unlikely that the area was backfilled with gasworks related wastes; and
- As discussed in **Section 3.2.3**, the western extent (approximately 25m) of the reclaimed historic Southern Cove comprises of a suspended reinforced slab supported on concrete piles. As such, there is a void below the concrete slab and above Darling Harbour (which extends under the slab to a rock armoured embankment constructed to facilitate reclamation of the historic Southern Cove). Based on the saturated soil analytical results discussed in **Section 8.2.3**, validation sampling of the materials beneath the rock armour is not considered to be required. Further it would not be practicable to collect samples from this area due to the void beneath the existing concrete slab and the 1,200mm thick rock armour.

The additional Area A (Southern Public Domain Area) validation sampling to be described by the Validation SAQP is expected to involve:

- Collection of additional soil samples such that the net sampling frequency across Area A (including both the previous investigation locations and additional validation locations) is at least one sample location per 20 m grid interval. This sampling grid may be varied, in consultation with the Auditor, based on the historic land uses of particular parts of Area A as described above;
- Where possible, soil samples will be collected from test pits to allow the collection of bulk samples as required for analysis of the gravimetric content of bonded ACM;
- Soil samples will collected from within the unsaturated zone at depths of approximately 0.5 and 1.5 m bgl;
- Soil samples will be biased toward those zones considered most likely to be impacted based on field observations (including visual/olfactory observations and PID readings); and
- All soil samples will be analysed for the CoPC detailed in per **Section 16.5** and adopting the analytical methods detailed in **Section 16.5.2**.

Based on the results of the additional validation sampling, an assessment of whether CIM and/or SPGWT are present within Area A (Southern Public Domain Area) will be undertaken and conclusions made regarding remediation requirements (if any) (refer to **Section 20.5.1**). These works will be undertaken in consultation with the NSW EPA Accredited Site Auditor and will likely be detailed in a Progressive Validation Report to be issued to the NSW EPA Accredited Site Auditor.

If CIM and/or SPGWT is identified by the additional validation sampling, additional delineation works may be required to appropriately characterise the vertical and horizontal extent of the impacts. If required, these delineation works would also be conducted in consultation with the NSW EPA Accredited Site Auditor.

16.4.2 Contingency Validation Measures

16.4.2.1 Validation of Treated Materials for Disposal to Landfill

If required, materials requiring stabilisation will be tested and validated in accordance with NSW EPA General Immobilisation Approval (approval number 2005/14 or a specific approval for the Site). This will involve the collection and analysis of validation samples from treated and untreated materials at a rate of 1 sample per 500 m^3. The validation samples will be analysed for the following:

- Untreated materials:
  - Heavy metals;
  - PAH and phenols;
  - TPH/BTEX;
  - Cyanide; and
  - Asbestos.
- Treated materials:
  - TCLP (Heavy metals)
  - TCLP (PAH and phenols);
  - TCLP (Cyanide); and
  - Unconfined Compressive Strength.

In addition to the above laboratory analysis:

- the composition of the reagent and ratio of reagent to untreated waste (mass/mass) used during the treatment works will be monitored and reported appropriately; and
- material requiring stabilisation will be inspected by a qualified environmental engineer/scientist to confirm whether it contains SPGWT and/or ACM and the results of this inspection documented.

If ACM is identified, it will be managed in accordance with **Section 13.8**.

Further detailing regarding the treatment of materials to facilitate disposal to landfill is provided in **Section 20.6**.

16.4.2.2 Stockpiling Areas

If stockpiling works (or on-site ex-situ treatment works, if required) are undertaken onsite, these works will be undertaken on appropriately sealed hardstand areas in a designated area, with diversion drains and bunding constructed around the perimeter of the area. Consequently, the soil beneath the hardstand is unlikely to be impacted by the stockpiling activities and subsequently, validation testing of these areas, once the hardstand is removed, is not proposed.

As a precautionary measure, before removal of hardstand is commenced, a careful inspection of these areas will be undertaken to identify the presence of contamination. If this inspection indicates the visual presence of any contamination relating to treatment operations, validation of the soil beneath the hardstand will be undertaken. These works will comprise the collection and analysis of validation samples on a 20 m sampling grid. Validation samples will be collected from the soil surface (0.0 to 0.15m depth) underlying the hardstand and analysed as per **Section 16.5**.

16.5 Validation Sample Analysis

16.5.1 Analysis Suite

All soil validation samples will be analysed by National Association of Testing Authorities (NATA) accredited laboratories.

The suite of analysis required for Area A will be as determined by the relevant soil SSTCs detailed in **Table T1**. Note that the analysis of asbestos in soils will be based on measurement of the gravimetric content of bonded ACM in soil as described by Schedule B1 of the NEPM (NEPC, 2013), to allow appropriate comparison to the asbestos SSTCs (refer to **Section 7.2.3**).

16.5.2 Analytical Methods

Two laboratories will analyse original, duplicate and triplicate soil samples using NATA registered methods. Both laboratories must undertake the required analytical testing in accordance with the requirements of Schedule B3 of the *NEPM* (NEPC, 2013) (and Schedule B2 of the NEPM [NEPC, 2013] in the case of asbestos).

Details regarding the analytical methods to be used will be discussed with the NSW EPA Accredited Site Auditor and the appropriate analytical laboratory engaged to undertake the works.

16.6 Soil Sampling Methodology

Fieldwork will be conducted in accordance with written standard operating procedures, copies of which will be maintained in a register on-site during the remedial works. This will ensure that representative samples of materials are collected and the sampling methodology remains consistent throughout the duration of the remedial works.

16.6.1 Sampling Methodology

Sample collection within the Site will be by:

- sampling trowel from excavation walls and bases from (only if it is safe to do so) (refer to **Section 16.4.1** to **16.4.2**);
- grab samples directly from the centre of an excavator bucket from the centre of stockpiles for validation of stockpiled or treated material; and
- grab samples directly from the centre of an excavator bucket from test pits excavated within excavation areas (if required, refer to **Section 16.4.1**).

All validation sample points will be surveyed.

Materials will be described in accordance with the Unified Soil Classification System (USCS), with soil type, descriptive properties (colour, particle size, moisture content, sorting), as well as discolouration, staining, odours and other indications (if any) being noted. The information will be recorded on field logs completed for each location.

On-site screening of samples for volatile organic compounds (VOCs) in the field will be undertaken using a portable photoionisation detector (PID). The PID will be calibrated at least once daily (at the start of each sampling day) with a known concentration of isobutylene.

Soil samples will be placed into laboratory supplied glass jars as soon as practicable after collection. The jar size will be sufficient to meet the laboratory requirements for the requested analysis. All sample containers will be filled completely using a method such that the loss of volatile components is minimised. All sample containers will be clearly labelled with information such as sample number, sample location, depth, date collected and sampler's identification. After filling, sample containers will then be transferred to a chilled esky for sample preservation prior to and during shipment to the testing laboratory. The sample preservation requirements are listed in **Table 7** below.

Table 7 Soil Sample Preservations and Storage

Analyte	Preservation	Storage
Inorganics		
Metals (General)	Unpreserved, glass jar with Teflon lined lid.	Store at <4°C, analysis within 6 months.
Metals (Chromium VI by alkali digestion)	Unpreserved, glass jar with Teflon lined lid.	Store at <4°C, extract within 28 days, analyse within 7 days.
Metals (inorganic Mercury)	Unpreserved, glass jar with Teflon lined lid.	Store at <4°C, analysis within 28 days.
Cyanide	Unpreserved, glass jar with Teflon lined lid.	Store at <4°C, extraction within seven days, analyse within 14 days.
Asbestos	NA	NA

Analyte	Preservation	Storage
Organics		
TPH C_6-C_9	Unpreserved, glass jar with Teflon lined lid.	Store at <4°C, nil headspace, analysis within 14 days.
TPH C_{10}-C_{36}	Unpreserved, glass jar with Teflon lined lid.	Store at <4°C, extraction within 14 days, analysis within 40 days.
BTEX	Unpreserved, glass jar with Teflon lined lid.	Store at <4°C, nil headspace, analysis within 14 days.
PAHs	Unpreserved, glass jar with Teflon lined lid.	Store at <4°C, extraction within 14 days, analysis within 40 days

A sample register will be updated daily to manage and track the validation process.

16.6.2 Sampling Equipment Decontamination

Equipment decontamination will be undertaken as described below. The following equipment will be needed for the detergent wash and water rinse decontamination process:

- laboratory (phosphate-free) detergent or Decon 90;
- tap water and deionised water;
- buckets or tubs (sufficient for size of equipment to be cleaned); and
- stiff brushes for cleaning.

Equipment that cannot be thoroughly decontaminated using the detergent wash and water rinse should be steam cleaned, or if a steam cleaner is not available, not used for further sampling (and marked clearly "not decontaminated") or discarded. Equipment decontaminated using the high pressure steam cleaner will be further decontaminated as described above.

16.6.3 Quality Control samples

The following quality control (QC) samples will be collected as part of the field quality control procedures:

- Intra-Laboratory Duplicates – are identical to field samples, but both samples are sent anonymously to the primary laboratory. Blind duplicates provide an indication of the analytical precision of the main testing laboratory, but may also be affected by sampling techniques and inherent heterogeneity in the sample medium;
- Inter-Laboratory Duplicates – are identical to blind duplicates, but the duplicate sample is sent to the second (check) laboratory. Split duplicates provide an indication of the accuracy of the main testing laboratory;
- Trip Blanks/Spikes – are samples of soil or water prepared by the laboratory with either zero or known anolyte concentration. Trip blanks/spikes are a check on the sample contamination originating or lost from sample transport and handling, and shipping. One Trip Blank/Spike will be analysed per sample batch;
- Field Blanks – are similar to trip blanks except the water is transferred to sample containers on-site. Field blanks are a check on sample contamination originating from sample transport, handling, shipping, site conditions or sample containers. One Field Blank will be analysed per water sample batch; and
- Rinsate blanks - one rinsate blank sample (from an item of sampling equipment) will be collected per day of sampling by running distilled water over the selected item and decanting directly into the sample bottle. The rinsate will be taken from the final rinse of the equipment after decontamination.

Procedures for duplicate sampling will be identical to those used for routine sampling and duplicate samples will be despatched for analysis for the same parameters using the same methods as the routine sample. Duplicate soil samples will be collected from directly adjacent to original samples (i.e., from the adjacent area of the excavation base or wall). No homogenisation of samples will occur to reduce the loss of volatile compounds.

Duplicates and equipment blank samples will be collected as follows:

- Intra-Laboratory duplicate samples will be collected at a rate of approximately 1 in 20 soil samples and analysed for the full analyte suite. At least one blind duplicate sample will be included in each batch of samples;

- Inter-Laboratory duplicates samples will be collected at a rate of approximately 1 in 20 soil samples and analysed for the full analyte suite. At least one split duplicate sample will be included in each batch of samples; and
- One equipment blank of soil sampling equipment will be collected for every day of sampling and analysed for the full analyte suite. At least one equipment blank will be included in each batch of samples.

16.6.4 Laboratory QA/QC

The laboratories will undertake the analyses utilising their internal procedures and their test methods (for which they are NATA, or equivalent, registered) and in accordance with their quality assurance (QA) system which forms part of their registration.

Laboratory quality control procedures, which will be used during the project, will comprise the following:

- Laboratory Duplicate Samples – these are sub-samples taken from one sample submitted for analytical testing in a batch. A laboratory duplicate provides data on analytical precision. The rate of duplicate analysis will be according to the requirements of the laboratory's accreditation but will be at least one per batch;
- Matrix Spiked Samples – the purpose of the matrix spike is to monitor the performance of the analytical methods used, and to determine whether matrix interferences exist. A sample is spiked by adding an aliquot of known concentration of the target analyte(s) to the sample matrix prior to sample extraction and analysis. A spike documents the effect of the sample matrix on the extraction and analytical techniques. These will be analysed at a rate of approximately 5% of all analyses. At least one per batch will be reported;
- Laboratory Blank – this is usually an organic or aqueous solution that is as free of analyte as possible and contains all the reagents in the same volume as used in the processing of the samples. The reagent blank must be carried through the complete sample preparation procedure and contains the same reagent concentrations in the final solution as in the sample solution used for analysis. The reagent blank is used to correct for possible contamination resulting from the preparation or processing of the sample. Blanks will be analysed at a rate of once per process batch, and typically at a rate of 5% of all analyses;
- Laboratory Control Samples – these comprise either a standard reference material or a control matrix fortified with analytes representative of the analyte class. Recovery check portions should be fortified at concentrations that are easily quantified but within the range of concentrations expected for real samples. These will be analysed at a rate of one per process batch, and typically at a rate of 5% of analyses; and
- Surrogates – surrogate spikes are known additions to each sample, blank and matrix spike or reference sample analysis, of compounds which are similar to the analytes of interest in terms of:
  - extraction;
  - recovery through clean-up procedures; and
  - response to chromatography or other determination;

  but which:
  - are not expected to be found in real samples;
  - will not interfere with quantification of any analyte of interest; and
  - may be separately and independently quantified by virtue of, for example, chromatographic separation or production of ions of different mass in a GC/MS analyser.

Surrogate spikes are added to the analysis before extraction. The purpose of surrogates is to provide a means of checking, for every analysis, that no gross errors have occurred at any stage of the procedure leading to significant analyte losses. Other internal laboratory quality control procedures, as required for NATA, or equivalent, registration, will also be performed.

Results of the QC analyses for both laboratories will be reported with each batch.

16.7 Validation Data Quality Objectives

The Data Quality Objectives (DQO) process is a systematic, seven-step process that defines the criteria that an investigation should satisfy. DQOs for the validation works have been developed based on the iterative DQO process developed by the USEPA (2000) Guidance for the Data Quality Objectives Process – EPA QA/G-4 and

adopted by NSW DEC (2006). The guidelines incorporate field quality control and laboratory analysis, methods and information on laboratory quality control data and have been used to validate the field and analytical data for the validation works.

The DQO approach follows the general guidance provided in Appendix IV of NSW DEC (2006) with respect to setting the DQOs and assessing their achievement by reference to the Data Quality Indicators (DQIs) set out in Appendix V of NSW DEC (2006). The approach has been modified to focus on setting appropriate objectives and ensuring the reliability of data from both field and laboratory procedures. The approach puts more emphasis on Step 5 (Developing the analytical approach to assessing data), which assesses the reliability of both the field and laboratory data and on demonstrating achievement of the objectives of the validation works. The approach assesses achievement of Step 6 (performance or acceptance criteria that data need to achieve) by reference to DQIs for both field and laboratory procedures.

The DQOs are detailed in the following Sections.

16.7.1 Step 1 – State the problem

The historic reclamation of the Site with fill materials (refer to **Section 3.2.1**) has caused low level metals, BTEX, PAH and TPH contamination in the soils in some areas of the Site. The *ORWN HHERA* (AECOM, 2014) has concluded that some chemicals are present in the Site soils at concentrations which may pose a risk to human health or the environment in the context of the proposed land uses. Consequently, management of soils in some areas of the Site is required.

A validation program is required to demonstrate that the remediation objectives of this RAP, specifically with respect to the mitigation of the risks to human health and the environment, have achieved.

16.7.2 Step 2 – Identify the decisions

The decisions to be made relate to whether the validation program has demonstrated that the works have achieved the objectives of the RAP:

- Is the developed Site protective of human health in the context of the proposed Lend Lease development works?
- Do the completed works comply with applicable legislative requirements including the appropriate requirements of the NSW DP&E and NSW EPA?

16.7.3 Step 3 - Identify the decision inputs

Inputs to the decision that need to be made with respect to whether the proposed excavation works at the Site have achieved the stated objectives are:

- The results of previous investigations (refer to **Section 8.0**);
- The use of appropriate remediation criteria (the SSTCs, refer to **Section 7.0**) as described in the *ORWN HHERA* (AECOM, 2014);
- The development and implementation of remedial options;
- The data to be obtained during soil sampling during the validation testing discussed in **Section 16.4**;
- The use of appropriate validation field methods, including sampling and preservation of soil and groundwater samples;
- The use of NATA registered methods for all analysis; and
- Confirmation that the DQIs have been achieved.

16.7.4 Step 4 – Definition of the boundaries of the remedial works

This is clearly defined by reference to the Site address and surveyed site areas (refer to **Section 3.1** and in **Figure F5** [Rygate site services plan]).

16.7.5 Step 5 – Develop decision rules

The quality of data from field and laboratory procedures will be achieved by assessing data with reference to DQIs. The criteria will be as follows:

Table 8 Field and Laboratory Data Quality Indicators

Data	Data Quality Indicators
Field	
Field Personnel	Use appropriately trained field personnel.
Field data collection	Site conditions and sample locations properly described. All soil sample and groundwater monitoring well locations will be surveyed. Information to be recorded in field notes. Field notes are appropriately completed.
Sample handling (storage and transport)	Soil samples will be collected will be collected in accordance with **Section 16.6**.
Field duplicates	As per the requirements of **Section 16.6.3**.
Field blanks	As per the requirements of **Section 16.6.3**.
Calibration of Field Equipment	On-site screening of samples for volatile organic compounds (VOCs) in the field will be undertaken using a portable photoionisation detector (PID). The PID will be calibrated at least once daily (at the start of each sampling day) with a known concentration of isobutylene. Water quality meters will be calibrated prior to the commencement of field activities with relevant solutions. The calibration will be in accordance with manufacturer's instructions or NATA publications *General Requirements for Registration: Supplementary Requirement: Chemical Testing (NATA 1993) and Technical Note N0. 19* (NATA 1994). Where satisfactory calibration cannot be achieved, the equipment will not be used. Calibration details will be recorded on field sheets, which will be included in the final report.
Laboratory	
Sample Analysis	All sample analyses to be conducted using National Association of Testing Authorities (NATA) certified laboratory using *NEPM* (1999) procedures. Use NATA certified check laboratory.
Holding times	Maximum acceptable sample holding time will be as follows: - BTEX - 14 days; - TPH C_6-C_9 - 14 days; - TPH C_{10}-C_{36} - extract within 7 days, analyse within 40 days; - PAHs - extract within 7 days, analyse within 40 days; - Phenols - extract within 7 days, analyse within 40 days; - Ammonia - 28 days; and. - Asbestos – NA.
QA/QC samples	As per the requirements of **Section 16.6.4**.
Practical Quantitation Limits (PQLs)	All PQLs to be less than the remediation criteria.
Laboratory Relative Percentage Difference (RPD)	The RPDs of replicates will be determined and compared to the following criteria (from tender brief) for acceptability: - Less than 20 percent for laboratory duplicates where the detection is greater than 20 times the PQL; - Less than 50 percent for laboratory duplicates where the detection is greater than 10 times the PQL and less than 20 times the PQL; and - No limit where concentration less than 10 times PQL
Control Spike Duplicate RPDs	RPDs for Control Spike Duplicates will be compared to an acceptable limit of 20% and undertaken at 1 in 20 samples or a minimum of 1 per batch.
Matrix Spike Duplicates RPD	RPDs for Matrix Spike Duplicates will be compared to an acceptable limit of 20% and undertaken at a minimum of 1 in 20 samples.
Control Spike and Matrix Spike Recoveries	Percent recoveries of control spikes and matrix spikes will be compared to an acceptable range of 75–130 % and/or the laboratories internal DQI limits.

Corrective Actions

Analytical data that fails to meet the predetermined DQIs listed in **Table 8** will be managed using the following corrective actions on a case-by-case basis:

- Inspect samples to determine heterogeneity;
- Reanalyse suspect samples;
- Evaluate and amend sampling and/or analytical procedures;
- Re-sampling and re-analysis;
- Accept the data with an acknowledged level of bias and imprecision; and
- Discard the data.

In the event that data of questionable reliability are used, then it is essential that any restrictions and limitations associated with the use of such data are clearly identified. Failure to meet the DQIs will be reported and the implications to data quality will be assessed.

If the DQIs are considered to have been achieved satisfactorily then it will be concluded that the data is suitable for use for validation purposes. If the DQIs are not achieved, the significance of possible errors will be assessed to decide whether the data is useable.

16.7.6 Step 6 – Specification of the acceptable limits on decision errors

Specification of the acceptable limits on decision errors will be achieved by reference to the DQIs outlined below:

Precision

Precision measures the reproducibility of measurements under a given set of conditions. The precision of the laboratory data and sampling techniques will be assessed by calculating the Relative Percent Difference (RPD) of duplicate (laboratory and field) samples. The criteria to be used for the assessment of RPD will be based on guidelines given in AS4482.1 1997. These criteria listed in **Table 9** below.

Table 9 RPD Assessment Criteria

Sample Type	Typical Acceptable RPD[(a)]
Intra-Laboratory Duplicate	30-50%[(b)]
Inter-Laboratory Duplicate	30-50%[(b)]

Notes: a) The significance of RPDs of results should be evaluated on the basis of sampling technique, sample variability, absolute concentration relative to criteria and laboratory performance.

b) This variation can be expected to be higher for organic analysis than for inorganics and for low concentrations of analytes which are close to the laboratory LOR.

If duplicate results are not within the acceptable RPD range, investigation into the cause will be initiated. The results of the investigations will be written up and filed, and followed up with the laboratories to achieve resolution. Thus the precision of the laboratory will be assessed by the acceptability of the RPD of laboratory duplicate samples, which should be within the acceptable RPD limits as established for intra-laboratory and inter-laboratory duplicates.

Accuracy

Accuracy measures the bias in measurement. Accuracy can be impacted by factors such as field contamination of samples, poor preservation of samples, poor sample preparation techniques and poor selection of analysis techniques by the analysing laboratory and improper analyses.

The accuracy of the laboratory data that will be generated during the project is a measure of the closeness of the analytical results obtained by a method to the 'true' value. For reference laboratory methods (e.g. USEPA methods), the following levels of accuracy should generally be achievable within ± 15 % of:

- the expected value of a certified reference material of similar matrix; or
- the value obtained by a separately validated and recognised quantitative method for the sample matrix.

Accuracy will be assessed by:

- reference to the analytical results of laboratory control samples;
- use of trip, equipment and field blanks to check the accuracy of sampling techniques; and
- evaluating the results of laboratory spikes and analyses against reference standards.

Analytical results of these should be sufficient to establish that accuracy has been achieved in the work of the sampling team.

Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represents a characteristic of a population or an environmental condition. Representativeness will be achieved by collecting samples on a grid basis from an adequate number of sample locations, to validate the subject area to the required accuracy and ensuring that an appropriate number of reliable analyses have been reported for each population or environmental condition, and that the concentrations of CoPC have been maintained in the samples during and after their collection. Consistent techniques and methods using written procedures will be utilised throughout the sampling program.

Completeness

Completeness is defined as the percentage of measurements made which are judged to be valid measurements. The completeness goal is set at there being a sufficient amount of valid data generated during the validation works. If there are insufficient valid data, as determined by the other DQIs, then additional data will be required to be collected.

Comparability

Comparability is a qualitative parameter expressing the confidence with which one data set can be compared with another. This will be achieved through maintaining a level of consistency in techniques used to collect samples, and ensuring the selected laboratories use consistent analytical techniques and reporting methods. Reporting of results will be done in consistent units and nomenclatures, and comparability will be achieved by ensuring that precision and accuracy objectives are met.

16.7.7 Step 7 – Optimisation of the design of the collection of data

This will be achieved by meeting the DQOs detailed in Steps 1 to 6 to confirm that the data generated from the remedial works is from appropriate locations, that analytical testing is undertaken for the identified CoPC, in appropriate quantities and of acceptable quality to confirm that the objectives of the remedial works have been achieved.

16.8 Validation Reporting

It is likely that validation of the proposed management strategies at the Site will be conducted progressively. Consequently, 'Progressive Validation Report' may be prepared following completion of each stage of excavation and validation works. These reports would be subsequently incorporated into a Final Validation Report following implementation of all elements of the proposed management strategies.

The reporting requirements for the Site will be confirmed with the various stakeholders including, but not limited to Lend Lease, the NSW EPA Accredited Site Auditor, NSW EPA and the BDA.

It is anticipated that the validation reporting will be undertaken in a manner which enables the NSW EPA Accredited Site Auditor to prepare Site Audit Statements confirming whether the Site has been remediated to a standard suitable for the proposed development works.

The Progressive and Final Validation Reports will be prepared in accordance with the requirements of the *Guidelines for Consultants Reporting on Contaminated Sites* (NSW EPA, 2011) and will include the following information:

- An overview of the excavation works carried out at the Site;
- A summary of the site history and basis for the management approach for the Site;
- Surveyed figures outlining the extent of the excavation works;

- The location of validation and characterisation samples;
- Descriptions of sampled materials (including visual and olfactory observations);
- Field Equipment calibration certificates/records;
- Photographic documentation of the bedrock validation works (if required);
- Details of imported material used at the Site;
- Waste classification certificates and landfill waste disposal information;
- Summary tables for soil and groundwater analytical results;
- Confirmation that the project DQO's and DQIs have been appropriately met;
- NATA registered laboratory analytical certificates;
- Summary of the tracking and fate of materials including materials excavated for on-site treatment, reuse on-site or off-site disposal;
- Landfill weighbridge dockets (if required);
- Conclusions as to the suitability of the Site, specifically for the proposed Lend Lease development works; and
- Recommendations (if required) for further works.

17.0 Environment Management Plan – During Excavation

17.1 General

This section of the RAP describes the minimum standards to be adopted to protect the environment during the bulk excavation works. The Contractor will develop and implement a suitable Environmental Management System in compliance with legislative and regulatory requirements. A site-specific Environmental Management Plan (EMP) will be developed prior to commencement of the excavation works. The EMP will detail the appropriate information and mitigation measures necessary to conduct the excavation works in a manner that will minimise the risk to the environment.

17.2 Water Management

The Environment Management Plan for the works will include procedures for the management of surface water and groundwater during the works as outlined in **Section 14.0**.

17.3 Air Quality Management

An Air Quality Impact Assessment will be prepared in accordance with the Approved Methods for the Modelling and Assessment of Air Pollutants in NSW (DEC, 2005) to assess potential air and odour issues generated during the excavation works. This assessment will make reference to the following guidance documents:

- *Assessment and Management of Odour from Stationary Sources in NSW: Technical Framework* (DEC, 2006a); and
- *Management of Odour from Stationary Sources in NSW: Technical Notes* (DEC, 2006c).

17.3.1 Odour

Odour management is recognised as a critical aspect of site environmental management and will need to be given high priority in the planning of all excavation and stockpiling of contaminated soil at the Site. Odours are expected during the soil excavation, and consequently, management procedures will need to be developed within the EMP to address odour issues during all excavation works.

Primarily, odours at the Site will be associated with the excavation of hydrocarbon impacted materials. Odour generation at the Site will be influenced by weather conditions, the extent of open excavations and stockpiles, and the quality of material exposed.

A detailed odour management system will be developed as part of the EMP incorporate the use of various management options as deemed appropriate for particular areas. The odour management system will include the following options:

- investigation as to the source of odours including odour monitoring;
- minimisation of the quantity or surface area of exposed odorous materials;
- implementation of odour management response procedures (as specified in the EMP);
- implementation of progressive contingency measures (as specified in the EMP);
- covering of exposed odorous materials progressively or at the completion of each work period;
- minimising exposed/excavation areas;
- apply odour suppressant sprays or foams to excavation surfaces;
- use an odour suppressant spray (if required); and
- undertake activities during favourable weather conditions.

Selection of the appropriate management and mitigation measures, including those summarised above, will be based on consideration of:

- the quantity of odorous materials that require remediation;
- the duration of the required excavation works and associated management of odorous materials;
- the proximity of the proposed excavation works to sensitive receptors;
- the prevailing and forecast weather conditions; and/or
- other activities being undertaken at the Site in parallel with the excavation work.

17.3.2 Dust

Care should be taken to manage wind-blown dust at the Site during excavation and earthworks activities. Dust can be generated through a range of means and activities:

- Wind action:
  - Exposed soil surfaces will generate dust during winds;
- Agitation and movement:
  - Excavation, mixing and placement of soil will generate dust;
  - Transfer of soil in uncovered trucks may result in dust generation;
- Vehicle Movements:
  - Vehicles' wheels on exposed soil surfaces (such as unsealed roadways) will generate dust.

Appropriate management of dust is required to ensure that it is minimised and/or prevented. Dust management will include the following:

- Covering surfaces;
- Minimising exposed/excavation areas;
- Wetting down; and
- Dust monitoring.

17.4 Noise and Vibration Management

An assessment of noise and vibration impacts potentially generated during the excavation works will be prepared in consultation with the NSW EPA. The assessment will be prepared in accordance with the *Interim Construction Noise Guideline* DECC (2009)*, Industrial Noise Policy* (NSW EPA 2000) and *Application Notes, Environmental Criteria for Road Traffic Noise* (NSW EPA 1999) *and Assessing Vibration: A Technical Guide* (DEC 2006b).

The potential for noise and vibration impacts from the remediation works will result from:

- Works associated with preparation of the Site;
- Movement of construction vehicles around the Site; and
- Operation of plant and activities on the Site.

17.5 Long Term Environmental Management Plan

On the basis that both the key assumptions and requirements of this RAP and the *ORWN HHERA* (AECOM, 2014) are successfully delivered and implemented during the execution of the works, and validated accordingly upon completion, no Long Term Management Plan is envisaged as a requirement of this RAP.

Should future land owners propose to re-develop the Site for a land use that is different to those included as part of the proposed development works (refer to **Section 4.0**), the associated development application would be required to consider the requirement (or otherwise) for a Long Term Environmental Management Plan or further remediation to facilitate the proposed re-developed land use. Such considerations are beyond the scope of this RAP.

18.0 Occupational Health and Safety – During Excavation

18.1 General

This section of the RAP describes the minimum standards to be adopted to protect the health and safety of all persons involved in the excavation works. The Contractor will develop and implement a suitable Health and Safety Management System in compliance with legislative and regulatory requirements. A site-specific Occupational Health and Safety Plan (OHSP) will be developed prior to commencement of the works. The OHSP will detail the appropriate health and safety information necessary to conduct the excavation works in a safe manner. The OHSP will be endorsed by a suitably qualified occupational hygienist.

18.2 Occupational Health & Safety Plan

The purpose of the site-specific OHSP is to present all relevant health and safety information for the works. The information presented in the OHSP will include:

- Assignment of responsibilities for management personnel and workers;
- An outline of the existing Site conditions;
- Details of all work to be conducted;
- An evaluation of hazards and risks;
- Details of the proposed measures to be implemented to manage the identified hazards and risks;
- Establishment of personnel protection standards and mandatory safe work procedures;
- Establishment of OHS monitoring protocols;
- Training requirements for emergency team members;
- Communication protocols and training procedures;
- Evacuation procedures, emergency contacts and emergency drills to be implemented; and
- Provision for contingencies and changes in work practices.

18.2.1 Responsibilities

The responsibilities and duties of the Contractor in relation to OHS will include:

- Ensuring all work undertaken is performed in accordance with relevant legislation and regulations, and directions issued by regulatory authorities;
- Developing and documenting safe working practices for all employees and subcontractors;
- Ensuring workers are adequately trained to undertake their work tasks using the adopted work practices;
- Ensuring that work is performed in strict adherence to the adopted work practices;
- Appointing a suitably qualified and experienced Site Safety Officer (SSO) to supervise and control safety matters;
- Supplying and maintaining first aid kits, first aid facilities and ensuring first aid attendants are present in accordance with statutory requirements;
- Ensuring that all workers are inducted prior to their commencement of work. This will include site-specific training in regard to the site conditions, works procedures, emergency and evacuation procedures, first aid procedures, decontamination procedures and other relevant matters detailed in the OHSP;
- Ensuring that copies of the OHSP are readily available;
- Establishment and maintenance of a record of all hazardous substances on the Site including provision of Safety Data Sheets (SDSs);
- Ensuring that all personnel who work with contaminated materials undergo a medical examination prior to and at the completion of their work on-site;

- Reporting all site incidents and accidents to WorkCover NSW;
- Ensuring that the SSO is on-site during all site works to monitor compliance with the OHSP;
- Ensuring that regular documented OHS inspections are conducted, including the use of a documented follow-up system to monitor improvements and measures introduced to rectify any observations made;
- Supplying and maintaining the required personal protective equipment (PPE);
- Ensuring all workers are trained in the use of the PPE and correctly use PPE; and
- Ensuring that all electrical equipment, plant and tools comply with appropriate statutory requirements and are maintained in a good, serviceable and safe condition.

18.2.2 OH&S Legislation, Regulations and Standards

The excavation works will be conducted in compliance with applicable OH&S legislation, regulations and standards. In addition, the excavation works will comply with relevant industry codes of practice, guidelines and other publications that have been developed by WorkCover NSW. These may include:

- *The Work Health and Safety Act* 2011 and *Regulation* (2011);
- *The Dangerous Good Act* 1975 and *General Regulation* (1999);
- *Guide for Riggers* (November 1995);
- *Electrical Practices for Construction Work* (February 1992); and
- *Exposure Standards for Atmospheric Contaminants in the Occupational Environment* (May 1995);

A number of Australian Standards have been identified relating to OH&S issues for the works proposed at the Site. These standards include:

- AS 1319 -1994 Safety Signs for the Occupational Environment;
- AS 1336 -1997 Recommended Practices for Occupational Eye Protection;
- AS 1470 -1986 Health and Safety at Work - Principles and Practices;
- AS 1715 -1994 Selection, Use and Maintenance of Respiratory Protective Devices;
- AS 1716 -2003 Respiratory Protective Devices;
- AS 1801 -1997 Occupational Protective Helmets;
- AS 1885.1 -1990 Measurements of Occupational Health and Safety Performance - Describing and Reporting Occupational Injuries and Disease (known as the National Standard for Workplace Injury and Disease Recording);
- AS 2161 - 2000 Occupational Protective Gloves;
- AS 2210 - 2000 Occupational Protective Footwear;
- AS 2436 -1981 Guide to Noise Control on Construction, Maintenance and Demolition Sites;
- AS 2601 -2001 The Demolition of Structures;
- AS/NZS 2865-2001 Safe Working in a Confined Space;
- AS 2986 -1987 Workplace Atmospheres - Organic vapours - Sampling by Solid Adsorption Techniques;
- AS/NZS 3012 -1995 Electrical Installations – Construction and Demolition Sites;
- AS 3640 -1989 Workplace Atmospheres - Method for Sampling and Gravimetric Determination of Inspirable Dust; and
- AS/NZS 4576 -1995 Guidelines for Scaffolding.

18.3 Risk Assessment

A hazard analysis should be conducted prior to site establishment to identify the OHS hazards expected during the course of the excavation works. A Risk Management Plan will be developed to identify hazards associated with the proposed excavation works, evaluate the associated risks and determine the necessary measures to reduce or mitigate those risks. This section of the RAP outlines some of the hazards expected over the course of the project. Hazard identification and risk assessment will be conducted and documented on an ongoing basis as the project works proceed.

18.3.1 Chemical Hazards

Based on the information provided in previous investigations at the Site, the presence of asbestos, metals, BTEX, TPH and PAHs has been confirmed within the Site's soils and groundwater in some areas. The hazard posed by these materials will be evaluated and the associated risks assessed in the Risk Management Plan.

18.3.2 Atmospheric Exposure Limits and Recognition Qualities

The exposure limits and recognition qualities of the chemicals likely to be encountered in the excavation works will be taken from the following guidelines (listed in order of precedence) and detailed in the OHSP:

- NOHSC, Exposure Standards for Atmospheric Contaminants in the Occupational Environment, 1995. The most up-to-date Australian exposure standards are located on the Safe Work Australia Hazardous Substances Information System (http://hsis.ascc.gov.au/SearchHS.aspx); and
- National Institute for Occupational Safety and Health (NIOSH) 2007, Pocket Guide to Chemical Hazards. Also refer to http://www.cdc.gov/niosh/npg/.

18.3.3 Additional Hazards and Risks

The OHSP will identify and describe a range of other hazards anticipated during the excavation works. These hazards will include:

- Heat stress;
- Explosive atmospheres in areas dealing with contaminated materials;
- Oxygen deficient atmospheres and confined spaces (as defined under AS/NZS 2865 - 2001 Safe Working in a Confined Space);
- Underground utilities;
- Underground pipelines, pits, and other obstructions;
- Above ground electrical and utility hazards;
- Traffic hazards (particularly noting that Hickson Road will remain operational during the excavation works);
- Instability of excavation batters and stockpiled material;
- Hazards associated with operation of the treatment works (if required); and
- If on-site ex-situ treatment is required (refer to **Section 12.3**):
    - Hazards associated with the construction and decontamination of the RE and ECS; and
    - Hazards associated with the airlock and decontamination operations in the RE.
- Physical hazards such as trip hazards and mobile plant.

Specific minimum standards for these hazards will be outlined within the Risk Management Plan.

18.4 Work Zones

The Site will be divided into a number of work zones, as follows:

- Exclusion Zones – for example the excavation area;
- Decontamination Zones – decontamination stations located adjacent to the exclusion zones; and
- Support Zones – the site office and site facilities areas adjacent to the decontamination zones.

Movement of personnel and equipment between these zones will be minimised and restricted to specific access control points and decontamination stations to prevent cross contamination to clean areas.

19.0 Community Engagement

Community engagement is critical to the success of development works at Barangaroo. Over the past four years, Lend Lease, in conjunction with the BDA, has undertaken an extensive program of community engagement on the excavation and remediation activities associated with Barangaroo South and the NSW EPA Declaration Area. This engagement has been aimed at educating the community and key stakeholders about the historic nature of the contamination at the Site and the importance of remediation works, the type of works proposed and to provide a forum for community feedback.

A number of consultation avenues have been utilised during this engagement program including:

- presentations to interested stakeholders;
- face to face meetings with key community groups and stakeholders to provide one-on-one briefings about the remediation;
- holding large scale community information sessions jointly between Lend Lease and the BDA;
- issue of Fact Sheets on remediation to relevant stakeholders and included on the BDA website - www.barangaroo.com; and
- newsletter updates and letterbox notifications.

All of these communications tools provided an opportunity to present factual information about the nature of the contamination and remediation works, along with ensuring the community could raise any issues of concern.

Lend Lease's community engagement program for the project has also included establishing a Business Construction Liaison Group (BCLG) and a Community Construction Liaison Group (CCLG), in conjunction with the BDA. The purpose of these groups is to brief key representatives from both the local commercial and residential communities on key aspects of the project, relating to construction, as early as possible in the planning process. To date, both of these forums have received extensive briefings on the proposed remediation and excavation activities at Barangaroo and remain keenly interested in further progress updates in the future. Representatives of these groups then assist in actively disseminating information back to their respective networks on the status of the project. It is intended that further presentations will be given to these two groups as the plans for remediation and excavation activities progress.

All consultation has been carried out in line with the principals and methodologies outlined in the Lend Lease Community & Stakeholder Engagement Strategy (May 2012).

Prior to undertaking excavation works associated with the Public Domain development works, Lend Lease will develop a Remediation Community Engagement Sub Plan, which will summarise ongoing engagement to be undertaken with the community. Engagement will continue, both prior to and during excavation activities, to ensure the community are fully informed of the remediation activities at the Site, and have an opportunity to provide feedback.

Table 10 Summary of Lend Lease Communication Strategy

Communication Channel	Purpose
1300 Community Enquiry Line	A key channel for the community to raise issues, ask questions and speak directly to a member of the Community Relations team. A 24 hour after hours service will be provided to ensure any issues occurring outside of business hours are addressed in a timely manner.
Barangaroo South Website (www.barangaroo.com)	This is the central portal for all information about the project. It is the one-stop-shop for everything the community and stakeholders will need to know about the remediation works including electronic copies of all newsletters, notifications, press releases and links to the NSW DP&E website and submissions.
Barangaroo South Blog (link on website)	An opportunity for open communication between the community, stakeholders and general public about the project.

Communication Channel	Purpose
Newsletters	To provide ongoing updates about the planning process and progress of works on site. This will be a key means of ensuring information transparently flows to the community and stakeholders about the remediation and excavation work.
Community Information Sessions	Used to convey key messages to the local stakeholders and proactively work to address specific concerns.
Stakeholder one-on-one briefings	To discuss concerns raised by key stakeholders face-to face and provide more detailed information and assurances about the project.
Public displays	To effectively raise greater awareness of the project and the progress, particularly during the design phase.
Notifications	To ensure all residents and businesses potentially impacted by Site works are informed in advance of key work commencing. Notifications will be used to inform the community of key issues such as the timing of noisy work, out of hours construction and traffic impacts.
Door knocking	To personally discuss concerns raised by the local business community (particularly the businesses along King Street Wharf and local cafes in the high rise commercial buildings) face-to-face on a one-on-one basis, proactively address any issues and provide assurances about the work.
Signage	To inform the community about who is responsible for the Site activities and the contact details for further information about the work.
Advertising	To provide regular updates to a large audience and direct them to the website for further information. To raise greater awareness about the project in the wider community.
Commercial Property Notice Boards	When appropriate, general information about the overall project will be included on the notice boards in commercial properties. This will also contain the contact details of the Lend Lease Barangaroo South Community Relations team should they require any further information about the work.
Hoardings	Hoardings will be used as a strategic communication tool to ensure the community and public are up to date with information regarding the construction and key marketing elements of the project (such as leasing enquiries). The relevant contact numbers (including the 24 hours Community Information Line) will be displayed on the hoarding at all times.

20.0 Contingency Planning

20.1 Approach

The purpose of the contingency plan is to outline procedures for the identification and management of unexpected issues or events that may occur during the works. The contingency plan will detail the following information:

- The assignment of responsibilities to nominated key personnel;
- The assessment of hazards associated with such situations, and the potential off-site impacts;
- Contingency responses; and
- Procedures for reporting relevant issues to regulatory authorities.

20.2 Potential Unexpected Events

Table 11 summarises the unexpected events which have the potential to occur during the excavation works, the likelihood of such an event occurring and the associated control measure which will mitigate such an event.

Table 11 Potential Unexpected Events and Related Control Measure

Potential Unexpected Event	Likelihood	Contingency Measure
Potential change in the development strategy	Medium	**Section 20.3**
Variation of contaminant characteristics or identification of unanticipated contaminants and materials	Low	**Section 20.4**
CIM/SPGWT is identified during the validation and/or excavation works	Low	**Section 20.5**
A portion of the existing Southern Cove embankment is removed	Low	**Section 20.6**
Treatment is required to facilitate offsite disposal	Low	**Section 20.6**
Failure of the preferred treatment approach to achieve a treatment standard required for off-site disposal of excavated material	Low	**Section 20.8**
Insufficient storage capacity to stockpile all required materials (*ex-situ* treatment works)	Low	**Section 20.9**
Operational issues during the remediation works including but not limited to: - Flooding of the Site; - Generation of unacceptable levels of dust during excavation and reinstatement works; - Release of unacceptable levels of fugitive emissions during the excavation works; - Generation of unacceptable odours from the excavation works; - Generation of unacceptable noise levels during site works; - Generation of unacceptable vibration levels during excavation and reinstatement works; and - Spills and leaks of hazardous materials.	 Low Medium Low Low Low Low Low	**Section 20.10**

Contingency mitigations for the above events are described in the following sections.

20.3 Changes to the Development Strategy

The development strategy for Barangaroo may develop during the course of the planning approval process associated with Barangaroo South. If changes resulting from this process affect the preferred remediation option identified by this RAP, the remediation strategy may require amendment.

Any change to the remediation strategy required may be based on consideration of:

- The requirement for, or changes to, development plans;
- Practical and commercial considerations; and

- Staging and sequencing of the remediation and development works in other Barangaroo site areas as part of the broader development works.

If required, an Addendum to this RAP would be issued to reflect any change to the management strategy. The Addendum would be issued to the NSW EPA Accredited Site Auditor for approval.

20.4 Variation of Contaminant Characteristics

The range of contaminants analysed in the previous investigations is considered to be appropriate for development of the soil SSTCs and assessment of whether CIM is present at the Site. However, there is the potential for occurrence of as-yet unidentified contaminants, and for variation in the concentrations or distribution of known contaminants.

Should any significant changes to the nature or types of contaminants be identified during the works a variation to this RAP, the *ORWN HHERA* (AECOM, 2014) and the soil SSTCs may be required. Variations will be issued to the NSW EPA Accredited Site Auditor for review and approval.

It is noted that the project team is familiar with potential site conditions based on its experience on areas adjacent to the Site, which at the time of this RAP included:

- Excavation and remediation of the Bond site (located on Hickson Road);
- Construction of the basement groundwater perimeter retention wall and a number of piled foundations within the adjacent ORWS Area (Stage 1A Basement);
- Bulk excavation of the Stage 1A Basement (which is complete); and
- Various preparatory and enabling works associated with the Stage 1A development. These have included intrusive works within the Site such as construction of stormwater diversions, establishment of a concrete batching plant and construction of a water treatment plant.

It is considered that any different materials encountered can be adequately addressed by AECOM and Lend Lease following assessment and refinement of any required remediation design.

20.5 Identification of SPGWT/CIM Requiring Remediation

As discussed in **Section 8.0**, SPGWT/CIM has not been identified by the available soil analytical results at the Site which would warrant remediation. However, there is a potential that SPGWT/CIM could be identified during the additional validation sampling of unsaturated soils as recommended by **Section 16.4.1**.

If SPGWT/CIM is identified during the above works it would be reported in the relevant Progressive Validation Report and appropriately managed in accordance with **Section 13.0** and **Section 17.0**.

20.5.1 Additional Validation Sampling

If SPGWT/CIM is identified as an outcome of the additional validation sampling that is considered to warrant remediation, the material would be selectively excavated and disposed off-site to landfill. If required to facilitate offsite disposal to landfill, the excavated material would be treated in accordance with **Section 20.6**. If CIM is identified as a result of the presence of asbestos containing material, the required excavation works would be managed in accordance with **Section 13.8**.

Selection of the preferred remediation approach for this material (i.e. offsite disposal to landfill) was based on the Remedial Technology Assessment presented in Section 10 of the *VMP/Block 4 RAP* (AECOM, 2013c). This is assessment is considered appropriate given the similar material, contaminant types and logistical constraints between the Site and the adjacent Block 4 Development Remediation Works. In particular, excavation and off-site disposal to a NSW EPA licensed landfill facility has been selected in consideration of: the limited opportunities for reuse of material within the development; the maximum potential depth of excavations required by the development (which will be limited to unsaturated soils only); and to be consistent with the works otherwise required as part of the proposed Lend Lease development works within Barangaroo South.

Remedial excavations that may be required to mitigate risks associated with SPGWT / CIM identified within the Area A unsaturated soils would be validated through the collection of soil samples to confirm that residual CoPC concentrations are less than the soil SSTC-A (including the asbestos SSTCs). In particular:

- Wall validation samples will be collected at 10 m lineal metre intervals along the extent of excavation walls in material identified to be the most impacted (either by visual observations of field screening of samples using a PID); and
- Base validation samples will be collected on a 10 m sampling grid across the excavation base.

20.6 Potential Disturbance of the Existing Southern Cove Embankment

As discussed in **Section 4.1**, the Lend Lease development plans for the proposed Watermans Cove do not involve the removal/disturbance of the historic Southern Cove embankment which is protected by a 1,200 mm thick rock armour layer on the upper surface.

If the proposed configuration of the proposed Watermans Cove is revised as part of the continued development design (refer to **Section 4.2** and **16.3.2**) such that removal of portions of the rock armour layer is required (such that the underlying fill materials are exposed), *soils within the base of the proposed potential Southern Cove from 0 to 0.5 m bgl will meet the Interim Sediment Quality Guidelines (ISQG) (High) Criteria*[4] (as recommended by the *ORWN HHERA* [AECOM, 2014]). Section 10.1 of the *ORWN HHERA* (AECOM, 2014) concluded that the ISQG (High) criteria *are considered to be suitably protective for recreational exposures for humans*.

To confirm the soils meet the ISQG (High) criteria, the following validation works will be conducted:

- The Validation SAQP will be prepared for review and endorsement by the NSW EPA Accredited Site Auditor (as required by **Section 16.2.1**) will be expanded to include these works;
- Soil samples will be collected across the affected area (i.e. where the rock armour is proposed to be removed) on a 10 m sampling grid;
- Soil samples will be collected at depths of 0-100 mm and 400-500mm at each of the sampling locations;
- All samples will be analysed for the CoPC listed in the ISQG (High) criteria including heavy metals, PAHs, OCPs, PCBs and tributyltin;
- The soil analytical results obtained from the affected area will be assessed to confirm whether the soils meet the ISQG (High) criteria or are considered to be representative of CIM. If CIM is identified by the validation sampling, additional delineation works may be required to appropriately characterise the vertical and horizontal extent of the impacts. If required, these delineation works would also be conducted in consultation with the NSW EPA Accredited Site Auditor;
- If required, remediation of the top 500mm of soil will be conducted and the remediated area backfilled with validated, suitable VENM (refer to **Section 15.0**). VENM required for potential reinstatement works will also need to be assessed to confirm that its geotechnical properties are suitable for the proposed waterway area (addressed separately to this RAP); and
- A Validation Report will be prepared to meet the requirements of **Section 16.8** of this RAP. The Validation Report will detail the results of the validation works, any remediation works conducted and conclude whether the soils are suitable for the proposed future landuse.

20.7 Treatment is Required to Facilitate Disposal to Landfill

Based on the current analytical data set, treatment of excavated materials is not expected to be required for the offsite disposal of material to a NSW EPA licensed landfill facility. However, it is possible that material (for example SPGWT/CIM as described by **Section 20.5**) will be encountered that requires treatment to facilitate offsite disposal to landfill.

If treatment works are required, Section 10 of the *VMP/Block 4 RAP* (AECOM, 2013c) ('Remediation Technology Assessment') will be referred to assist in the selection of the most appropriate remedial technology. This is considered appropriate given the similar material, contaminant types and logistical constraints anticipated at the Site and those identified in the Declaration Area.

The preferred approach for treatment of material to facilitate off-site disposal to landfill is ex situ stabilisation. If required, ex situ stabilisation will be undertaken as described by **Appendix D**.

[4] Australian and New Zealand Environment and Conservation Council (2000) Interim Sediment Quality (High) Guidelines.

Selection of the preferred remediation approach for treatment of material to facilitate landfill disposal is based on the Remedial Technology Assessment presented in Section 10 of the *VMP/Block 4 RAP* (AECOM, 2013c). This is assessment is considered appropriate given the similar material, contaminant types and logistical constraints between the Site and the adjacent Block 4 Development Remediation Works. In particular, Section 10.3.9 of the *VMP/Block 4 RAP* (AECOM, 2013c) concluded that the most appropriate remediation technology was excavation and ex situ stabilisation and offsite disposal to a NSW EPA licensed landfill facility. Depending on staging/sequencing, stabilisation works required at the Site may be undertaken utilising the infrastructure established for the Block 4 Development Remediation Works.

It is noted that stabilisation works will not address asbestos contamination. If asbestos is present, then the waste will be classified as Special Waste (asbestos containing) irrespective of the stabilisation process.

As discussed in **Section 16.4.2.1**, the NSW EPA General Immobilisation Approval # 2005/14 provides specific requirements for the stabilisation of coal tar contaminated soil for the purpose of disposal to an off-site NSW EPA licensed landfill facility. These requirements will include testing of the treated validation samples as per **Section 16.4.2.1**.

20.8 Failure of the Preferred Treatment Approach(es)

As discussed in **Section 20.6**, the preferred approach to treatment of material as required to facilitate disposal to landfill is ex-situ stabilisation. The preferred approach has been selected based on consideration of:

- the ability to obtain an Immobilisation Approval for the stabilisation of material requiring disposal to an off-site licensed landfill;
- consideration of treatment rates, stockpile and curing requirements, programing of the remediation works and commercial efficacy; and
- consistency with the treatment approach proposed in relation to the Block 4 Development Remediation Works (as described by the *VMP / Block 4 RAP* (AECOM, 2013c)).

Depending on timing, the validity of the preferred treatment approach as described by **Section 20.6** will be reviewed based on the outcomes of the Block 4 Development Remediation Works.

Should this treatment approach prove to be unsuccessful in stabilising materials in accordance with the NSW EPA (2014) *Waste Classification Guidelines*, consideration will be given to:

- refinement of the treatment approach including use of different quantities of additives or different additives; or
- Implementation of an alternative ex situ treatment approach.

20.9 Insufficient Storage Capacity for Stockpiles

The proposed remediation strategy is to minimise the requirement for on-site stockpiling by direct transfer of material for off-site disposal. Notwithstanding, variations in quantities or contaminant characteristics or the requirement for ex-situ treatment of material prior to landfill disposal (refer to **Section 20.6**) and associated delays in establishment of treatment infrastructure may result in the requirement for additional stockpiling.

If there is insufficient storage capacity for the stockpiling of material in designated areas within Barangaroo, the following options will be assessed:

- Consider collection of additional *in situ* samples to facilitate characterisation of material (where contaminant quantities or contaminant characteristics may be different from those expected) for off-site disposal before it is excavated;
- Explore options for temporary stockpiling of material outside of Barangaroo South; and
- Consider options for reuse of excavated materials at other sites outside of Barangaroo based on a NSW EPA approved Resource Recovery Exemption.

20.10 Operational Contingencies

20.10.1 Flooding of the Site

The EMP for the excavation works will be developed to control the impact of site works in order to minimise and mitigate against any impacts to off-site waters (Darling Harbour). As outlined in **Section 14.0**, the implementation and maintenance of a variety of environmental control measures will be undertaken during the project to manage water encountered during the works. Measures such as the installation of drains to divert clean water from up gradient areas to on-site stormwater drains, recycling of water and off-site water treatment will be conducted to manage and control water. Surface berms will also be constructed around the sub-surface top down excavation area to mitigate inflows into this area.

In extreme situations such as flooding or heavy rainfall, the discharge of treated water may be permitted to the sewer system in accordance with the conditions of a Sydney Water licence. All water intended for discharge will be stored on-site and tested prior to discharge to confirm compliance.

Records of all discharges will be kept describing the estimated volume of water discharged, the time period over which the discharge occurred, and the water quality results of water samples collected prior to discharge.

These control measures will be monitored during significant rainfall events to confirm their integrity and suitability.

20.10.2 Control of Dust

Should unacceptable levels of dust be detected during the excavation works, an investigation will be conducted to determine the source of the dust, and evaluate the appropriate measures to be implemented.

These measures may include the following:

- Increased use of a water cart or water sprays to suppress dust in open areas;
- Installation of temporary sheeting to cover localised exposed areas and stockpiles;
- Installation of dust screens around the sub-surface top down excavation area;
- Covering stockpiles of contaminated soil which will remain on the Site for more than 24 hours (where practical);
- Alteration of the works program to minimise the extent of disturbed open areas;
- Consolidation of material stockpiles;
- Use of chemical dust-suppressants provided the chemicals do not pose a contamination or OHS hazard;
- Use of alternative coverings such as hydro-mulch to stabilise the surface of open disturbed areas;
- Use of additional dust suppression features on items of dust generating plant and equipment;
- Securely covering all loads entering or exiting the Site; and
- Use of alternate work practices such as modified equipment to minimise dust generation.

20.10.3 Fugitive Emissions and Odours

Should unacceptable levels of fugitive emissions be detected at the Site boundaries or in the surrounding area during the project, an investigation will be conducted to determine the source of the emissions, and to evaluate the appropriate measures to be implemented.

These measures may include the following:

- Alteration in the works program to minimise in the extent of disturbed open areas;
- Prompt removal and treatment of heavily contaminated materials that have been exposed and are identified to have caused the emissions;
- Use of fine mist sprays around the excavation area;
- Conducting the work in more favourable weather conditions;
- Use of alternate work practices to minimise the period of impact of the emissions;
- Use of additional features to control emissions from plant and equipment;

- Use of alternate work practices such as using modified equipment;
- Relocation of offending plant and equipment to less sensitive on-site areas;
- Reducing the number of plant and equipment items on-site; and
- Use of a deodorant within water sprays at locations on-site and at Site boundaries provided the chemicals do not pose a contamination or OHS hazard.

20.10.4 Noise and Vibration

Should unacceptable noise and/or vibration levels be detected during the excavation works the following measures may be implemented:

- Modify the works program to minimise the impact of noisy or vibratory operations, including:
  - Modify the timing of the works to appropriate times of the day; and
  - Accelerate the works program to complete the works quickly and minimise the period of disturbance;
- Install additional noise suppression features on plant and equipment;
- Construct additional noise attenuation measures such as stockpile barriers, works area enclosures; and
- Use of different items of plant and equipment that generate less noise or vibration.

20.10.5 Spills and Leaks

A spill response plan will be developed and implemented as part of the Emergency Response Plan (ERP) detailing the procedures for responding to spills and leaks (refer to **Section 20.10.6**). The procedures outlined in the plan will be aimed at minimising the impact of any contaminant releases that may occur during the works.

The following actions will be taken in preparation for spills or leaks:

- Training of site personnel in appropriate spill response techniques;
- Allocation of spill response materials and equipment on-site (such as oil absorbent pads, booms and bio-dispersants);
- Containment of all storage tanks and drums inside bunded areas with a capacity of 110% of the largest container, or 25% of the total volume of all containers, whichever is greater;
- Initial assessment of the spill;
- Notification of the appropriate authorities if necessary;
- Following a spill or leak, an investigation to determine the root cause of the incident will be undertaken; and
- Corrective and preventative actions implemented to prevent future incidents.

20.10.6 Emergency Response Plan

An ERP will be prepared prior to the commencement of the excavation works. The plan will outline the process for identifying possible emergency situations and detailing the procedures necessary to ensure the safety of both on-site and off-site personnel in the event of an emergency.

The plan should include the following general information:

- Assignment of responsibilities to nominated key personnel;
- Assessment of the potential on and off-site impacts of hazards;
- Emergency reporting procedures including on-site reporting and reporting to the appropriate authorities;
- Emergency response procedures including, but not limited to, the following:
  - On-site fires or explosions;
  - Chemical spills;
  - Rupture of buried services;
  - Hazardous gas releases and emissions;

- Confined spaces situations;
- Traffic accidents both involving the transportation of "Dangerous Goods";
- First aid for injured personnel;
- Evacuation of on-site personnel; and
- Managing unknown/uncertain situations.

Incident investigation procedures to determine the root cause of the incident, and to identify the appropriate corrective and preventative actions to prevent future incidents.

21.0 Key Personnel

The contractual framework of delivery of the excavation works has not yet been determined by Lend Lease. Potential contractual structures include:

- Turn key deliver of the excavation works by a civil contractor;
- Supervision of the excavation works by a superintendent and validation team engaged separately for the civil contractor; and
- A variation on the above.

Notwithstanding the contractual framework initially adopted by Lend Lease, the key roles and responsibilities associated with the excavation works are as discussed following. Depending on the contract structure the various roles and responsibilities may be discharged by one or more entities.

21.1 Project Director

The Project Director is responsible for ensuring that the excavation works undertaken on-site are in accordance with this RAP, RWP, EMP, the OHSP and other relevant documentation, and that the objectives stated within the RAP are ultimately met. The Project Director will generally also be responsible for ensuring that the project occurs within the timeframe nominated and within the financial budget allocated, and is completed safely. The Project Director assumes ultimate responsibility for the project.

21.2 Project Manager

The Project Manager is responsible for daily operations and directs the site operations to ensure effective planning, verification, documentation and management of operational and environmental and safety issues in accordance with this RAP. This includes maintaining a liaison with regulatory authorities to ensure that the necessary work is undertaken to satisfy the NSW EPA and NSW EPA Accredited Site Auditor that the excavation works achieves the objectives of this RAP.

The Project Manager is responsible for the implementation of all Project Plans including the RAP, RWP, EMP, OHSP Plan, Quality Plan and other relevant contractual documents associated with the excavation works. This includes responsibility for:

- any design that may be required during the work;
- implementation and scheduling of the excavation works in accordance with the abovementioned documents; and
- ensuring compliance with relevant legislation and regulations.

The Project Manager is also responsible for ensuring that human health and the environment are protected at all times, including the provision of training and site inductions to all appropriate subcontractors and workers.

The Project Manager will be a primary community contact and the first point of contact for sub-contractor issues.

21.3 Validation Team

A suitably qualified consultant will undertake the supervision and validation of the excavation works under the direction of a Validation Project Director (VPD). The VPD is responsible for ensuring that all required validation systems are fully functional, and that staff are trained in the requirements of the validation requirements as detailed in **Section 16.0** of this RAP.

Daily validation management will be from an on-site project office. A site-based administrative system will be established to ensure that the project is fully documented. A daily fieldwork summary will be prepared and filed. All job-related incoming and outgoing communications will be logged in a register.

Decisions related to validation will be made in accordance with relevant guidelines endorsed by the NSW EPA and NSW EPA Accredited Site Auditor. Copies of relevant guidelines will be kept in the Site office. All fieldwork will be undertaken by qualified environmental engineer(s)/scientist(s) with experience working on contaminated sites.

A member of the Consultant's field team will be the Site Validation Manager (SVM) responsible for making all validation decisions and directing all routine site fieldwork. Prior to commencement of the project, the SVM will prepare a project manual containing all required procedures and forms. The manual will be updated, in conformance with the VP, on an as needed basis. It is the responsibility of the SVM to ensure that the validation requirements detailed in **Section 16.0** are followed.

Site meetings will be convened, as required, to discuss fieldwork procedures. At least one meeting per week will be held with the SVM and the Project Manager to plan work for the following week and to resolve outstanding issues.

Where, because of an unforseen circumstance, the SVM considers that a departure from the validation requirements is required, this must be discussed with the VPD and NSW EPA Accredited Site Auditor before any other related action is taken. If the departure is approved it will be documented in site files. If urgent action is required, the VPD will be responsible for deciding the particular issue. The NSW EPA Accredited Site Auditor will be sent written confirmation as soon as practicable, but in any case within 5 working days of the reasons for making the changes to the validation procedures detailed in **Section 16.0** and feedback and endorsement of the changes will be requested in writing from the NSW EPA Accredited Site Auditor.

21.4 Site Foreman

The Site Foreman implements day-to-day operations as directed by the Project Manager.

21.5 Safety/Quality Officer and Environment

The Safety / Quality Officer is responsible for implementation of the quality and safety management systems. This person assists the Project Manager with day-to-day tasks that arise, reports activities undertaken, directs the subcontractors, maintains accurate records of works such as safety checklists, and maintains a photographic record of works undertaken. This will include review and update of the OH&S Plan and EMP plus health and safety manuals, rules and procedures.

The Safety / Quality Officer ensures personnel and visitors to the site are inducted and has responsibility for emergency response and training in accordance with the Emergency Plan. The Safety / Quality Officer has the authority and independence to require reasonable steps to be taken to avoid or minimise unintended or adverse work safety impacts, and can direct relevant actions to be ceased should any adverse impact on worker safety be likely to occur.

The Safety / Quality Officer ensures all H&S monitoring devices are operating in accordance with the RAP, EMP and OHSP and also keeps the incident and accident register up to date with notification given to Work Cover NSW as necessary.

The Safety / Quality Officer will provide advice and recommendations, when appropriate, with regards to:

- legal requirements;
- changes in legislation;
- dealings with Work Cover New South Wales;
- prevention of injury or damage;
- accident and injury investigations and reports;
- work methods, equipment, or materials which could reduce risk; and
- selection, suitability and application of safety equipment.

The Safety/Quality Officer will be responsible for holding regular 'toolbox' safety meetings with all site personnel and will ensure meeting minutes are appropriately documented.

21.6 Subcontractors

All work, irrespective of whom it is completed by will be undertaken, as specified by the Project Manager, and per the requirements stated within this RAP and the RWP, EMP, OHSP and relevant management plans.

Subcontractors will be advised of required work procedures through induction, training, and meetings provided by the Contractor. Maintenance of subcontractor equipment will be the responsibility of the subcontractors.

The Subcontractor is responsible for ensuring that all works executed by the subcontractor complies with relevant WorkCover NSW as necessary.

22.0 Conclusion

The key remediation objective for the Site is to facilitate the future retail, Public Domain and publicly accessible waterway land-uses proposed for the Site. Specific objectives of the remediation works are:

- To ensure the remediated site is protective of human health in the context of the proposed Public Domain land-uses;
- To ensure the remediated site is protective of the environment (specifically groundwater and the adjacent Darling Harbour), to the extent practicable, by minimising the risk of ongoing contamination; and
- Comply with applicable legislative and policy requirements including the appropriate requirements of the NSW EPA and NSW Department of Planning and Environment (DoPE).

Confirmed Impacted Material (CIM, soil or groundwater) has not been identified within the Site based on the previous intrusive investigations undertaken within the Site. However, it should be noted that additional validation works are required in Area A (Southern Public Domain Area) to appropriately characterise the unsaturated soils and to further assess the potential presence of CIM which may warrant remediation.

As recommended by the *ORWN HHERA* (AECOM, 2014), comparison of the Area A saturated soils results (at the Site and in adjacent areas) to the ANZECC (2000) ISQG-High was also undertaken to confirm the suitability of materials within the proposed Watermans Cove. The soil results (including CoPC heavy metals and PAH compounds) were generally less than the ANZECC (2000) ISQG-High and therefore are not likely to impact on future benthic organisms in the proposed Watermans Cove. Consequently, remediation of the materials within the proposed Watermans Cove is not considered to be required on the basis that the 1200 mm thick rock armour on the historic Southern Cove embankment remains intact (as is proposed).

Based on the available information, the preferred remediation strategy recommended for the proposed Site development works is:

- Additional validation sampling to confirm whether remediation of identified CIM/SPGWT (unsaturated soils) proposed to remain in situ is warranted;
- If required, remediation of identified CIM/SPGWT and validation of the remediated areas;
- Excavation as required for the installation of underground services, landscaped areas for trees, etc and disposal of excavated material to a NSW EPA licensed landfill (including treatment if required); and
- Placement of Suitable Fill as required to protect human health and to achieve proposed finished Site levels.

This RAP has generally been prepared to meet the requirements of the SEPP 55 (Remediation of Land) (DUAP and NSW EPA, 1998) and the *CLM Act* (NSW Govt, 1997a).

It is concluded that:

- Based on the VMP Remediation Works being completed as described by the *VMP/Block 4 RAP* (AECOM, 2013c), any residual gasworks contamination that might remain *in situ* within the Site will not represent an unacceptable risk to the environment; and
- The preferred remediation strategy described by this RAP will, upon successful implementation as evidenced by the prescribed validation program, ensure that the Site is suitable for the proposed land uses, specifically a mixed use comprising retail, public open space and the creation of a publicly accessible waterway connected to Darling Harbour or any combination of the above.

23.0 References

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Appendix A

Summary Analytical Tables

Appendix A Summary Analytical Tables

Table T1: Soil Remediation Criteria

Table T2: Groundwater Remediation Criteria

Table T3: Area A Soil Analytical Results - Unsaturated

Table T4: Area A Soil Analytical Results – Saturated

Table T5: Area A Asbestos Analytical Results – Saturated

Table T6: Groundwater Analytical Results

Table T7: Summary of Field Observations of Gasworks Related Impacts

Table T8: Terrestrial Soil Criteria

Table T9: Marine Water Quality Criteria

	SOIL REMEDIATION CRITERIA			
	Soil SSTC-A		Soil SSTC-B	
Chemicals of Potential Concern		**Land Use Scenario**		**Land Use Scenario**
Relevant Land Use Scenarios	**mg/kg**	**Area A - unsaturated soil**	**mg/kg**	**Area B (if required)**
Benzene	380	Scenario 3	380	Scenario 3
Cresols (Total)	61,000	Scenario 3	61,000	Scenario 3
Dimethylphenol, 2,4-	36,000	Scenario 6	36,000	Scenario 6
Naphthalene	320	Scenario 5	320	Scenario 5
Lead	11,000	Scenario 6	11,000	Scenario 6
TRH C_6-C_{10}	NL	All Scenarios	NL	All Scenarios
TRH C_{10}-C_{16}	19,000	Scenario 6	19,000	Scenario 6
TRH C_{16}-C_{34}	NL	All Scenarios	NL	All Scenarios
TRH C_{34}-C_{40}	NL	All Scenarios	NL	All Scenarios
Trimethylbenzene, 1,2,4-	370	Scenario 3	370	Scenario 3
CPAH**	130	Scenario 6	130	Scenario 6
Asbestos [1]	0.05% w/w	Scenario 6	0.05% w/w	Scenario 6

Notes:
All soil criteria in mg/kg
SSTC - Site Specific Target Criteria
TPH - Total Petroleum Hydrocarbons
CPAH= Sum of 8 carcinogenic PAH Compounds (Benz(a)anthracene Benzo(a) pyrene; Benzo(b)fluoranthene; Benzo(g,h,i)perylene; Benzo(k)fluoranthene; Chrysene; Dibenz(a,h)anthracene; Indeno(1,2,3-c,d)pyrene)

[1] Asbestos analysis to be conducted as per Schedule B2 of the NEPM (NEPC, 1999, as amended 2013)

Land Use Scenarios:
Scenario 2: Upper Basement
Scenario 3: Unpaved Recreation
Scenario 4 - Paved Recreation
Scenario 5 - Commercial Slab on Ground
Scenario 6 - Intrusive Maintenance Worker
Scenario 7 - High Density Residential

	GROUNDWATER REMEDIATION CRITERIA	
		Groundwater SSTC-A
Chemicals of Potential Concern		**Land Use Scenario**
Relevant Land Use Scenarios	**mg/L**	**Area A**
Acenaphthylene	33	Scenario 6
Acenaphthene	35	Scenario 6
Ammonia	150	Scenario 6
Aniline	680	Scenario 6
Arsenic	140	Scenario 6
Barium	830	Scenario 6
Benzene	7.0	Scenario 6
Cadmium	110	Scenario 6
Cobalt	250	Scenario 6
Cresols (Total)	2.7	Scenario 6
Dimethylphenol, 2,4-	430	Scenario 6
Ethylbenzene	100	Scenario 6
Lead and compounds	630	Scenario 6
Manganese	27,000	Scenario 6
Methylnaphthalene, 2-	22	Scenario 6
Naphthalene	1.3	Scenario 6
Nickel	1,300	Scenario 6
Phenol	340	Scenario 6
Styrene	47	Scenario 6
Toluene	370	Scenario 6
TPH C_6-C_{10}	170	Scenario 5
TPH >C_{10}-C_{16}	12	Scenario 6
TPH >C_{16}-C_{34}	130	Scenario 6
TPH >C_{34}-C_{40}	853,000	Scenario 6
Trimethylbenzene, 1,2,4-	16.0	Scenario 6
Trimethylbenzene, 1,3,5-	26	Scenario 6

Notes:
All groundwater criteria in mg/L
SSTC - Site Specific Target Criteria
TPH - Total Petroleum Hydrocarbons
CPAH= Sum of 8 carcinogenic PAH Compounds (Benz(a)anthracene Benzo(a) pyrene; Benzo(b)fluoranthene; Benzo(g,h,i)perylene; Benzo(k)fluoranthene; Chrysene; Dibenz(a,h)anthracene; Indeno(1,2,3-c,d)pyrene)

= an SSTC has not been determined for remediation purposes as the derived level is at least 10 times greater than saturation/ solubility limits

Land Use Scenarios:
Scenario 5: Commercial Slab on Ground
Scenario 6: Intrusive Maintenance Worker

Field_ID	BH01_0.3-0.4	BH01_1.0-1.2	QC01	QC02	BH035_ 0.3-0.5	BH035_ 1.5-1.95	D1805-1	BH047_0.3-0.5	BH047_1.5-1.95	BH049_0.3-0.5	BH116 1.5_1.95	BH116 1.5_1.95	BH37_0.06-0.1
Lab_Report_Number	ES0918573	ES1001619	ES0918573	45989	ES0606393	ES0606393	ES0606393	ES0606484	ES0606484	ES0606484	ES0607931	ES0608109	ES1003391
Location_Code	AECOM_BH01	AECOM_BH01	AECOM_BH01	AECOM_BH01	BH035	BH035	BH035	BH047	BH047	BH049	BH116	BH116	AECOM_BH37
Sample_Depth_Range	0.3-0.4	1-1.2	1-1.2	1-1.2	0.3-0.5	1.5-1.95	1.5-1.95	0.3-0.5	1.5-1.95	0.3-0.5	1.5-1.95	1.5-1.95	0.06-0.1
Sampled_Date_Time	12/02/2009	12/02/2009	12/02/2009	12/02/2009	18/05/2006	18/05/2006	18/05/2006	24/05/2006	24/05/2006	25/05/2006	28/06/2006	27/06/2006	17/02/2010
Sample_Type	Normal	Normal	Field_D	Interlab_D	Normal	Normal	Field_D	Normal	Normal	Normal	Normal	Normal	Normal

Chem_Group	ChemName	output unit	EQL	SSTC-A & B													
	CPAH (ESDAT)	mg/kg		130	-	-	<4	<3	-	-	-	-	-	-	-	0.7	-
	Pronamide	mg/kg	0.5		-	-	-	-	-	-	-	-	-	-	-	-	-
PAHs	CPAH (TEF)	mg/kg			-	-	<1.21	<1.11	-	-	-	-	-	-	-	0.07	-
	PAH (ESDAT TOTAL)	mg/kg			-	-	<8	-	-	-	-	-	-	-	-	2.5	-
	PAH (total, NSW Waste 2008)	mg/kg			-	-	<8	<7	-	-	-	-	-	-	-	2.5	-
	Sum of 10 PAHs	mg/kg			-	-	<5	<4	-	-	-	-	-	-	-	2.5	-
	Sum of 5 PAHs	mg/kg			-	-	<3	<3	-	-	-	-	-	-	-	<3	-
	2-chloronaphthalene	mg/kg	0.5		-	-	-	-	-	-	-	-	-	-	-	-	-
	2-methylnaphthalene	mg/kg	0.5		-	-	-	-	-	-	-	-	-	-	-	-	-
	3-methylcholanthrene	mg/kg	0.5		-	-	-	-	-	-	-	-	-	-	-	-	-
	Acenaphthene	mg/kg	0.5		-	-	<0.5	<0.5	-	-	-	-	-	-	-	<0.5	-
	Acenaphthylene	mg/kg	0.5		-	-	<0.5	<0.5	-	-	-	-	-	-	-	<0.5	-
	Acetophenone	mg/kg	0.5		-	-	-	-	-	-	-	-	-	-	-	-	-
	Anthracene	mg/kg	0.5		-	-	<0.5	<0.5	-	-	-	-	-	-	-	<0.5	-
	Benz(a)anthracene	mg/kg	0.5		-	-	<0.5	<0.5	-	-	-	-	-	-	-	<0.5	-
	Benzo(a) pyrene	mg/kg	0.5		-	-	<0.5	<0.5	-	-	-	-	-	-	-	<0.5	-
	Benzo(b)&(k)fluoranthene	mg/kg	1		-	-	-	<1	-	-	-	-	-	-	-	-	-
	Benzo(b)fluoranthene	mg/kg	0.5		-	-	<0.5	-	-	-	-	-	-	-	-	0.7	-
	Benzo(g,h,i)perylene	mg/kg	0.5		-	-	<0.5	<0.5	-	-	-	-	-	-	-	<0.5	-
	Benzo(k)fluoranthene	mg/kg	0.5		-	-	<0.5	-	-	-	-	-	-	-	-	<0.5	-
	Chrysene	mg/kg	0.5		-	-	<0.5	<0.5	-	-	-	-	-	-	-	<0.5	-
	Dibenz(a,h)anthracene	mg/kg	0.5		-	-	<0.5	<0.5	-	-	-	-	-	-	-	<0.5	-
	Fluoranthene	mg/kg	0.5		-	-	<0.5	<0.5	-	-	-	-	-	-	-	0.9	-
	Fluorene	mg/kg	0.5		-	-	<0.5	<0.5	-	-	-	-	-	-	-	<0.5	-
	Indeno(1,2,3-c,d)pyrene	mg/kg	0.5		-	-	<0.5	<0.5	-	-	-	-	-	-	-	<0.5	-
	Naphthalene	mg/kg	0.5	320	-	-	<0.5	<0.5	-	-	-	-	-	-	-	<0.5	-
	PAHs (Sum of total)	mg/kg			-	-	-	0	-	-	-	-	-	-	-	-	-
	Phenanthrene	mg/kg	0.5		-	-	<0.5	<0.5	-	-	-	-	-	-	-	<0.5	-
	Pyrene	mg/kg	0.5		-	-	<0.5	<0.5	-	-	-	-	-	-	-	0.9	-
Phenols	2,4-dimethylphenol	mg/kg	0.5	36,000	-	-	-	-	-	-	-	-	-	-	-	<0.5	-
	3-&4-methylphenol	mg/kg	0.5		-	-	-	-	-	-	-	-	-	-	-	<1	-
	2-methylphenol	mg/kg	0.5		-	-	-	-	-	-	-	-	-	-	-	<0.5	-
	Total Cresols	mg/kg	0.5	61,000	-	-	-	-	-	-	-	-	-	-	-	<0.5	-
	2-nitrophenol	mg/kg	0.5		-	-	-	-	-	-	-	-	-	-	-	<0.5	-
	4-chloro-3-methylphenol	mg/kg	0.5		-	-	-	-	-	-	-	-	-	-	-	<0.5	-
	Phenol	mg/kg	0.5		-	-	-	-	-	-	-	-	-	-	-	<0.5	-
	Phenolics Total	mg/kg			-	-	-	-	-	-	-	-	-	-	-	-	-
TPH	TPH C15-C36	mg/kg			-	-	<200	<200	<200	-	<200	<200	<200	-	<200	-	-
	TPH C10 - C14	mg/kg	50	19,000	-	-	<50	<50	<50	-	<50	<50	<50	-	<50	-	-
	TPH C15-C28	mg/kg	100		-	-	<100	<100	<100	-	<100	<100	<100	-	<100	-	-
	TPH C29-C36	mg/kg	100		-	-	<100	<100	<100	-	<100	<100	<100	-	<100	-	-
	TPH C6 - C9	mg/kg	2		-	-	<10	<10	<2	-	<2	<2	<2	-	<2	-	-
	TPH+C10 - C36 (Sum of total)	mg/kg	50		-	-	<50	<250 - 0	<250	-	<250	<250	<250	-	<250	-	-
BTEX	Total Xylene (ESDAT)	mg/kg			-	-	<1	<1.5 - 0	<0.4	-	<0.4	<0.4	<0.4	-	<0.4	-	-
	Benzene	mg/kg	0.2	380	-	-	<0.2	<0.2	<0.2	-	<0.2	<0.2	<0.2	-	<0.2	-	-
	Ethylbenzene	mg/kg	0.2		-	-	<0.5	<0.5	<0.2	-	<0.2	<0.2	<0.2	-	<0.2	-	-
	Toluene	mg/kg	0.2		-	-	<0.5	<0.5	<0.2	-	<0.2	<0.2	<0.2	-	<0.2	-	-
	Xylene (m & p)	mg/kg	0.2		-	-	<0.5	<1	<0.2	-	<0.2	<0.2	<0.2	-	<0.2	-	-
	Xylene (o)	mg/kg	0.2		-	-	<0.5	<0.5	<0.2	-	<0.2	<0.2	<0.2	-	<0.2	-	-
Cyanides	Cyanide (WAD)	mg/kg	1		-	-	-	-	-	-	-	-	-	-	-	-	-
Herbicides	Diallate	mg/kg	0.5		-	-	-	-	-	-	-	-	-	-	-	-	-
Metals	Arsenic	mg/kg	1		<5	<5	<5	<1	<5	<5	<5	6	<5	<5	<5	-	<5
	Barium	mg/kg	5		20	40	30	15	-	-	-	-	-	-	-	-	20
	Beryllium	mg/kg	1		1	<1	<1	<1	-	-	-	-	-	-	-	-	<1
	Cadmium	mg/kg	0.1		<1	<1	<1	<0.1	<1	<1	<1	<1	<1	<1	<1	-	<1
	Chromium	mg/kg	1		2	7	6	6	2	11	12	7	10	3	9	-	2
	Chromium (hexavalent)	mg/kg	0.5		-	-	-	-	-	-	-	-	-	-	-	-	-
	Cobalt	mg/kg	1		12	3	2	1	-	-	-	-	-	-	-	-	12
	Copper	mg/kg	2		331	17	11	6	212	9	19	127	15	262	30	-	225
	Iron	mg/kg	10		-	-	-	-	-	-	-	-	-	-	-	-	-
	Lead	mg/kg	2	11,000	6	19	14	11	7	20	27	15	23	6	23	-	6
	Manganese	mg/kg	5		725	152	105	78	-	-	-	-	-	-	-	-	768
	Mercury	mg/kg	0.05		<0.1	-	<0.1	<0.05	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1
	Nickel	mg/kg	1		6	4	2	2	6	5	5	8	7	6	4	-	7
	Vanadium	mg/kg	5		106	16	16	11	-	-	-	-	-	-	-	-	125
	Zinc	mg/kg	5		46	38	26	16	48	31	38	53	47	54	38	-	47

Field_ID	BH01_0.3-0.4	BH01_1.0-1.2	QC01	QC02	BH035_ 0.3-0.5	BH035_ 1.5-1.95	D1805-1	BH047_0.3-0.5	BH047_1.5-1.95	BH049_0.3-0.5	BH116 1.5_1.95	BH116 1.5_1.95	BH37_0.06-0.1
Lab_Report_Number	ES0918573	ES1001619	ES0918573	45989	ES0606393	ES0606393	ES0606393	ES0606484	ES0606484	ES0606484	ES0607931	ES0608109	ES1003391
Location_Code	AECOM_BH01	AECOM_BH01	AECOM_BH01	AECOM_BH01	BH035	BH035	BH035	BH047	BH047	BH049	BH116	BH116	AECOM_BH37
Sample_Depth_Range	0.3-0.4	1-1.2	1-1.2	1-1.2	0.3-0.5	1.5-1.95	1.5-1.95	0.3-0.5	1.5-1.95	0.3-0.5	1.5-1.95	1.5-1.95	0.06-0.1
Sampled_Date_Time	12/02/2009	12/02/2009	12/02/2009	12/02/2009	18/05/2006	18/05/2006	18/05/2006	24/05/2006	24/05/2006	25/05/2006	28/06/2006	27/06/2006	17/02/2010
Sample_Type	Normal	Normal	Field_D	Interlab_D	Normal	Normal	Field_D	Normal	Normal	Normal	Normal	Normal	Normal

Chem_Group	ChemName	output unit	EQL	SSTC-A & B													
Organochlorine Pes	4,4-DDE	mg/kg	0.05		-	-	-	-	-	-	-	-	-	-	-	<0.05	-
	a-BHC	mg/kg	0.05		-	-	-	-	-	-	-	-	-	-	-	<0.05	-
	Aldrin	mg/kg	0.05		-	-	-	-	-	-	-	-	-	-	-	<0.05	-
	Aldrin + Dieldrin	mg/kg			-	-	-	-	-	-	-	-	-	-	-	<0.1	-
	b-BHC	mg/kg	0.05		-	-	-	-	-	-	-	-	-	-	-	<0.05	-
	cis-Chlordane	mg/kg	0.05		-	-	-	-	-	-	-	-	-	-	-	<0.05	-
	d-BHC	mg/kg	0.05		-	-	-	-	-	-	-	-	-	-	-	<0.05	-
	DDD	mg/kg	0.05		-	-	-	-	-	-	-	-	-	-	-	<0.05	-
	DDT	mg/kg	0.2		-	-	-	-	-	-	-	-	-	-	-	<0.2	-
	DDT+DDE+DDD	mg/kg			-	-	-	-	-	-	-	-	-	-	-	<0.3	-
	Dieldrin	mg/kg	0.05		-	-	-	-	-	-	-	-	-	-	-	<0.05	-
	Endosulfan I	mg/kg	0.05		-	-	-	-	-	-	-	-	-	-	-	<0.05	-
	Endosulfan II	mg/kg	0.05		-	-	-	-	-	-	-	-	-	-	-	<0.05	-
	Endosulfan sulphate	mg/kg	0.05		-	-	-	-	-	-	-	-	-	-	-	<0.05	-
	Endrin	mg/kg	0.05		-	-	-	-	-	-	-	-	-	-	-	<0.05	-
	Endrin aldehyde	mg/kg	0.05		-	-	-	-	-	-	-	-	-	-	-	<0.05	-
	Endrin ketone	mg/kg	0.05		-	-	-	-	-	-	-	-	-	-	-	<0.05	-
	g-BHC (Lindane)	mg/kg	0.05		-	-	-	-	-	-	-	-	-	-	-	<0.05	-
	Heptachlor	mg/kg	0.05		-	-	-	-	-	-	-	-	-	-	-	<0.05	-
	Heptachlor epoxide	mg/kg	0.05		-	-	-	-	-	-	-	-	-	-	-	<0.05	-
	Hexachlorobenzene	mg/kg	0.05		-	-	-	-	-	-	-	-	-	-	-	<0.05	-
	Methoxychlor	mg/kg	0.2		-	-	-	-	-	-	-	-	-	-	-	<0.2	-
	trans-chlordane	mg/kg	0.05		-	-	-	-	-	-	-	-	-	-	-	<0.05	-
Organophosphorous	Azinophos methyl	mg/kg	0.05		-	-	-	-	-	-	-	-	-	-	-	<0.05	-
	Bromophos-ethyl	mg/kg	0.05		-	-	-	-	-	-	-	-	-	-	-	<0.05	-
	Carbophenothion	mg/kg	0.05		-	-	-	-	-	-	-	-	-	-	-	<0.05	-
	Chlorfenvinphos	mg/kg	0.05		-	-	-	-	-	-	-	-	-	-	-	<0.05	-
	Chlorpyrifos	mg/kg	0.05		-	-	-	-	-	-	-	-	-	-	-	<0.05	-
	Chlorpyrifos-methyl	mg/kg	0.05		-	-	-	-	-	-	-	-	-	-	-	<0.05	-
	cis-Isosafrole	mg/kg	0.5		-	-	-	-	-	-	-	-	-	-	-	-	-
	Diazinon	mg/kg	0.05		-	-	-	-	-	-	-	-	-	-	-	<0.05	-
	Dichlorvos	mg/kg	0.05		-	-	-	-	-	-	-	-	-	-	-	<0.05	-
	Dimethoate	mg/kg	0.05		-	-	-	-	-	-	-	-	-	-	-	<0.05	-
	Ethion	mg/kg	0.05		-	-	-	-	-	-	-	-	-	-	-	<0.05	-
	Ethyl methanesulfonate	mg/kg	0.5		-	-	-	-	-	-	-	-	-	-	-	-	-
	Fenthion	mg/kg	0.05		-	-	-	-	-	-	-	-	-	-	-	<0.05	-
	Malathion	mg/kg	0.05		-	-	-	-	-	-	-	-	-	-	-	<0.05	-
	Methyl methanesulfonate	mg/kg	0.5		-	-	-	-	-	-	-	-	-	-	-	-	-
	Methyl parathion	mg/kg	0.2		-	-	-	-	-	-	-	-	-	-	-	<0.2	-
	Monocrotophos	mg/kg	0.2		-	-	-	-	-	-	-	-	-	-	-	<0.2	-
	Pirimphos-ethyl	mg/kg	0.05		-	-	-	-	-	-	-	-	-	-	-	<0.05	-
	Prothiofos	mg/kg	0.05		-	-	-	-	-	-	-	-	-	-	-	<0.05	-
	Safrole	mg/kg	0.5		-	-	-	-	-	-	-	-	-	-	-	-	-
	trans-Isosafrole	mg/kg	0.5		-	-	-	-	-	-	-	-	-	-	-	-	-
Pesticides	Pesticides (total, NSW Waste 2008)	mg/kg			-	-	-	-	-	-	-	-	-	-	-	<1	-
	Demeton-S-methyl	mg/kg	0.05		-	-	-	-	-	-	-	-	-	-	-	<0.05	-
	Fenamiphos	mg/kg	0.05		-	-	-	-	-	-	-	-	-	-	-	<0.05	-
	Parathion	mg/kg	0.2		-	-	-	-	-	-	-	-	-	-	-	<0.2	-
VOCs	1,1,1,2-tetrachloroethane	mg/kg	0.5		-	-	-	-	-	-	-	-	-	-	-	-	-
	1,1,1-trichloroethane	mg/kg	0.5		-	-	-	-	-	-	-	-	-	-	-	-	-
	1,1,2,2-tetrachloroethane	mg/kg	0.5		-	-	-	-	-	-	-	-	-	-	-	-	-
	1,1,2-trichloroethane	mg/kg	0.5		-	-	-	-	-	-	-	-	-	-	-	-	-
	1,1-dichloroethane	mg/kg	0.5		-	-	-	-	-	-	-	-	-	-	-	-	-
	1,1-dichloroethene	mg/kg	0.5		-	-	-	-	-	-	-	-	-	-	-	-	-
	1,1-dichloropropene	mg/kg	0.5		-	-	-	-	-	-	-	-	-	-	-	-	-
	1,2,3-trichlorobenzene	mg/kg	0.5		-	-	-	-	-	-	-	-	-	-	-	-	-
	1,2,3-trichloropropane	mg/kg	0.5		-	-	-	-	-	-	-	-	-	-	-	-	-
	1,2,4-trichlorobenzene	mg/kg	0.5		-	-	-	-	-	-	-	-	-	-	-	-	-
	1,2,4-trimethylbenzene	mg/kg	0.5	370	-	-	-	-	-	-	-	-	-	-	-	-	-
	1,2-dibromo-3-chloropropane	mg/kg	0.5		-	-	-	-	-	-	-	-	-	-	-	-	-
	1,2-dibromoethane	mg/kg	0.5		-	-	-	-	-	-	-	-	-	-	-	-	-
	1,2-dichlorobenzene	mg/kg	0.5		-	-	-	-	-	-	-	-	-	-	-	-	-
	1,2-dichloroethane	mg/kg	0.5		-	-	-	-	-	-	-	-	-	-	-	-	-
	1,2-dichloropropane	mg/kg	0.5		-	-	-	-	-	-	-	-	-	-	-	-	-
	1,3,5-trimethylbenzene	mg/kg	0.5		-	-	-	-	-	-	-	-	-	-	-	-	-
	1,3-dichlorobenzene	mg/kg	0.5		-	-	-	-	-	-	-	-	-	-	-	-	-

Field_ID	BH01_0.3-0.4	BH01_1.0-1.2	QC01	QC02	BH035_ 0.3-0.5	BH035_ 1.5-1.95	D1805-1	BH047_0.3-0.5	BH047_1.5-1.95	BH049_0.3-0.5	BH116 1.5_1.95	BH116 1.5_1.95	BH37_0.06-0.1
Lab_Report_Number	ES0918573	ES1001619	ES0918573	45989	ES0606393	ES0606393	ES0606393	ES0606484	ES0606484	ES0606484	ES0607931	ES0608109	ES1003391
Location_Code	AECOM_BH01	AECOM_BH01	AECOM_BH01	AECOM_BH01	BH035	BH035	BH035	BH047	BH047	BH049	BH116	BH116	AECOM_BH37
Sample_Depth_Range	0.3-0.4	1-1.2	1-1.2	1-1.2	0.3-0.5	1.5-1.95	1.5-1.95	0.3-0.5	1.5-1.95	0.3-0.5	1.5-1.95	1.5-1.95	0.06-0.1
Sampled_Date_Time	12/02/2009	12/02/2009	12/02/2009	12/02/2009	18/05/2006	18/05/2006	18/05/2006	24/05/2006	24/05/2006	25/05/2006	28/06/2006	27/06/2006	17/02/2010
Sample_Type	Normal	Normal	Field_D	Interlab_D	Normal	Normal	Field_D	Normal	Normal	Normal	Normal	Normal	Normal

Chem_Group	ChemName	output unit	EQL	SSTC-A & B													
	1,3-dichloropropane	mg/kg	0.5		-	-	-	-	-	-	-	-	-	-	-	-	-
	1,4-dichlorobenzene	mg/kg	0.5		-	-	-	-	-	-	-	-	-	-	-	-	-
	2,2-dichloropropane	mg/kg	0.5		-	-	-	-	-	-	-	-	-	-	-	-	-
	2-chlorotoluene	mg/kg	0.5		-	-	-	-	-	-	-	-	-	-	-	-	-
	4-chlorotoluene	mg/kg	0.5		-	-	-	-	-	-	-	-	-	-	-	-	-
	4-Methyl-2-pentanone	mg/kg	5		-	-	-	-	-	-	-	-	-	-	-	-	-
	Bromobenzene	mg/kg	0.5		-	-	-	-	-	-	-	-	-	-	-	-	-
	Bromodichloromethane	mg/kg	0.5		-	-	-	-	-	-	-	-	-	-	-	-	-
	Bromoform	mg/kg	0.5		-	-	-	-	-	-	-	-	-	-	-	-	-
	Bromomethane	mg/kg	5		-	-	-	-	-	-	-	-	-	-	-	-	-
	Carbon disulfide	mg/kg	0.5		-	-	-	-	-	-	-	-	-	-	-	-	-
	Carbon tetrachloride	mg/kg	0.5		-	-	-	-	-	-	-	-	-	-	-	-	-
	Chlorobenzene	mg/kg	0.5		-	-	-	-	-	-	-	-	-	-	-	-	-
	Chlorodibromomethane	mg/kg	0.5		-	-	-	-	-	-	-	-	-	-	-	-	-
	Chloroethane	mg/kg	5		-	-	-	-	-	-	-	-	-	-	-	-	-
	Chloroform	mg/kg	0.5		-	-	-	-	-	-	-	-	-	-	-	-	-
	Chloromethane	mg/kg	5		-	-	-	-	-	-	-	-	-	-	-	-	-
	cis-1,3-dichloropropene	mg/kg	0.5		-	-	-	-	-	-	-	-	-	-	-	-	-
	cis-1,4-Dichloro-2-butene	mg/kg	0.5		-	-	-	-	-	-	-	-	-	-	-	-	-
	Dibromomethane	mg/kg	0.5		-	-	-	-	-	-	-	-	-	-	-	-	-
	Dichlorodifluoromethane	mg/kg	5		-	-	-	-	-	-	-	-	-	-	-	-	-
	Hexachlorobutadiene	mg/kg	0.5		-	-	-	-	-	-	-	-	-	-	-	-	-
	Iodomethane	mg/kg	0.5		-	-	-	-	-	-	-	-	-	-	-	-	-
	Isophorone	mg/kg	0.5		-	-	-	-	-	-	-	-	-	-	-	-	-
	Isopropylbenzene	mg/kg	0.5		-	-	-	-	-	-	-	-	-	-	-	-	-
	n-butylbenzene	mg/kg	0.5		-	-	-	-	-	-	-	-	-	-	-	-	-
	n-propylbenzene	mg/kg	0.5		-	-	-	-	-	-	-	-	-	-	-	-	-
	Pentachloroethane	mg/kg	0.5		-	-	-	-	-	-	-	-	-	-	-	-	-
	p-isopropyltoluene	mg/kg	0.5		-	-	-	-	-	-	-	-	-	-	-	-	-
	sec-butylbenzene	mg/kg	0.5		-	-	-	-	-	-	-	-	-	-	-	-	-
	Styrene	mg/kg	0.5		-	-	-	-	-	-	-	-	-	-	-	-	-
	tert-butylbenzene	mg/kg	0.5		-	-	-	-	-	-	-	-	-	-	-	-	-
	trans-1,2-dichloroethene	mg/kg	0.5		-	-	-	-	-	-	-	-	-	-	-	-	-
	trans-1,3-dichloropropene	mg/kg	0.5		-	-	-	-	-	-	-	-	-	-	-	-	-
	trans-1,4-Dichloro-2-butene	mg/kg	0.5		-	-	-	-	-	-	-	-	-	-	-	-	-
	Trichlorofluoromethane	mg/kg	5		-	-	-	-	-	-	-	-	-	-	-	-	-
	Vinyl acetate	mg/kg	5		-	-	-	-	-	-	-	-	-	-	-	-	-

Notes:
All soil criteria in mg/kg
SSTC - Site Specific Target Criteria for Land Use Scenario
TPH - Total Petroleum Hydrocarbons
PAHs - Polycylic Aromatic Hydrocarbons
VOCs - Volatile Organic Compounds
SPOCAS - Suspension Peroxide Oxidation Combined Acidity & Sulfur
CPAH= Sum of 8 carcinogenic PAH Compounds (Benz(a)anthracene
Benzo(a) pyrene; Benzo(b)fluoranthene; Benzo(g,h,i)perylene;
Benzo(k)fluoranthene; Chrysene; Dibenz(a,h)anthracene; Indeno(1,2,3-

Field_ID	BH38_0.15-0.25	BH39_0.15-0.25	BH40_1.0-1.2	BH46-1.0-1.2	QC56
Lab_Report_Number	ES1003391	ES1003391	ES1003390	ES1003671	ES1003671
Location_Code	AECOM_BH38	AECOM_BH39	AECOM_BH40	AECOM_BH46	AECOM_BH46
Sample_Depth_Range	0.15-0.25	0.15-0.25	1-1.2	1-1.2	1-1.2
Sampled_Date_Time	18/02/2010	18/02/2010	18/02/2010	23/02/2010	23/02/2010
Sample_Type	Normal	Normal	Normal	Normal	Field_D

Chem_Group	ChemName	output unit	EQL	SSTC-A & B					
	CPAH (ESDAT)	mg/kg		130	-	-	-	<4	<4
	Pronamide	mg/kg	0.5		-	-	-	-	-
PAHs	CPAH (TEF)	mg/kg			-	-	-	<1.21	<1.21
	PAH (ESDAT TOTAL)	mg/kg			-	-	-	<8	<8
	PAH (total, NSW Waste 2008)	mg/kg			-	-	-	<8	<8
	Sum of 10 PAHs	mg/kg			-	-	-	<5	<5
	Sum of 5 PAHs	mg/kg			-	-	-	<3	<3
	2-chloronaphthalene	mg/kg	0.5		-	-	-	-	-
	2-methylnaphthalene	mg/kg	0.5		-	-	-	-	-
	3-methylcholanthrene	mg/kg	0.5		-	-	-	-	-
	Acenaphthene	mg/kg	0.5		-	-	-	<0.5	<0.5
	Acenaphthylene	mg/kg	0.5		-	-	-	<0.5	<0.5
	Acetophenone	mg/kg	0.5		-	-	-	-	-
	Anthracene	mg/kg	0.5		-	-	-	<0.5	<0.5
	Benz(a)anthracene	mg/kg	0.5		-	-	-	<0.5	<0.5
	Benzo(a) pyrene	mg/kg	0.5		-	-	-	<0.5	<0.5
	Benzo(b)&(k)fluoranthene	mg/kg	1		-	-	-	-	-
	Benzo(b)fluoranthene	mg/kg	0.5		-	-	-	<0.5	<0.5
	Benzo(g,h,i)perylene	mg/kg	0.5		-	-	-	<0.5	<0.5
	Benzo(k)fluoranthene	mg/kg	0.5		-	-	-	<0.5	<0.5
	Chrysene	mg/kg	0.5		-	-	-	<0.5	<0.5
	Dibenz(a,h)anthracene	mg/kg	0.5		-	-	-	<0.5	<0.5
	Fluoranthene	mg/kg	0.5		-	-	-	<0.5	<0.5
	Fluorene	mg/kg	0.5		-	-	-	<0.5	<0.5
	Indeno(1,2,3-c,d)pyrene	mg/kg	0.5		-	-	-	<0.5	<0.5
	Naphthalene	mg/kg	0.5	320	-	-	-	<0.5	<0.5
	PAHs (Sum of total)	mg/kg			-	-	-	-	-
	Phenanthrene	mg/kg	0.5		-	-	-	<0.5	<0.5
	Pyrene	mg/kg	0.5		-	-	-	<0.5	<0.5
Phenols	2,4-dimethylphenol	mg/kg	0.5	36,000	-	-	-	<0.5	<0.5
	3-&4-methylphenol	mg/kg	0.5		-	-	-	<1	<1
	2-methylphenol	mg/kg	0.5		-	-	-	<0.5	<0.5
	Total Cresols	mg/kg	0.5	61,000	-	-	-	<0.5	<0.5
	2-nitrophenol	mg/kg	0.5		-	-	-	<0.5	<0.5
	4-chloro-3-methylphenol	mg/kg	0.5		-	-	-	<0.5	<0.5
	Phenol	mg/kg	0.5		-	-	-	<0.5	<0.5
	Phenolics Total	mg/kg			-	-	-	-	-
TPH	TPH C15-C36	mg/kg			-	-	-	<200	<200
	TPH C10 - C14	mg/kg	50	19,000	-	-	-	<50	<50
	TPH C15-C28	mg/kg	100		-	-	-	<100	<100
	TPH C29-C36	mg/kg	100		-	-	-	<100	<100
	TPH C6 - C9	mg/kg	2		-	-	-	<10	<10
	TPH+C10 - C36 (Sum of total)	mg/kg	50		-	-	-	<50	<50
BTEX	Total Xylene (ESDAT)	mg/kg			-	-	-	<1	<1
	Benzene	mg/kg	0.2	380	-	-	-	<0.2	<0.2
	Ethylbenzene	mg/kg	0.2		-	-	-	<0.5	<0.5
	Toluene	mg/kg	0.2		-	-	-	<0.5	<0.5
	Xylene (m & p)	mg/kg	0.2		-	-	-	<0.5	<0.5
	Xylene (o)	mg/kg	0.2		-	-	-	<0.5	<0.5
Cyanides	Cyanide (WAD)	mg/kg	1		-	-	-	-	-
Herbicides	Diallate	mg/kg	0.5		-	-	-	-	-
Metals	Arsenic	mg/kg	1		<5	<5	<5	<5	<5
	Barium	mg/kg	5		30	20	20	270	300
	Beryllium	mg/kg	1		<1	<1	<1	<1	<1
	Cadmium	mg/kg	0.1		<1	<1	<1	<1	<1
	Chromium	mg/kg	1		4	2	9	20	11
	Chromium (hexavalent)	mg/kg	0.5		-	-	-	-	-
	Cobalt	mg/kg	1		13	13	3	5	5
	Copper	mg/kg	2		231	247	<5	7	5
	Iron	mg/kg	10		-	-	-	-	-
	Lead	mg/kg	2	11,000	11	6	10	11	12
	Manganese	mg/kg	5		864	819	181	285	352
	Mercury	mg/kg	0.05		<0.1	<0.1	<0.1	<0.1	<0.1
	Nickel	mg/kg	1		7	7	4	6	6
	Vanadium	mg/kg	5		128	139	13	13	14
	Zinc	mg/kg	5		50	52	20	29	34

Field_ID	BH38_0.15-0.25	BH39_0.15-0.25	BH40_1.0-1.2	BH46-1.0-1.2	QC56
Lab_Report_Number	ES1003391	ES1003391	ES1003390	ES1003671	ES1003671
Location_Code	AECOM_BH38	AECOM_BH39	AECOM_BH40	AECOM_BH46	AECOM_BH46
Sample_Depth_Range	0.15-0.25	0.15-0.25	1-1.2	1-1.2	1-1.2
Sampled_Date_Time	18/02/2010	18/02/2010	18/02/2010	23/02/2010	23/02/2010
Sample_Type	Normal	Normal	Normal	Normal	Field_D

Chem_Group	ChemName	output unit	EQL	SSTC-A & B					
Organochlorine Pes	4,4-DDE	mg/kg	0.05		-	-	-	-	-
	a-BHC	mg/kg	0.05		-	-	-	-	-
	Aldrin	mg/kg	0.05		-	-	-	-	-
	Aldrin + Dieldrin	mg/kg			-	-	-	-	-
	b-BHC	mg/kg	0.05		-	-	-	-	-
	cis-Chlordane	mg/kg	0.05		-	-	-	-	-
	d-BHC	mg/kg	0.05		-	-	-	-	-
	DDD	mg/kg	0.05		-	-	-	-	-
	DDT	mg/kg	0.2		-	-	-	-	-
	DDT+DDE+DDD	mg/kg			-	-	-	-	-
	Dieldrin	mg/kg	0.05		-	-	-	-	-
	Endosulfan I	mg/kg	0.05		-	-	-	-	-
	Endosulfan II	mg/kg	0.05		-	-	-	-	-
	Endosulfan sulphate	mg/kg	0.05		-	-	-	-	-
	Endrin	mg/kg	0.05		-	-	-	-	-
	Endrin aldehyde	mg/kg	0.05		-	-	-	-	-
	Endrin ketone	mg/kg	0.05		-	-	-	-	-
	g-BHC (Lindane)	mg/kg	0.05		-	-	-	-	-
	Heptachlor	mg/kg	0.05		-	-	-	-	-
	Heptachlor epoxide	mg/kg	0.05		-	-	-	-	-
	Hexachlorobenzene	mg/kg	0.05		-	-	-	-	-
	Methoxychlor	mg/kg	0.2		-	-	-	-	-
	trans-chlordane	mg/kg	0.05		-	-	-	-	-
Organophosphorous	Azinophos methyl	mg/kg	0.05		-	-	-	-	-
	Bromophos-ethyl	mg/kg	0.05		-	-	-	-	-
	Carbophenothion	mg/kg	0.05		-	-	-	-	-
	Chlorfenvinphos	mg/kg	0.05		-	-	-	-	-
	Chlorpyrifos	mg/kg	0.05		-	-	-	-	-
	Chlorpyrifos-methyl	mg/kg	0.05		-	-	-	-	-
	cis-Isosafrole	mg/kg	0.5		-	-	-	-	-
	Diazinon	mg/kg	0.05		-	-	-	-	-
	Dichlorvos	mg/kg	0.05		-	-	-	-	-
	Dimethoate	mg/kg	0.05		-	-	-	-	-
	Ethion	mg/kg	0.05		-	-	-	-	-
	Ethyl methanesulfonate	mg/kg	0.5		-	-	-	-	-
	Fenthion	mg/kg	0.05		-	-	-	-	-
	Malathion	mg/kg	0.05		-	-	-	-	-
	Methyl methanesulfonate	mg/kg	0.5		-	-	-	-	-
	Methyl parathion	mg/kg	0.2		-	-	-	-	-
	Monocrotophos	mg/kg	0.2		-	-	-	-	-
	Pirimphos-ethyl	mg/kg	0.05		-	-	-	-	-
	Prothiofos	mg/kg	0.05		-	-	-	-	-
	Safrole	mg/kg	0.5		-	-	-	-	-
	trans-Isosafrole	mg/kg	0.5		-	-	-	-	-
Pesticides	Pesticides (total, NSW Waste 2008)	mg/kg			-	-	-	<0.5	<0.5
	Demeton-S-methyl	mg/kg	0.05		-	-	-	-	-
	Fenamiphos	mg/kg	0.05		-	-	-	-	-
	Parathion	mg/kg	0.2		-	-	-	-	-
VOCs	1,1,1,2-tetrachloroethane	mg/kg	0.5		-	-	-	-	-
	1,1,1-trichloroethane	mg/kg	0.5		-	-	-	-	-
	1,1,2,2-tetrachloroethane	mg/kg	0.5		-	-	-	-	-
	1,1,2-trichloroethane	mg/kg	0.5		-	-	-	-	-
	1,1-dichloroethane	mg/kg	0.5		-	-	-	-	-
	1,1-dichloroethene	mg/kg	0.5		-	-	-	-	-
	1,1-dichloropropene	mg/kg	0.5		-	-	-	-	-
	1,2,3-trichlorobenzene	mg/kg	0.5		-	-	-	-	-
	1,2,3-trichloropropane	mg/kg	0.5		-	-	-	-	-
	1,2,4-trichlorobenzene	mg/kg	0.5		-	-	-	-	-
	1,2,4-trimethylbenzene	mg/kg	0.5	370	-	-	-	-	-
	1,2-dibromo-3-chloropropane	mg/kg	0.5		-	-	-	-	-
	1,2-dibromoethane	mg/kg	0.5		-	-	-	-	-
	1,2-dichlorobenzene	mg/kg	0.5		-	-	-	-	-
	1,2-dichloroethane	mg/kg	0.5		-	-	-	-	-
	1,2-dichloropropane	mg/kg	0.5		-	-	-	-	-
	1,3,5-trimethylbenzene	mg/kg	0.5		-	-	-	-	-
	1,3-dichlorobenzene	mg/kg	0.5		-	-	-	-	-

Field_ID	BH38_0.15-0.25	BH39_0.15-0.25	BH40_1.0-1.2	BH46-1.0-1.2	QC56
Lab_Report_Number	ES1003391	ES1003391	ES1003390	ES1003671	ES1003671
Location_Code	AECOM_BH38	AECOM_BH39	AECOM_BH40	AECOM_BH46	AECOM_BH46
Sample_Depth_Range	0.15-0.25	0.15-0.25	1-1.2	1-1.2	1-1.2
Sampled_Date_Time	18/02/2010	18/02/2010	18/02/2010	23/02/2010	23/02/2010
Sample_Type	Normal	Normal	Normal	Normal	Field_D

Chem_Group	ChemName	output unit	EQL	SSTC-A & B					
	1,3-dichloropropane	mg/kg	0.5		-	-	-	-	-
	1,4-dichlorobenzene	mg/kg	0.5		-	-	-	-	-
	2,2-dichloropropane	mg/kg	0.5		-	-	-	-	-
	2-chlorotoluene	mg/kg	0.5		-	-	-	-	-
	4-chlorotoluene	mg/kg	0.5		-	-	-	-	-
	4-Methyl-2-pentanone	mg/kg	5		-	-	-	-	-
	Bromobenzene	mg/kg	0.5		-	-	-	-	-
	Bromodichloromethane	mg/kg	0.5		-	-	-	-	-
	Bromoform	mg/kg	0.5		-	-	-	-	-
	Bromomethane	mg/kg	5		-	-	-	-	-
	Carbon disulfide	mg/kg	0.5		-	-	-	-	-
	Carbon tetrachloride	mg/kg	0.5		-	-	-	-	-
	Chlorobenzene	mg/kg	0.5		-	-	-	-	-
	Chlorodibromomethane	mg/kg	0.5		-	-	-	-	-
	Chloroethane	mg/kg	5		-	-	-	-	-
	Chloroform	mg/kg	0.5		-	-	-	-	-
	Chloromethane	mg/kg	5		-	-	-	-	-
	cis-1,3-dichloropropene	mg/kg	0.5		-	-	-	-	-
	cis-1,4-Dichloro-2-butene	mg/kg	0.5		-	-	-	-	-
	Dibromomethane	mg/kg	0.5		-	-	-	-	-
	Dichlorodifluoromethane	mg/kg	5		-	-	-	-	-
	Hexachlorobutadiene	mg/kg	0.5		-	-	-	-	-
	Iodomethane	mg/kg	0.5		-	-	-	-	-
	Isophorone	mg/kg	0.5		-	-	-	-	-
	Isopropylbenzene	mg/kg	0.5		-	-	-	-	-
	n-butylbenzene	mg/kg	0.5		-	-	-	-	-
	n-propylbenzene	mg/kg	0.5		-	-	-	-	-
	Pentachloroethane	mg/kg	0.5		-	-	-	-	-
	p-isopropyltoluene	mg/kg	0.5		-	-	-	-	-
	sec-butylbenzene	mg/kg	0.5		-	-	-	-	-
	Styrene	mg/kg	0.5		-	-	-	-	-
	tert-butylbenzene	mg/kg	0.5		-	-	-	-	-
	trans-1,2-dichloroethene	mg/kg	0.5		-	-	-	-	-
	trans-1,3-dichloropropene	mg/kg	0.5		-	-	-	-	-
	trans-1,4-Dichloro-2-butene	mg/kg	0.5		-	-	-	-	-
	Trichlorofluoromethane	mg/kg	5		-	-	-	-	-
	Vinyl acetate	mg/kg	5		-	-	-	-	-

Notes:
All soil criteria in mg/kg
SSTC - Site Specific Target Criteria for Land Use Scenario
TPH - Total Petroleum Hydrocarbons
PAHs - Polycylic Aromatic Hydrocarbons
VOCs - Volatile Organic Compounds
SPOCAS - Suspension Peroxide Oxidation Combined Acidity & Sulfur
CPAH= Sum of 8 carcinogenic PAH Compounds (Benz(a)anthracene
Benzo(a) pyrene; Benzo(b)fluoranthene; Benzo(g,h,i)perylene;
Benzo(k)fluoranthene; Chrysene; Dibenz(a,h)anthracene; Indeno(1,2,3-

Field_ID	BH01_10.0-10.2	QC03	BH01_12.0-12.1	BH01_17.65-17.75	BH01_17.65-17.75	BH01_2.0-2.2	BH01_20.5-20.6	BH01_25.0-25.1	BH01_4.0-4.1	BH01_7.0-7.1	BH01_9.0-9.1
Lab_Report_Number	ES0918573	ES0918573	ES0918573	ES0918573	ES0918575	ES0918573	ES0918573	ES0918573	ES0918573	ES0918573	ES0918573
Location_Code	AECOM_BH01	AECOM_BH01	AECOM_BH01	AECOM_BH01	AECOM_BH01	AECOM_BH01	AECOM_BH01	AECOM_BH01	AECOM_BH01	AECOM_BH01	AECOM_BH01
Sample_Depth_Range	10-10.2	10-10.2	12-12.1	17.65-17.75	17.65-17.75	2-2.2	20.5-20.6	25-25.1	4-4.1	7-7.1	9-9.1
Sampled_Date_Time	12/02/2009	12/02/2009	12/02/2009	12/03/2009	12/02/2009	12/02/2009	12/03/2009	12/10/2009	12/02/2009	12/02/2009	12/02/2009
Sample_Type	Normal	Field_D	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal

Chem_Group	ChemName	output unit	EQL	ISQG-High	SSTC-A & B											
	CPAH (ESDAT)	mg/kg			130	-	-	-	<4	-	-	-	<4	7.5	6.6	-
	Pronamide	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	-
PAHs	CPAH (TEF)	mg/kg				-	-	-	<1.21	-	-	-	<1.21	1.65	1.641	-
	PAH (ESDAT TOTAL)	mg/kg				-	-	-	<8	-	-	-	<8	23.6	18	-
	PAH (total, NSW Waste 2008)	mg/kg				-	-	-	<8	-	-	-	<8	23.6	18	-
	Sum of 10 PAHs	mg/kg				-	-	-	<5	-	-	-	<5	16.8	14.9	-
	Sum of 5 PAHs	mg/kg				-	-	-	<3	-	-	-	<3	6.8	3.1	-
	2-chloronaphthalene	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	-
	2-methylnaphthalene	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	-
	3-methylcholanthrene	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	-
	Acenaphthene	mg/kg	0.5	**0.5**		-	-	-	<0.5	-	-	-	<0.5	<0.5	<0.5	-
	Acenaphthylene	mg/kg	0.5	**0.64**		-	-	-	<0.5	-	-	-	<0.5	<0.5	<0.5	-
	Acetophenone	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	-
	Anthracene	mg/kg	0.5	**1.1**		-	-	-	<0.5	-	-	-	<0.5	1.5	0.8	-
	Benz(a)anthracene	mg/kg	0.5	**1.6**		-	-	-	<0.5	-	-	-	<0.5	1.9	1.8	-
	Benzo(a) pyrene	mg/kg	0.5	**1.6**		-	-	-	<0.5	-	-	-	<0.5	1.2	1.3	-
	Benzo(b)&(k)fluoranthene	mg/kg	1			-	-	-	-	-	-	-	-	-	-	-
	Benzo(b)fluoranthene	mg/kg	0.5			-	-	-	<0.5	-	-	-	<0.5	1.2	1.4	-
	Benzo(g,h,i)perylene	mg/kg	0.5			-	-	-	<0.5	-	-	-	<0.5	0.6	0.6	-
	Benzo(k)fluoranthene	mg/kg	0.5			-	-	-	<0.5	-	-	-	<0.5	0.7	<0.5	-
	Chrysene	mg/kg	0.5	**2.8**		-	-	-	<0.5	-	-	-	<0.5	1.4	1.5	-
	Dibenz(a,h)anthracene	mg/kg	0.5	**0.26**		-	-	-	<0.5	-	-	-	<0.5	<0.5	<0.5	-
	Fluoranthene	mg/kg	0.5	**5.1**		-	-	-	<0.5	-	-	-	<0.5	4.9	4.1	-
	Fluorene	mg/kg	0.5	**0.54**		-	-	-	<0.5	-	-	-	<0.5	<0.5	<0.5	-
	Indeno(1,2,3-c,d)pyrene	mg/kg	0.5			-	-	-	<0.5	-	-	-	<0.5	0.5	<0.5	-
	Naphthalene	mg/kg	0.5	**2.1**	320	-	-	-	<0.5	-	-	-	<0.5	<0.5	<0.5	-
	PAHs (Sum of total)	mg/kg				-	-	-	-	-	-	-	-	-	-	-
	Phenanthrene	mg/kg	0.5	**1.5**		-	-	-	<0.5	-	-	-	<0.5	5.3	2.3	-
	Pyrene	mg/kg	0.5	**2.6**		-	-	-	<0.5	-	-	-	<0.5	**4.4**	**4.2**	-
Phenols	2,4-dimethylphenol	mg/kg	0.5		36000	-	-	-	-	-	-	-	-	-	-	-
	2-methylphenol	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	-
	3-&4-methylphenol	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	-
	Total Cresols	mg/kg	0.5		61,000	-	-	-	-	-	-	-	-	-	-	-
	2-nitrophenol	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	-
	4-chloro-3-methylphenol	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	-
	Phenol	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	-
	Phenolics Total	mg/kg				-	-	-	-	-	-	-	-	-	-	-
TPH	TPH C15-C36	mg/kg				-	-	-	<200	-	-	-	<200	<200	<200	-
	TPH C10 - C14	mg/kg	50		19,000	-	-	-	<50	-	-	-	<50	<50	<50	-
	TPH C15-C28	mg/kg	100			-	-	-	<100	-	-	-	<100	<100	<100	-
	TPH C29-C36	mg/kg	100			-	-	-	<100	-	-	-	<100	<100	<100	-
	TPH C6 - C9	mg/kg	2			-	-	-	<10	-	-	-	<10	<10	<10	-
	TPH+C10 - C36 (Sum of total)	mg/kg	50			-	-	-	<50	-	-	-	<50	<50	<50	-
BTEX	Total Xylene (ESDAT)	mg/kg				-	-	-	<1	-	-	-	<1	<1	<1	-
	Benzene	mg/kg	0.2		380	-	-	-	<0.2	-	-	-	<0.2	<0.2	<0.2	-
	Ethylbenzene	mg/kg	0.2			-	-	-	<0.5	-	-	-	<0.5	<0.5	<0.5	-
	Toluene	mg/kg	0.2			-	-	-	<0.5	-	-	-	<0.5	<0.5	<0.5	-
	Xylene (m & p)	mg/kg	0.2			-	-	-	<0.5	-	-	-	<0.5	<0.5	<0.5	-
	Xylene (o)	mg/kg	0.2			-	-	-	<0.5	-	-	-	<0.5	<0.5	<0.5	-
Cyanides	Cyanide (WAD)	mg/kg	1			-	-	-	-	-	-	-	-	-	-	-
Herbicides	Diallate	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	-
Inorganics	Cyanide (Free)	mg/kg	1			-	-	-	-	-	-	-	-	-	-	-
	Cyanide Total	mg/kg	1			-	-	-	-	-	-	-	-	-	-	-
	Weak Acid Dissociable Cyanide	mg/kg	1			-	-	-	-	-	-	-	-	-	-	-
Metals	Arsenic	mg/kg	1			6	<5	<5	<5	-	<5	<5	27	<5	12	14
	Barium	mg/kg	5			60	60	40	10	-	70	<10	<10	40	40	60
	Beryllium	mg/kg	1			<1	<1	<1	<1	-	<1	<1	<1	<1	<1	<1
	Cadmium	mg/kg	0.1	**10**		<1	<1	<1	<1	-	<1	<1	<1	<1	1	<1
	Chromium	mg/kg	1	**370**		7	13	7	31	-	18	3	37	10	7	5
	Chromium (hexavalent)	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	-
	Cobalt	mg/kg	1			2	<2	2	<2	-	5	<2	<2	6	<2	2
	Copper	mg/kg	2	**270**		13	16	30	<5	-	44	<5	8	92	44	21
	Iron	mg/kg	10			-	-	-	-	-	-	-	-	-	-	-
	Lead	mg/kg	2	**220**	11000	104	59	47	28	-	30	<5	13	16	132	74
	Manganese	mg/kg	5			159	138	132	<5	-	329	<5	5	355	160	147
	Mercury	mg/kg	0.05	**1**		<0.1	<0.1	<0.1	<0.1	-	<0.1	<0.1	<0.1	<0.1	0.2	<0.1
	Nickel	mg/kg	1	**52**		4	5	6	3	-	8	<2	<2	5	10	4
	Vanadium	mg/kg	5			14	15	19	118	-	32	6	57	51	8	13
	Zinc	mg/kg	5	**410**		47	57	96	<5	-	**2,070**	<5	10	42	115	47

Field_ID	BH01_10.0-10.2	QC03	BH01_12.0-12.1	BH01_17.65-17.75	BH01_17.65-17.75	BH01_2.0-2.2	BH01_20.5-20.6	BH01_25.0-25.1	BH01_4.0-4.1	BH01_7.0-7.1	BH01_9.0-9.1
Lab_Report_Number	ES0918573	ES0918573	ES0918573	ES0918573	ES0918575	ES0918573	ES0918573	ES0918573	ES0918573	ES0918573	ES0918573
Location_Code	AECOM_BH01	AECOM_BH01	AECOM_BH01	AECOM_BH01	AECOM_BH01	AECOM_BH01	AECOM_BH01	AECOM_BH01	AECOM_BH01	AECOM_BH01	AECOM_BH01
Sample_Depth_Range	10-10.2	10-10.2	12-12.1	17.65-17.75	17.65-17.75	2-2.2	20.5-20.6	25-25.1	4-4.1	7-7.1	9-9.1
Sampled_Date_Time	12/02/2009	12/02/2009	12/02/2009	12/03/2009	12/02/2009	12/02/2009	12/03/2009	12/10/2009	12/02/2009	12/02/2009	12/02/2009
Sample_Type	Normal	Field_D	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal

Chem_Group	ChemName	output unit	EQL	ISQG-High	SSTC-A & B											
SPOCAS	Acid Reacted Calcium	%	0.02			-	-	-	-	<0.02	-	-	-	-	-	-
	acidity - Acid Reacted Calcium	mole H+/t	10			-	-	-	-	<10	-	-	-	-	-	-
	acidity - Acid Reacted Magnesium	mole H+/t	10			-	-	-	-	<10	-	-	-	-	-	-
	acidity - Peroxide Oxidisable Sulfur	mole H+/t	10			-	-	-	-	<10	-	-	-	-	-	-
	ANC Fineness Factor	-	0.5			-	-	-	-	1.5	-	-	-	-	-	-
	Calcium in Peroxide	%	0.02			-	-	-	-	0.03	-	-	-	-	-	-
	KCl Extractable Calcium	%	0.02			-	-	-	-	0.03	-	-	-	-	-	-
	KCl Extractable Magnesium	%	0.02			-	-	-	-	0.04	-	-	-	-	-	-
	Liming Rate	kg CaCO3/t	1			-	-	-	-	2	-	-	-	-	-	-
	Magnesium in Peroxide	%	0.02			-	-	-	-	0.04	-	-	-	-	-	-
	Net Acidity (acidity units)	mole H+/t	10			-	-	-	-	33	-	-	-	-	-	-
	Net Acidity (sulfur units)	%S	0.02			-	-	-	-	0.05	-	-	-	-	-	-
	Peroxide Oxidisable Sulfur	%	0.02			-	-	-	-	<0.02	-	-	-	-	-	-
	pH (KCl)	pH Unit	0.1			-	-	-	-	5	-	-	-	-	-	-
	pH (Ox)	pH Unit	0.1			-	-	-	-	4.7	-	-	-	-	-	-
	sulfidic - Acid Reacted Calcium	% S	0.02			-	-	-	-	<0.02	-	-	-	-	-	-
	sulfidic - Acid Reacted Magnesium	%S	0.02			-	-	-	-	<0.02	-	-	-	-	-	-
	sulfidic - Titratable Actual Acidity	%S	0.02			-	-	-	-	0.04	-	-	-	-	-	-
	sulfidic - Titratable Peroxide Acidity	%S	0.02			-	-	-	-	0.04	-	-	-	-	-	-
	sulfidic - Titratable Sulfidic Acidity	%S	0.02			-	-	-	-	<0.02	-	-	-	-	-	-
	Sulfur in Peroxide	%	0.02			-	-	-	-	0.04	-	-	-	-	-	-
	Titratable Actual Acidity	mole H+/t	2			-	-	-	-	25	-	-	-	-	-	-
VOCs	1,1,1,2-tetrachloroethane	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	-
	1,1,1-trichloroethane	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	-
	1,1,2,2-tetrachloroethane	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	-
	1,1,2-trichloroethane	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	-
	1,1-dichloroethane	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	-
	1,1-dichloroethene	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	-
	1,1-dichloropropene	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	-
	1,2,3-trichlorobenzene	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	-
	1,2,3-trichloropropane	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	-
	1,2,4-trichlorobenzene	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	-
	1,2,4-trimethylbenzene	mg/kg	0.5		70	-	-	-	-	-	-	-	-	-	-	-
	1,2-dibromo-3-chloropropane	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	-
	1,2-dibromoethane	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	-
	1,2-dichlorobenzene	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	-
	1,2-dichloroethane	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	-
	1,2-dichloropropane	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	-
	1,3,5-trimethylbenzene	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	-
	1,3-dichlorobenzene	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	-
	1,3-dichloropropane	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	-
	1,4-dichlorobenzene	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	-
	2,2-dichloropropane	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	-
	2-chlorotoluene	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	-
	4-chlorotoluene	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	-
	4-Methyl-2-pentanone	mg/kg	5			-	-	-	-	-	-	-	-	-	-	-
	Bromobenzene	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	-
	Bromodichloromethane	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	-
	Bromoform	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	-
	Bromomethane	mg/kg	5			-	-	-	-	-	-	-	-	-	-	-
	Carbon disulfide	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	-
	Carbon tetrachloride	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	-
	Chlorobenzene	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	-
	Chlorodibromomethane	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	-
	Chloroethane	mg/kg	5			-	-	-	-	-	-	-	-	-	-	-
	Chloroform	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	-
	Chloromethane	mg/kg	5			-	-	-	-	-	-	-	-	-	-	-
	cis-1,3-dichloropropene	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	-
	cis-1,4-Dichloro-2-butene	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	-
	Dibromomethane	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	-
	Dichlorodifluoromethane	mg/kg	5			-	-	-	-	-	-	-	-	-	-	-
	Hexachlorobutadiene	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	-
	Iodomethane	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	-
	Isophorone	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	-
	Isopropylbenzene	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	-
	n-butylbenzene	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	-
	n-propylbenzene	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	-
	Pentachloroethane	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	-
	p-isopropyltoluene	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	-

Field_ID	BH01_10.0-10.2	QC03	BH01_12.0-12.1	BH01_17.65-17.75	BH01_17.65-17.75	BH01_2.0-2.2	BH01_20.5-20.6	BH01_25.0-25.1	BH01_4.0-4.1	BH01_7.0-7.1	BH01_9.0-9.1
Lab_Report_Number	ES0918573	ES0918573	ES0918573	ES0918573	ES0918575	ES0918573	ES0918573	ES0918573	ES0918573	ES0918573	ES0918573
Location_Code	AECOM_BH01	AECOM_BH01	AECOM_BH01	AECOM_BH01	AECOM_BH01	AECOM_BH01	AECOM_BH01	AECOM_BH01	AECOM_BH01	AECOM_BH01	AECOM_BH01
Sample_Depth_Range	10-10.2	10-10.2	12-12.1	17.65-17.75	17.65-17.75	2-2.2	20.5-20.6	25-25.1	4-4.1	7-7.1	9-9.1
Sampled_Date_Time	12/02/2009	12/02/2009	12/02/2009	12/03/2009	12/02/2009	12/02/2009	12/03/2009	12/10/2009	12/02/2009	12/02/2009	12/02/2009
Sample_Type	Normal	Field_D	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal

Chem_Group	ChemName	output unit	EQL	ISQG-High	SSTC-A & B											
	sec-butylbenzene	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	-
	Styrene	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	-
	tert-butylbenzene	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	-
	trans-1,2-dichloroethene	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	-
	trans-1,3-dichloropropene	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	-
	trans-1,4-Dichloro-2-butene	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	-
	Trichlorofluoromethane	mg/kg	5			-	-	-	-	-	-	-	-	-	-	-
	Vinyl acetate	mg/kg	5			-	-	-	-	-	-	-	-	-	-	-

Notes:
All soil criteria in mg/kg
SSTC - Site Specific Target Criteria for Land Use Scenario
TPH - Total Petroleum Hydrocarbons
PAHs - Polycylic Aromatic Hydrocarbons
VOCs - Volatile Organic Compounds
SPOCAS - Suspension Peroxide Oxidation Combined Acidity & Sulfur
CPAH= Sum of 8 carcinogenic PAH Compounds (Benz(a)anthracene
Benzo(a) pyrene; Benzo(b)fluoranthene; Benzo(g,h,i)perylene;
Benzo(k)fluoranthene; Chrysene; Dibenz(a,h)anthracene; Indeno(1,2,3-

Field_ID	BH017 21.5-22	BH017 3.0-3.45	BH035_ 4.0-4.5	D1805-2	BH049_3.0-3.45	BH116 3.0_3.45	BH116 3.0_3.45	BH37_15.8-16.0	QC69	BH37_2.5-2.7	BH37_20.4-20.5
Lab_Report_Number	ES0605781	ES0605781	ES0606393	ES0606393	ES0606484	ES0607931	ES0608109	ES1003391	ES1003391	ES1003391	ES1003391
Location_Code	BH017	BH017	BH035	BH035	BH049	BH116	BH116	AECOM_BH37	AECOM_BH37	AECOM_BH37	AECOM_BH37
Sample_Depth_Range	21.5-22	3-3.45	4-4.5	4-4.5	3-3.45	3-3.45	3-3.45	15.8-16	15.8-16	2.5-2.7	20.4-20.5
Sampled_Date_Time	8/05/2006	8/05/2006	18/05/2006	18/05/2006	25/05/2006	28/06/2006	27/06/2006	18/02/2010	18/02/2010	17/02/2010	18/02/2010
Sample_Type	Normal	Normal	Normal	Field_D	Normal	Normal	Normal	Normal	Field_D	Normal	Normal

Chem_Group	ChemName	output unit	EQL	ISQG-High	SSTC-A & B										
	CPAH (ESDAT)	mg/kg			130	-	-	-	-	-	-	1.3	0.5	<4	-	2.9
	Pronamide	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	<0.5
PAHs	CPAH (TEF)	mg/kg				-	-	-	-	-	-	0.13	0.05	<1.21	-	0.929
	PAH (ESDAT TOTAL)	mg/kg				-	-	-	-	-	-	4.7	10.6	1.9	-	51.9
	PAH (total, NSW Waste 2008)	mg/kg				-	-	-	-	-	-	4.7	10.6	1.9	-	51.9
	Sum of 10 PAHs	mg/kg				-	-	-	-	-	-	3.7	2.5	<5	-	7.1
	Sum of 5 PAHs	mg/kg				-	-	-	-	-	-	1	8.1	1.9	-	44.8
	2-chloronaphthalene	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	<0.5
	2-methylnaphthalene	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	14.4
	3-methylcholanthrene	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	<0.5
	Acenaphthene	mg/kg	0.5	**0.5**		-	-	-	-	-	-	<0.5	<0.5	<0.5	-	0.6
	Acenaphthylene	mg/kg	0.5	**0.64**		-	-	-	-	-	-	<0.5	1	<0.5	-	3.8
	Acetophenone	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	<0.5
	Anthracene	mg/kg	0.5	**1.1**		-	-	-	-	-	-	<0.5	0.6	<0.5	-	1.5
	Benz(a)anthracene	mg/kg	0.5	**1.6**		-	-	-	-	-	-	0.6	0.5	<0.5	-	1.2
	Benzo(a) pyrene	mg/kg	0.5	**1.6**		-	-	-	-	-	-	<0.5	<0.5	<0.5	-	0.8
	Benzo(b)&(k)fluoranthene	mg/kg	1			-	-	-	-	-	-	-	-	-	-	<1
	Benzo(b)fluoranthene	mg/kg	0.5			-	-	-	-	-	-	0.7	<0.5	<0.5	-	-
	Benzo(g,h,i)perylene	mg/kg	0.5			-	-	-	-	-	-	<0.5	<0.5	<0.5	-	<0.5
	Benzo(k)fluoranthene	mg/kg	0.5			-	-	-	-	-	-	<0.5	<0.5	<0.5	-	-
	Chrysene	mg/kg	0.5	**2.8**		-	-	-	-	-	-	<0.5	<0.5	<0.5	-	0.9
	Dibenz(a,h)anthracene	mg/kg	0.5	**0.26**		-	-	-	-	-	-	<0.5	<0.5	<0.5	-	<0.5
	Fluoranthene	mg/kg	0.5	**5.1**		-	-	-	-	-	-	1.3	0.8	<0.5	-	1.6
	Fluorene	mg/kg	0.5	**0.54**		-	-	-	-	-	-	<0.5	0.9	<0.5	-	1.9
	Indeno(1,2,3-c,d)pyrene	mg/kg	0.5			-	-	-	-	-	-	<0.5	<0.5	<0.5	-	<0.5
	Naphthalene	mg/kg	0.5	**2.1**	320	-	-	-	-	-	-	<0.5	3.3	1	-	31.1
	PAHs (Sum of total)	mg/kg				-	-	-	-	-	-	-	-	-	-	-
	Phenanthrene	mg/kg	0.5	**1.5**		-	-	-	-	-	-	1	2.3	0.9	-	5.9
	Pyrene	mg/kg	0.5	**2.6**		-	-	-	-	-	-	1.1	1.2	<0.5	-	**2.6**
Phenols	2,4-dimethylphenol	mg/kg	0.5		36000	-	-	-	-	-	-	-	<0.5	<0.5	-	<0.5
	2-methylphenol	mg/kg	0.5			-	-	-	-	-	-	-	<0.5	<0.5	-	<0.5
	3-&4-methylphenol	mg/kg	0.5			-	-	-	-	-	-	-	<1	<1	-	<0.5
	Total Cresols	mg/kg	0.5		61,000	-	-	-	-	-	-	-	<0.5	<0.5	-	<0.5
	2-nitrophenol	mg/kg	0.5			-	-	-	-	-	-	-	<0.5	<0.5	-	<0.5
	4-chloro-3-methylphenol	mg/kg	0.5			-	-	-	-	-	-	-	<0.5	<0.5	-	<0.5
	Phenol	mg/kg	0.5			-	-	-	-	-	-	-	<0.5	<0.5	-	<0.5
	Phenolics Total	mg/kg				-	-	-	-	-	-	-	-	-	-	-
TPH	TPH C15-C36	mg/kg				-	-	<200	-	-	-	-	<200	<200	-	-
	TPH C10 - C14	mg/kg	50		19,000	-	-	<50	-	-	-	-	<50	<50	-	-
	TPH C15-C28	mg/kg	100			-	-	<100	-	-	-	-	<100	<100	-	-
	TPH C29-C36	mg/kg	100			-	-	<100	-	-	-	-	<100	<100	-	-
	TPH C6 - C9	mg/kg	2			-	-	<2	-	-	-	-	53	<10	-	-
	TPH+C10 - C36 (Sum of total)	mg/kg	50			-	-	<250	-	-	-	-	<50	<50	-	-
BTEX	Total Xylene (ESDAT)	mg/kg				-	-	<0.4	-	-	-	-	19.1	2.2	-	15.7
	Benzene	mg/kg	0.2		380	-	-	<0.2	-	-	-	-	0.6	0.4	-	3.1
	Ethylbenzene	mg/kg	0.2			-	-	<0.2	-	-	-	-	2.6	<0.5	-	2.9
	Toluene	mg/kg	0.2			-	-	<0.2	-	-	-	-	5.7	1.2	-	12
	Xylene (m & p)	mg/kg	0.2			-	-	<0.2	-	-	-	-	12.2	1.4	-	10.2
	Xylene (o)	mg/kg	0.2			-	-	<0.2	-	-	-	-	6.9	0.8	-	5.5
Cyanides	Cyanide (WAD)	mg/kg	1			-	-	-	-	-	-	-	-	-	-	-
Herbicides	Diallate	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	-
Inorganics	Cyanide (Free)	mg/kg	1			-	-	-	-	-	-	-	<1	<1	-	<1
	Cyanide Total	mg/kg	1			-	-	-	-	-	-	-	<1	<1	-	<1
	Weak Acid Dissociable Cyanide	mg/kg	1			-	-	-	-	-	-	-	-	-	-	-
Metals	Arsenic	mg/kg	1			<5	<5	<5	<5	<5	<5	-	<5	<5	<5	<5
	Barium	mg/kg	5			-	-	-	-	-	-	-	20	20	<10	<10
	Beryllium	mg/kg	1			-	-	-	-	-	-	-	<1	<1	<1	<1
	Cadmium	mg/kg	0.1	**10**		<1	<1	<1	<1	<1	<1	-	<1	<1	<1	<1
	Chromium	mg/kg	1	**370**		41	19	16	15	3	31	-	11	12	5	2
	Chromium (hexavalent)	mg/kg	0.5			-	-	-	-	-	-	-	<0.5	<0.5	-	<0.5
	Cobalt	mg/kg	1			-	-	-	-	-	-	-	<2	<2	<2	<2
	Copper	mg/kg	2	**270**		8	32	10	10	<5	18	-	<5	<5	23	<5
	Iron	mg/kg	10			-	-	-	-	-	-	-	1030	1120	-	620
	Lead	mg/kg	2	**220**	11000	22	18	18	18	8	14	-	10	9	9	6
	Manganese	mg/kg	5			-	-	-	-	-	-	-	<5	<5	9	<5
	Mercury	mg/kg	0.05	**1**		0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	<0.1	<0.1	<0.1	<0.1
	Nickel	mg/kg	1	**52**		4	5	33	6	2	4	-	2	2	<2	2
	Vanadium	mg/kg	5			-	-	-	-	-	-	-	9	9	8	10
	Zinc	mg/kg	5	**410**		25	40	38	34	10	28	-	<5	<5	11	<5

Field_ID	BH017 21.5-22	BH017 3.0-3.45	BH035_ 4.0-4.5	D1805-2	BH049_3.0-3.45	BH116 3.0_3.45	BH116 3.0_3.45	BH37_15.8-16.0	QC69	BH37_2.5-2.7	BH37_20.4-20.5
Lab_Report_Number	ES0605781	ES0605781	ES0606393	ES0606393	ES0606484	ES0607931	ES0608109	ES1003391	ES1003391	ES1003391	ES1003391
Location_Code	BH017	BH017	BH035	BH035	BH049	BH116	BH116	AECOM_BH37	AECOM_BH37	AECOM_BH37	AECOM_BH37
Sample_Depth_Range	21.5-22	3-3.45	4-4.5	4-4.5	3-3.45	3-3.45	3-3.45	15.8-16	15.8-16	2.5-2.7	20.4-20.5
Sampled_Date_Time	8/05/2006	8/05/2006	18/05/2006	18/05/2006	25/05/2006	28/06/2006	27/06/2006	18/02/2010	18/02/2010	17/02/2010	18/02/2010
Sample_Type	Normal	Normal	Normal	Field_D	Normal	Normal	Normal	Normal	Field_D	Normal	Normal

Chem_Group	ChemName	output unit	EQL	ISQG-High	SSTC-A & B											
SPOCAS	Acid Reacted Calcium	%	0.02			-	-	-	-	-	-	-	-	-	-	-
	acidity - Acid Reacted Calcium	mole H+/t	10			-	-	-	-	-	-	-	-	-	-	-
	acidity - Acid Reacted Magnesium	mole H+/t	10			-	-	-	-	-	-	-	-	-	-	-
	acidity - Peroxide Oxidisable Sulfur	mole H+/t	10			-	-	-	-	-	-	-	-	-	-	-
	ANC Fineness Factor	-	0.5			-	-	-	-	-	-	-	-	-	-	-
	Calcium in Peroxide	%	0.02			-	-	-	-	-	-	-	-	-	-	-
	KCl Extractable Calcium	%	0.02			-	-	-	-	-	-	-	-	-	-	-
	KCl Extractable Magnesium	%	0.02			-	-	-	-	-	-	-	-	-	-	-
	Liming Rate	kg CaCO3/t	1			-	-	-	-	-	-	-	-	-	-	-
	Magnesium in Peroxide	%	0.02			-	-	-	-	-	-	-	-	-	-	-
	Net Acidity (acidity units)	mole H+/t	10			-	-	-	-	-	-	-	-	-	-	-
	Net Acidity (sulfur units)	%S	0.02			-	-	-	-	-	-	-	-	-	-	-
	Peroxide Oxidisable Sulfur	%	0.02			-	-	-	-	-	-	-	-	-	-	-
	pH (KCl)	pH Unit	0.1			-	-	-	-	-	-	-	-	-	-	-
	pH (Ox)	pH Unit	0.1			-	-	-	-	-	-	-	-	-	-	-
	sulfidic - Acid Reacted Calcium	% S	0.02			-	-	-	-	-	-	-	-	-	-	-
	sulfidic - Acid Reacted Magnesium	%S	0.02			-	-	-	-	-	-	-	-	-	-	-
	sulfidic - Titratable Actual Acidity	%S	0.02			-	-	-	-	-	-	-	-	-	-	-
	sulfidic - Titratable Peroxide Acidity	%S	0.02			-	-	-	-	-	-	-	-	-	-	-
	sulfidic - Titratable Sulfidic Acidity	%S	0.02			-	-	-	-	-	-	-	-	-	-	-
	Sulfur in Peroxide	%	0.02			-	-	-	-	-	-	-	-	-	-	-
	Titratable Actual Acidity	mole H+/t	2			-	-	-	-	-	-	-	-	-	-	-
VOCs	1,1,1,2-tetrachloroethane	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	<0.5
	1,1,1-trichloroethane	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	<0.5
	1,1,2,2-tetrachloroethane	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	<0.5
	1,1,2-trichloroethane	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	<0.5
	1,1-dichloroethane	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	<0.5
	1,1-dichloroethene	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	<0.5
	1,1-dichloropropene	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	<0.5
	1,2,3-trichlorobenzene	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	<0.5
	1,2,3-trichloropropane	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	<0.5
	1,2,4-trichlorobenzene	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	<0.5
	1,2,4-trimethylbenzene	mg/kg	0.5		70	-	-	-	-	-	-	-	-	-	-	6.8
	1,2-dibromo-3-chloropropane	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	<0.5
	1,2-dibromoethane	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	-
	1,2-dichlorobenzene	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	<0.5
	1,2-dichloroethane	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	<0.5
	1,2-dichloropropane	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	<0.5
	1,3,5-trimethylbenzene	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	1.8
	1,3-dichlorobenzene	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	<0.5
	1,3-dichloropropane	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	<0.5
	1,4-dichlorobenzene	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	<0.5
	2,2-dichloropropane	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	<0.5
	2-chlorotoluene	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	<0.5
	4-chlorotoluene	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	<0.5
	4-Methyl-2-pentanone	mg/kg	5			-	-	-	-	-	-	-	-	-	-	<5
	Bromobenzene	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	<0.5
	Bromodichloromethane	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	<0.5
	Bromoform	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	<0.5
	Bromomethane	mg/kg	5			-	-	-	-	-	-	-	-	-	-	<5
	Carbon disulfide	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	<0.5
	Carbon tetrachloride	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	<0.5
	Chlorobenzene	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	<0.5
	Chlorodibromomethane	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	<0.5
	Chloroethane	mg/kg	5			-	-	-	-	-	-	-	-	-	-	<5
	Chloroform	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	<0.5
	Chloromethane	mg/kg	5			-	-	-	-	-	-	-	-	-	-	<5
	cis-1,3-dichloropropene	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	<0.5
	cis-1,4-Dichloro-2-butene	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	<0.5
	Dibromomethane	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	<0.5
	Dichlorodifluoromethane	mg/kg	5			-	-	-	-	-	-	-	-	-	-	<5
	Hexachlorobutadiene	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	<0.5
	Iodomethane	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	<0.5
	Isophorone	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	<0.5
	Isopropylbenzene	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	<0.5
	n-butylbenzene	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	<0.5
	n-propylbenzene	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	<0.5
	Pentachloroethane	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	<0.5
	p-isopropyltoluene	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	<0.5

Field_ID	BH017 21.5-22	BH017 3.0-3.45	BH035_ 4.0-4.5	D1805-2	BH049_3.0-3.45	BH116 3.0_3.45	BH116 3.0_3.45	BH37_15.8-16.0	QC69	BH37_2.5-2.7	BH37_20.4-20.5
Lab_Report_Number	ES0605781	ES0605781	ES0606393	ES0606393	ES0606484	ES0607931	ES0608109	ES1003391	ES1003391	ES1003391	ES1003391
Location_Code	BH017	BH017	BH035	BH035	BH049	BH116	BH116	AECOM_BH37	AECOM_BH37	AECOM_BH37	AECOM_BH37
Sample_Depth_Range	21.5-22	3-3.45	4-4.5	4-4.5	3-3.45	3-3.45	3-3.45	15.8-16	15.8-16	2.5-2.7	20.4-20.5
Sampled_Date_Time	8/05/2006	8/05/2006	18/05/2006	18/05/2006	25/05/2006	28/06/2006	27/06/2006	18/02/2010	18/02/2010	17/02/2010	18/02/2010
Sample_Type	Normal	Normal	Normal	Field_D	Normal	Normal	Normal	Normal	Field_D	Normal	Normal

Chem_Group	ChemName	output unit	EQL	ISQG-High	SSTC-A & B											
	sec-butylbenzene	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	<0.5
	Styrene	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	6.1
	tert-butylbenzene	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	<0.5
	trans-1,2-dichloroethene	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	<0.5
	trans-1,3-dichloropropene	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	<0.5
	trans-1,4-Dichloro-2-butene	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	<0.5
	Trichlorofluoromethane	mg/kg	5			-	-	-	-	-	-	-	-	-	-	<5
	Vinyl acetate	mg/kg	5			-	-	-	-	-	-	-	-	-	-	<5

Notes:
All soil criteria in mg/kg
SSTC - Site Specific Target Criteria for Land Use Scenario
TPH - Total Petroleum Hydrocarbons
PAHs - Polycylic Aromatic Hydrocarbons
VOCs - Volatile Organic Compounds
SPOCAS - Suspension Peroxide Oxidation Combined Acidity & Sulfur
CPAH= Sum of 8 carcinogenic PAH Compounds (Benz(a)anthracene
Benzo(a) pyrene; Benzo(b)fluoranthene; Benzo(g,h,i)perylene;
Benzo(k)fluoranthene; Chrysene; Dibenz(a,h)anthracene; Indeno(1,2,3-

Field_ID	BH37_22.2-AUGER	BH37_5.5-5.7	BH37_5.5-5.7	BH37_8.3-8.5	QC67	QC68	BH38_11.5-11.7	BH38_14.5-14.7	BH38_2.5-2.7	BH38_20.5-20.7	BH38_8.5-8.7
Lab_Report_Number	ES1003391	ES1003391	ES1003432	ES1003391	ES1003391	47060	ES1003391	ES1003391	ES1003391	ES1003391	ES1003391
Location_Code	AECOM_BH37	AECOM_BH37	AECOM_BH37	AECOM_BH37	AECOM_BH37	AECOM_BH37	AECOM_BH38	AECOM_BH38	AECOM_BH38	AECOM_BH38	AECOM_BH38
Sample_Depth_Range	22.2	5.5-5.7	5.5-5.7	8.3-8.5	8.3-8.5	8.3-8.5	11.5-11.7	14.5-14.7	2.5-2.7	20.5-20.7	8.5-8.7
Sampled_Date_Time	18/02/2010	18/02/2010	18/02/2010	18/02/2010	18/02/2010	18/02/2010	19/02/2010	19/02/2010	19/02/2010	19/02/2010	19/02/2010
Sample_Type	Normal	Normal	Normal	Normal	Field_D	Interlab_D	Normal	Normal	Normal	Normal	Normal

Chem_Group	ChemName	output unit	EQL	ISQG-High	SSTC-A & B										
	CPAH (ESDAT)	mg/kg			130	94.1	<4	-	<4	<4	<3	<3	<4	-	<4	<4
	Pronamide	mg/kg	0.5			<0.6	-	-	-	-	-	<0.5	-	-	-	-
PAHs	CPAH (TEF)	mg/kg				29.156	<1.21	-	<1.21	<1.21	<1.11	<1.11	<1.21	-	<1.21	<1.21
	PAH (ESDAT TOTAL)	mg/kg				1536	<8	-	<8	<8	-	<7	1.4	-	<8	0.5
	PAH (total, NSW Waste 2008)	mg/kg				1536	<8	-	<8	<8	<7	<7	1.4	-	<8	0.5
	Sum of 10 PAHs	mg/kg				206.9	<5	-	<5	<5	<4	<4	0.5	-	<5	<5
	Sum of 5 PAHs	mg/kg				1329.1	<3	-	<3	<3	<3	<3	0.9	-	<3	0.5
	2-chloronaphthalene	mg/kg	0.5			<0.6	-	-	-	-	-	<0.5	-	-	-	-
	2-methylnaphthalene	mg/kg	0.5			396	-	-	-	-	-	<0.5	-	-	-	-
	3-methylcholanthrene	mg/kg	0.5			<0.6	-	-	-	-	-	<0.5	-	-	-	-
	Acenaphthene	mg/kg	0.5	**0.5**		16.1	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5
	Acenaphthylene	mg/kg	0.5	**0.64**		112	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5
	Acetophenone	mg/kg	0.5			<0.6	-	-	-	-	-	<0.5	-	-	-	-
	Anthracene	mg/kg	0.5	**1.1**		39.9	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5
	Benz(a)anthracene	mg/kg	0.5	**1.6**		35	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5
	Benzo(a) pyrene	mg/kg	0.5	**1.6**		22.8	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5
	Benzo(b)&(k)fluoranthene	mg/kg	1			18	-	-	-	-	<1	<1	-	-	-	-
	Benzo(b)fluoranthene	mg/kg	0.5			-	<0.5	-	<0.5	<0.5	-	-	<0.5	-	<0.5	<0.5
	Benzo(g,h,i)perylene	mg/kg	0.5			5.5	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5
	Benzo(k)fluoranthene	mg/kg	0.5			-	<0.5	-	<0.5	<0.5	-	-	<0.5	-	<0.5	<0.5
	Chrysene	mg/kg	0.5	**2.8**		**24.1**	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5
	Dibenz(a,h)anthracene	mg/kg	0.5	**0.26**		2.1	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5
	Fluoranthene	mg/kg	0.5	**5.1**		**44.6**	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5
	Fluorene	mg/kg	0.5	**0.54**		54.1	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5
	Indeno(1,2,3-c,d)pyrene	mg/kg	0.5			4.6	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5
	Naphthalene	mg/kg	0.5	**2.1**	320	**948**	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5
	PAHs (Sum of total)	mg/kg				-	-	-	-	-	0	-	-	-	-	-
	Phenanthrene	mg/kg	0.5	**1.5**		159	<0.5	-	<0.5	<0.5	<0.5	<0.5	0.9	-	<0.5	0.5
	Pyrene	mg/kg	0.5	**2.6**		**68.2**	<0.5	-	<0.5	<0.5	<0.5	<0.5	0.5	-	<0.5	<0.5
Phenols	2,4-dimethylphenol	mg/kg	0.5		36000	<0.6	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5
	2-methylphenol	mg/kg	0.5			<0.6	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5
	3-&4-methylphenol	mg/kg	0.5			<1.2	<1	-	<1	<1	<1	<0.5	<1	-	<1	<1
	Total Cresols	mg/kg	0.5		61,000	<0.6	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5
	2-nitrophenol	mg/kg	0.5			<0.6	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5
	4-chloro-3-methylphenol	mg/kg	0.5			<0.6	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5
	Phenol	mg/kg	0.5			<0.6	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5
	Phenolics Total	mg/kg				-	-	-	-	-	0	-	-	-	-	-
TPH	TPH C15-C36	mg/kg				-	<200	-	<200	<200	<200	-	<200	-	<200	<200
	TPH C10 - C14	mg/kg	50		19,000	-	<50	-	<50	<50	<50	-	<50	-	<50	<50
	TPH C15-C28	mg/kg	100			-	<100	-	<100	<100	<100	-	<100	-	<100	<100
	TPH C29-C36	mg/kg	100			-	<100	-	<100	<100	<100	-	<100	-	<100	<100
	TPH C6 - C9	mg/kg	2			-	<10	-	<10	<10	<10	-	<10	-	<10	<10
	TPH+C10 - C36 (Sum of total)	mg/kg	50			-	<50	-	<50	<50	<250 - 0	-	<50	-	<50	<50
BTEX	Total Xylene (ESDAT)	mg/kg				-	<1	-	<1	<1	<1.5 - 0	<1	<1	-	<1	<1
	Benzene	mg/kg	0.2		380	-	<0.2	-	<0.2	<0.2	<0.2	<0.2	<0.2	-	<0.2	<0.2
	Ethylbenzene	mg/kg	0.2			-	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5
	Toluene	mg/kg	0.2			-	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5
	Xylene (m & p)	mg/kg	0.2			-	<0.5	-	<0.5	<0.5	<1	<0.5	<0.5	-	<0.5	<0.5
	Xylene (o)	mg/kg	0.2			-	<0.5	-	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5
Cyanides	Cyanide (WAD)	mg/kg	1			-	-	-	-	-	-	-	-	-	-	-
Herbicides	Diallate	mg/kg	0.5			<0.6	-	-	-	-	-	-	-	-	-	-
Inorganics	Cyanide (Free)	mg/kg	1			-	-	-	-	-	<1	<1	<1	<1	-	<1	<1
	Cyanide Total	mg/kg	1			<1	<1	-	-	<1	<1	<1	<1	-	<1	<1
	Weak Acid Dissociable Cyanide	mg/kg	1			-	-	-	-	-	-	-	-	-	-	-
Metals	Arsenic	mg/kg	1			<5	<5	-	<5	<5	3	<5	<5	<5	<5	<5
	Barium	mg/kg	5			20	30	-	80	70	74	40	30	30	20	70
	Beryllium	mg/kg	1			<1	<1	-	<1	<1	<1	<1	<1	<1	<1	<1
	Cadmium	mg/kg	0.1	**10**		<1	<1	-	<1	<1	<0.1	<1	<1	<1	<1	<1
	Chromium	mg/kg	1	**370**		7	8	-	10	9	8	15	7	6	17	6
	Chromium (hexavalent)	mg/kg	0.5			<0.5	<0.5	-	-	<0.5	<1	<0.5	<0.5	-	<0.5	<0.5
	Cobalt	mg/kg	1			<2	3	-	6	7	7	5	2	<2	<2	<2
	Copper	mg/kg	2	**270**		<5	<5	-	<5	6	4	5	7	15	<5	8
	Iron	mg/kg	10			9810	8730	-	-	20,000	22,600	-	-	-	-	8210
	Lead	mg/kg	2	**220**	11000	10	20	-	11	15	14	14	9	31	9	42
	Manganese	mg/kg	5			11	125	-	329	486	418	345	183	185	<5	167
	Mercury	mg/kg	0.05	**1**		<0.1	<0.1	-	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1	<0.1	<0.1
	Nickel	mg/kg	1	**52**		<2	5	-	9	11	10	7	3	3	<2	4
	Vanadium	mg/kg	5			15	15	-	16	17	13	22	10	14	34	11
	Zinc	mg/kg	5	**410**		6	28	-	46	46	41	31	26	57	<5	53

Field_ID	BH37_22.2-AUGER	BH37_5.5-5.7	BH37_5.5-5.7	BH37_8.3-8.5	QC67	QC68	BH38_11.5-11.7	BH38_14.5-14.7	BH38_2.5-2.7	BH38_20.5-20.7	BH38_8.5-8.7
Lab_Report_Number	ES1003391	ES1003391	ES1003432	ES1003391	ES1003391	47060	ES1003391	ES1003391	ES1003391	ES1003391	ES1003391
Location_Code	AECOM_BH37	AECOM_BH37	AECOM_BH37	AECOM_BH37	AECOM_BH37	AECOM_BH37	AECOM_BH38	AECOM_BH38	AECOM_BH38	AECOM_BH38	AECOM_BH38
Sample_Depth_Range	22.2	5.5-5.7	5.5-5.7	8.3-8.5	8.3-8.5	8.3-8.5	11.5-11.7	14.5-14.7	2.5-2.7	20.5-20.7	8.5-8.7
Sampled_Date_Time	18/02/2010	18/02/2010	18/02/2010	18/02/2010	18/02/2010	18/02/2010	19/02/2010	19/02/2010	19/02/2010	19/02/2010	19/02/2010
Sample_Type	Normal	Normal	Normal	Normal	Field_D	Interlab_D	Normal	Normal	Normal	Normal	Normal

Chem_Group	ChemName	output unit	EQL	ISQG-High	SSTC-A & B										
SPOCAS	Acid Reacted Calcium	%	0.02			-	-	-	-	-	-	-	-	-	-	-
	acidity - Acid Reacted Calcium	mole H+/t	10			-	-	-	-	-	-	-	-	-	-	-
	acidity - Acid Reacted Magnesium	mole H+/t	10			-	-	-	-	-	-	-	-	-	-	-
	acidity - Peroxide Oxidisable Sulfur	mole H+/t	10			-	-	-	-	-	-	-	-	-	-	-
	ANC Fineness Factor	-	0.5			-	-	-	-	-	-	-	-	-	-	-
	Calcium in Peroxide	%	0.02			-	-	-	-	-	-	-	-	-	-	-
	KCl Extractable Calcium	%	0.02			-	-	-	-	-	-	-	-	-	-	-
	KCl Extractable Magnesium	%	0.02			-	-	-	-	-	-	-	-	-	-	-
	Liming Rate	kg CaCO3/t	1			-	-	-	-	-	-	-	-	-	-	-
	Magnesium in Peroxide	%	0.02			-	-	-	-	-	-	-	-	-	-	-
	Net Acidity (acidity units)	mole H+/t	10			-	-	-	-	-	-	-	-	-	-	-
	Net Acidity (sulfur units)	%S	0.02			-	-	-	-	-	-	-	-	-	-	-
	Peroxide Oxidisable Sulfur	%	0.02			-	-	-	-	-	-	-	-	-	-	-
	pH (KCl)	pH Unit	0.1			-	-	-	-	-	-	-	-	-	-	-
	pH (Ox)	pH Unit	0.1			-	-	-	-	-	-	-	-	-	-	-
	sulfidic - Acid Reacted Calcium	% S	0.02			-	-	-	-	-	-	-	-	-	-	-
	sulfidic - Acid Reacted Magnesium	%S	0.02			-	-	-	-	-	-	-	-	-	-	-
	sulfidic - Titratable Actual Acidity	%S	0.02			-	-	-	-	-	-	-	-	-	-	-
	sulfidic - Titratable Peroxide Acidity	%S	0.02			-	-	-	-	-	-	-	-	-	-	-
	sulfidic - Titratable Sulfidic Acidity	%S	0.02			-	-	-	-	-	-	-	-	-	-	-
	Sulfur in Peroxide	%	0.02			-	-	-	-	-	-	-	-	-	-	-
	Titratable Actual Acidity	mole H+/t	2			-	-	-	-	-	-	-	-	-	-	-
VOCs	1,1,1,2-tetrachloroethane	mg/kg	0.5			-	-	-	-	-	-	<0.5	-	-	-	-
	1,1,1-trichloroethane	mg/kg	0.5			-	-	-	-	-	-	<0.5	-	-	-	-
	1,1,2,2-tetrachloroethane	mg/kg	0.5			-	-	-	-	-	-	<0.5	-	-	-	-
	1,1,2-trichloroethane	mg/kg	0.5			-	-	-	-	-	-	<0.5	-	-	-	-
	1,1-dichloroethane	mg/kg	0.5			-	-	-	-	-	-	<0.5	-	-	-	-
	1,1-dichloroethene	mg/kg	0.5			-	-	-	-	-	-	<0.5	-	-	-	-
	1,1-dichloropropene	mg/kg	0.5			-	-	-	-	-	-	<0.5	-	-	-	-
	1,2,3-trichlorobenzene	mg/kg	0.5			-	-	-	-	-	-	<0.5	-	-	-	-
	1,2,3-trichloropropane	mg/kg	0.5			-	-	-	-	-	-	<0.5	-	-	-	-
	1,2,4-trichlorobenzene	mg/kg	0.5			<0.6	-	-	-	-	-	<0.5	-	-	-	-
	1,2,4-trimethylbenzene	mg/kg	0.5		70	-	-	-	-	-	-	<0.5	-	-	-	-
	1,2-dibromo-3-chloropropane	mg/kg	0.5			-	-	-	-	-	-	<0.5	-	-	-	-
	1,2-dibromoethane	mg/kg	0.5			-	-	-	-	-	-	-	-	-	-	-
	1,2-dichlorobenzene	mg/kg	0.5			<0.6	-	-	-	-	-	<0.5	-	-	-	-
	1,2-dichloroethane	mg/kg	0.5			-	-	-	-	-	-	<0.5	-	-	-	-
	1,2-dichloropropane	mg/kg	0.5			-	-	-	-	-	-	<0.5	-	-	-	-
	1,3,5-trimethylbenzene	mg/kg	0.5			-	-	-	-	-	-	<0.5	-	-	-	-
	1,3-dichlorobenzene	mg/kg	0.5			<0.6	-	-	-	-	-	<0.5	-	-	-	-
	1,3-dichloropropane	mg/kg	0.5			-	-	-	-	-	-	<0.5	-	-	-	-
	1,4-dichlorobenzene	mg/kg	0.5			<0.6	-	-	-	-	-	<0.5	-	-	-	-
	2,2-dichloropropane	mg/kg	0.5			-	-	-	-	-	-	<0.5	-	-	-	-
	2-chlorotoluene	mg/kg	0.5			-	-	-	-	-	-	<0.5	-	-	-	-
	4-chlorotoluene	mg/kg	0.5			-	-	-	-	-	-	<0.5	-	-	-	-
	4-Methyl-2-pentanone	mg/kg	5			-	-	-	-	-	-	<5	-	-	-	-
	Bromobenzene	mg/kg	0.5			-	-	-	-	-	-	<0.5	-	-	-	-
	Bromodichloromethane	mg/kg	0.5			-	-	-	-	-	-	<0.5	-	-	-	-
	Bromoform	mg/kg	0.5			-	-	-	-	-	-	<0.5	-	-	-	-
	Bromomethane	mg/kg	5			-	-	-	-	-	-	<5	-	-	-	-
	Carbon disulfide	mg/kg	0.5			-	-	-	-	-	-	<0.5	-	-	-	-
	Carbon tetrachloride	mg/kg	0.5			-	-	-	-	-	-	<0.5	-	-	-	-
	Chlorobenzene	mg/kg	0.5			-	-	-	-	-	-	<0.5	-	-	-	-
	Chlorodibromomethane	mg/kg	0.5			-	-	-	-	-	-	<0.5	-	-	-	-
	Chloroethane	mg/kg	5			-	-	-	-	-	-	<5	-	-	-	-
	Chloroform	mg/kg	0.5			-	-	-	-	-	-	<0.5	-	-	-	-
	Chloromethane	mg/kg	5			-	-	-	-	-	-	<5	-	-	-	-
	cis-1,3-dichloropropene	mg/kg	0.5			-	-	-	-	-	-	<0.5	-	-	-	-
	cis-1,4-Dichloro-2-butene	mg/kg	0.5			-	-	-	-	-	-	<0.5	-	-	-	-
	Dibromomethane	mg/kg	0.5			-	-	-	-	-	-	<0.5	-	-	-	-
	Dichlorodifluoromethane	mg/kg	5			-	-	-	-	-	-	<5	-	-	-	-
	Hexachlorobutadiene	mg/kg	0.5			<0.6	-	-	-	-	-	<0.5	-	-	-	-
	Iodomethane	mg/kg	0.5			-	-	-	-	-	-	<0.5	-	-	-	-
	Isophorone	mg/kg	0.5			<0.6	-	-	-	-	-	<0.5	-	-	-	-
	Isopropylbenzene	mg/kg	0.5			-	-	-	-	-	-	<0.5	-	-	-	-
	n-butylbenzene	mg/kg	0.5			-	-	-	-	-	-	<0.5	-	-	-	-
	n-propylbenzene	mg/kg	0.5			-	-	-	-	-	-	<0.5	-	-	-	-
	Pentachloroethane	mg/kg	0.5			-	-	-	-	-	-	<0.5	-	-	-	-
	p-isopropyltoluene	mg/kg	0.5			-	-	-	-	-	-	<0.5	-	-	-	-

Field_ID	BH37_22.2-AUGER	BH37_5.5-5.7	BH37_5.5-5.7	BH37_8.3-8.5	QC67	QC68	BH38_11.5-11.7	BH38_14.5-14.7	BH38_2.5-2.7	BH38_20.5-20.7	BH38_8.5-8.7
Lab_Report_Number	ES1003391	ES1003391	ES1003432	ES1003391	ES1003391	47060	ES1003391	ES1003391	ES1003391	ES1003391	ES1003391
Location_Code	AECOM_BH37	AECOM_BH37	AECOM_BH37	AECOM_BH37	AECOM_BH37	AECOM_BH37	AECOM_BH38	AECOM_BH38	AECOM_BH38	AECOM_BH38	AECOM_BH38
Sample_Depth_Range	22.2	5.5-5.7	5.5-5.7	8.3-8.5	8.3-8.5	8.3-8.5	11.5-11.7	14.5-14.7	2.5-2.7	20.5-20.7	8.5-8.7
Sampled_Date_Time	18/02/2010	18/02/2010	18/02/2010	18/02/2010	18/02/2010	18/02/2010	19/02/2010	19/02/2010	19/02/2010	19/02/2010	19/02/2010
Sample_Type	Normal	Normal	Normal	Normal	Field_D	Interlab_D	Normal	Normal	Normal	Normal	Normal

Chem_Group	ChemName	output unit	EQL	ISQG-High	SSTC-A & B											
	sec-butylbenzene	mg/kg	0.5			-	-	-	-	-	-	<0.5	-	-	-	-
	Styrene	mg/kg	0.5			-	-	-	-	-	-	<0.5	-	-	-	-
	tert-butylbenzene	mg/kg	0.5			-	-	-	-	-	-	<0.5	-	-	-	-
	trans-1,2-dichloroethene	mg/kg	0.5			-	-	-	-	-	-	<0.5	-	-	-	-
	trans-1,3-dichloropropene	mg/kg	0.5			-	-	-	-	-	-	<0.5	-	-	-	-
	trans-1,4-Dichloro-2-butene	mg/kg	0.5			-	-	-	-	-	-	<0.5	-	-	-	-
	Trichlorofluoromethane	mg/kg	5			-	-	-	-	-	-	<5	-	-	-	-
	Vinyl acetate	mg/kg	5			-	-	-	-	-	-	<5	-	-	-	-

Notes:
All soil criteria in mg/kg
SSTC - Site Specific Target Criteria for Land Use Scenario
TPH - Total Petroleum Hydrocarbons
PAHs - Polycylic Aromatic Hydrocarbons
VOCs - Volatile Organic Compounds
SPOCAS - Suspension Peroxide Oxidation Combined Acidity & Sulfur
CPAH= Sum of 8 carcinogenic PAH Compounds (Benz(a)anthracene Benzo(a) pyrene; Benzo(b)fluoranthene; Benzo(g,h,i)perylene; Benzo(k)fluoranthene; Chrysene; Dibenz(a,h)anthracene; Indeno(1,2,3-

Field_ID	QC70	QC71	BH39-11.5-11.7	BH39-16.0-16.2	QC101	QC102	BH39-2.5-2.7	BH39-20.5-20.7	BH39-4.0-4.2	BH39-7.0-7.2	BH40_13.0-13.2	BH40_16.5-16.7
Lab_Report_Number	ES1003391	ES1003391	ES1003671	ES1003671	ES1003671	47097	ES1003671	ES1003671	ES1003671	ES1003671	ES1003390	ES1003390
Location_Code	AECOM_BH38	AECOM_BH38	AECOM_BH39	AECOM_BH39	AECOM_BH39	AECOM_BH39	AECOM_BH39	AECOM_BH39	AECOM_BH39	AECOM_BH39	AECOM_BH40	AECOM_BH40
Sample_Depth_Range	8.5-8.7	8.5-8.7	11.5-11.7	16-16.2	16-16.2	16-16.2	2.5-2.7	20.5-20.7	4-4.2	7-7.2	13-13.2	16.5-16.7
Sampled_Date_Time	19/02/2010	19/02/2010	24/02/2010	24/02/2010	24/02/2010	24/02/2010	23/02/2010	24/02/2010	24/02/2010	24/02/2010	18/02/2010	18/02/2010
Sample_Type	Field_D	Interlab_D	Normal	Normal	Field_D	Interlab_D	Normal	Normal	Normal	Normal	Normal	Normal

Chem_Group	ChemName	output unit	EQL	ISQG-High	SSTC-A & B											
	CPAH (ESDAT)	mg/kg			130	<4	<4	<4	<4	<4	<3	-	<3	<4	-	-	25.8
	Pronamide	mg/kg	0.5			-	-	-	-	-	-	-	<0.5	-	-	-	<0.5
PAHs	CPAH (TEF)	mg/kg				<1.21	<1.21	<1.21	<1.21	<1.21	<1.11	-	<1.11	<1.21	-	-	8.52
	PAH (ESDAT TOTAL)	mg/kg				<8	1.1	<8	<8	2	<7	-	<7	<8	-	-	288.6
	PAH (total, NSW Waste 2008)	mg/kg				<8	1.1	<8	<8	2	<7	-	<7	<8	-	-	288.6
	Sum of 10 PAHs	mg/kg				<5	0.6	<5	<5	2	<4	-	<4	<5	-	-	76.8
	Sum of 5 PAHs	mg/kg				<3	0.5	<3	<3	<3	<3	-	<3	<3	-	-	211.8
	2-chloronaphthalene	mg/kg	0.5			-	-	-	-	-	-	-	<0.5	-	-	-	<0.5
	2-methylnaphthalene	mg/kg	0.5			-	-	-	-	-	-	-	<0.5	-	-	-	28.6
	3-methylcholanthrene	mg/kg	0.5			-	-	-	-	-	-	-	<0.5	-	-	-	<0.5
	Acenaphthene	mg/kg	0.5	**0.5**		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	-	-	2.5
	Acenaphthylene	mg/kg	0.5	**0.64**		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	-	-	13.1
	Acetophenone	mg/kg	0.5			-	-	-	-	-	-	-	<0.5	-	-	-	<0.5
	Anthracene	mg/kg	0.5	**1.1**		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	-	-	10
	Benz(a)anthracene	mg/kg	0.5	**1.6**		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	-	-	8.4
	Benzo(a) pyrene	mg/kg	0.5	**1.6**		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	-	-	6.8
	Benzo(b)&(k)fluoranthene	mg/kg	1			-	-	-	-	-	<1	-	<1	-	-	-	6
	Benzo(b)fluoranthene	mg/kg	0.5			<0.5	<0.5	<0.5	<0.5	<0.5	-	-	-	<0.5	-	-	-
	Benzo(g,h,i)perylene	mg/kg	0.5			<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	-	-	2
	Benzo(k)fluoranthene	mg/kg	0.5			<0.5	<0.5	<0.5	<0.5	<0.5	-	-	-	<0.5	-	-	-
	Chrysene	mg/kg	0.5	**2.8**		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	-	-	**6**
	Dibenz(a,h)anthracene	mg/kg	0.5	**0.26**		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	-	-	0.6
	Fluoranthene	mg/kg	0.5	**5.1**		<0.5	<0.5	<0.5	<0.5	1	<0.5	-	<0.5	<0.5	-	-	**31.8**
	Fluorene	mg/kg	0.5	**0.54**		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	-	-	12.6
	Indeno(1,2,3-c,d)pyrene	mg/kg	0.5			<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	-	-	2
	Naphthalene	mg/kg	0.5	**2.1**	320	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	-	-	137
	PAHs (Sum of total)	mg/kg				-	-	-	-	-	0	-	-	-	-	-	-
	Phenanthrene	mg/kg	0.5	**1.5**		<0.5	0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	-	-	36.6
	Pyrene	mg/kg	0.5	**2.6**		<0.5	0.6	<0.5	<0.5	1	<0.5	-	<0.5	<0.5	-	-	**19.2**
Phenols	2,4-dimethylphenol	mg/kg	0.5		36000	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	-	-	5.9
	2-methylphenol	mg/kg	0.5			<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	-	-	<0.5
	3-&4-methylphenol	mg/kg	0.5			<1	<1	<1	<1	<1	<1	-	<0.5	<1	-	-	3
	Total Cresols	mg/kg	0.5		61,000	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	-	-	3
	2-nitrophenol	mg/kg	0.5			<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	-	-	<0.5
	4-chloro-3-methylphenol	mg/kg	0.5			<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	-	-	<0.5
	Phenol	mg/kg	0.5			<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	-	-	<0.5
	Phenolics Total	mg/kg				-	-	-	-	-	0	-	-	-	-	-	-
TPH	TPH C15-C36	mg/kg				<200	<200	<200	<200	<200	<200	-	<200	<200	-	-	-
	TPH C10 - C14	mg/kg	50		19,000	<50	<50	<50	<50	<50	<50	-	<50	<50	-	-	-
	TPH C15-C28	mg/kg	100			<100	<100	<100	<100	<100	<100	-	<100	<100	-	-	-
	TPH C29-C36	mg/kg	100			<100	<100	<100	<100	<100	<100	-	<100	<100	-	-	-
	TPH C6 - C9	mg/kg	2			<10	<10	<10	<10	<10	<10	-	<10	<10	-	-	-
	TPH+C10 - C36 (Sum of total)	mg/kg	50			<50	<50	<50	<50	<50	<250 - 0	-	<50	<50	-	-	-
BTEX	Total Xylene (ESDAT)	mg/kg				<1	<1	<1	<1	<1	<1.5 - 0	-	<1	<1	-	-	22.8
	Benzene	mg/kg	0.2		380	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	-	<0.2	<0.2	-	-	5.4
	Ethylbenzene	mg/kg	0.2			<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	-	-	1.3
	Toluene	mg/kg	0.2			<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	-	-	14
	Xylene (m & p)	mg/kg	0.2			<0.5	<0.5	<0.5	<0.5	<0.5	<1	-	<0.5	<0.5	-	-	17.2
	Xylene (o)	mg/kg	0.2			<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5	<0.5	-	-	5.6
Cyanides	Cyanide (WAD)	mg/kg	1			-	-	-	-	-	<1	-	-	-	-	-	-
Herbicides	Diallate	mg/kg	0.5			-	-	-	-	-	-	-	<0.5	-	-	-	-
Inorganics	Cyanide (Free)	mg/kg	1			<1	<1	-	<1	<1	<1	-	<1	-	-	-	<1
	Cyanide Total	mg/kg	1			<1	<1	-	-	-	-	-	-	-	-	-	-
	Weak Acid Dissociable Cyanide	mg/kg	1			-	-	-	<1	<1	-	-	<1	-	-	-	<1
Metals	Arsenic	mg/kg	1			<5	<5	<5	<5	<5	<1	<5	<5	<5	<5	<5	20
	Barium	mg/kg	5			80	80	20	20	20	9	110	10	110	30	<10	<10
	Beryllium	mg/kg	1			<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
	Cadmium	mg/kg	0.1	**10**		<1	<1	<1	<1	<1	<0.1	<1	<1	<1	<1	<1	<1
	Chromium	mg/kg	1	**370**		6	8	7	7	10	7	8	4	10	12	4	22
	Chromium (hexavalent)	mg/kg	0.5			2	<0.5	-	-	-	-	-	-	-	-	-	<0.5
	Cobalt	mg/kg	1			<2	2	<2	<2	<2	<1	3	<2	3	2	<2	<2
	Copper	mg/kg	2	**270**		11	12	<5	<5	6	2	<5	<5	<5	<5	<5	<5
	Iron	mg/kg	10			8350	8520	-	-	-	-	-	-	-	-	-	17,800
	Lead	mg/kg	2	**220**	11000	48	74	<5	5	11	10	6	<5	7	6	8	6
	Manganese	mg/kg	5			145	186	134	<5	6	<5	156	<5	206	200	77	<5
	Mercury	mg/kg	0.05	**1**		<0.1	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Nickel	mg/kg	1	**52**		4	4	<2	<2	<2	1	3	<2	3	3	<2	<2
	Vanadium	mg/kg	5			12	14	7	14	25	9	10	<5	11	12	8	86
	Zinc	mg/kg	5	**410**		60	81	8	<5	8	<5	18	<5	16	23	36	<5

Field_ID	QC70	QC71	BH39-11.5-11.7	BH39-16.0-16.2	QC101	QC102	BH39-2.5-2.7	BH39-20.5-20.7	BH39-4.0-4.2	BH39-7.0-7.2	BH40_13.0-13.2	BH40_16.5-16.7
Lab_Report_Number	ES1003391	ES1003391	ES1003671	ES1003671	ES1003671	47097	ES1003671	ES1003671	ES1003671	ES1003671	ES1003390	ES1003390
Location_Code	AECOM_BH38	AECOM_BH38	AECOM_BH39	AECOM_BH39	AECOM_BH39	AECOM_BH39	AECOM_BH39	AECOM_BH39	AECOM_BH39	AECOM_BH39	AECOM_BH40	AECOM_BH40
Sample_Depth_Range	8.5-8.7	8.5-8.7	11.5-11.7	16-16.2	16-16.2	16-16.2	2.5-2.7	20.5-20.7	4-4.2	7-7.2	13-13.2	16.5-16.7
Sampled_Date_Time	19/02/2010	19/02/2010	24/02/2010	24/02/2010	24/02/2010	24/02/2010	23/02/2010	24/02/2010	24/02/2010	24/02/2010	18/02/2010	18/02/2010
Sample_Type	Field_D	Interlab_D	Normal	Normal	Field_D	Interlab_D	Normal	Normal	Normal	Normal	Normal	Normal

Chem_Group	ChemName	output unit	EQL	ISQG-High	SSTC-A & B											
SPOCAS	Acid Reacted Calcium	%	0.02			-	-	-	-	-	-	-	-	-	-	-	-
	acidity - Acid Reacted Calcium	mole H+/t	10			-	-	-	-	-	-	-	-	-	-	-	-
	acidity - Acid Reacted Magnesium	mole H+/t	10			-	-	-	-	-	-	-	-	-	-	-	-
	acidity - Peroxide Oxidisable Sulfur	mole H+/t	10			-	-	-	-	-	-	-	-	-	-	-	-
	ANC Fineness Factor	-	0.5			-	-	-	-	-	-	-	-	-	-	-	-
	Calcium in Peroxide	%	0.02			-	-	-	-	-	-	-	-	-	-	-	-
	KCl Extractable Calcium	%	0.02			-	-	-	-	-	-	-	-	-	-	-	-
	KCl Extractable Magnesium	%	0.02			-	-	-	-	-	-	-	-	-	-	-	-
	Liming Rate	kg CaCO3/t	1			-	-	-	-	-	-	-	-	-	-	-	-
	Magnesium in Peroxide	%	0.02			-	-	-	-	-	-	-	-	-	-	-	-
	Net Acidity (acidity units)	mole H+/t	10			-	-	-	-	-	-	-	-	-	-	-	-
	Net Acidity (sulfur units)	%S	0.02			-	-	-	-	-	-	-	-	-	-	-	-
	Peroxide Oxidisable Sulfur	%	0.02			-	-	-	-	-	-	-	-	-	-	-	-
	pH (KCl)	pH Unit	0.1			-	-	-	-	-	-	-	-	-	-	-	-
	pH (Ox)	pH Unit	0.1			-	-	-	-	-	-	-	-	-	-	-	-
	sulfidic - Acid Reacted Calcium	% S	0.02			-	-	-	-	-	-	-	-	-	-	-	-
	sulfidic - Acid Reacted Magnesium	%S	0.02			-	-	-	-	-	-	-	-	-	-	-	-
	sulfidic - Titratable Actual Acidity	%S	0.02			-	-	-	-	-	-	-	-	-	-	-	-
	sulfidic - Titratable Peroxide Acidity	%S	0.02			-	-	-	-	-	-	-	-	-	-	-	-
	sulfidic - Titratable Sulfidic Acidity	%S	0.02			-	-	-	-	-	-	-	-	-	-	-	-
	Sulfur in Peroxide	%	0.02			-	-	-	-	-	-	-	-	-	-	-	-
	Titratable Actual Acidity	mole H+/t	2			-	-	-	-	-	-	-	-	-	-	-	-
VOCs	1,1,1,2-tetrachloroethane	mg/kg	0.5			-	-	-	-	-	-	-	<0.5	-	-	-	<0.5
	1,1,1-trichloroethane	mg/kg	0.5			-	-	-	-	-	-	-	<0.5	-	-	-	<0.5
	1,1,2,2-tetrachloroethane	mg/kg	0.5			-	-	-	-	-	-	-	<0.5	-	-	-	<0.5
	1,1,2-trichloroethane	mg/kg	0.5			-	-	-	-	-	-	-	<0.5	-	-	-	<0.5
	1,1-dichloroethane	mg/kg	0.5			-	-	-	-	-	-	-	<0.5	-	-	-	<0.5
	1,1-dichloroethene	mg/kg	0.5			-	-	-	-	-	-	-	<0.5	-	-	-	<0.5
	1,1-dichloropropene	mg/kg	0.5			-	-	-	-	-	-	-	<0.5	-	-	-	<0.5
	1,2,3-trichlorobenzene	mg/kg	0.5			-	-	-	-	-	-	-	<0.5	-	-	-	<0.5
	1,2,3-trichloropropane	mg/kg	0.5			-	-	-	-	-	-	-	<0.5	-	-	-	<0.5
	1,2,4-trichlorobenzene	mg/kg	0.5			-	-	-	-	-	-	-	<0.5	-	-	-	<0.5
	1,2,4-trimethylbenzene	mg/kg	0.5		70	-	-	-	-	-	-	-	<0.5	-	-	-	7.5
	1,2-dibromo-3-chloropropane	mg/kg	0.5			-	-	-	-	-	-	-	<0.5	-	-	-	<0.5
	1,2-dibromoethane	mg/kg	0.5			-	-	-	-	-	-	-	<0.5	-	-	-	-
	1,2-dichlorobenzene	mg/kg	0.5			-	-	-	-	-	-	-	<0.5	-	-	-	<0.5
	1,2-dichloroethane	mg/kg	0.5			-	-	-	-	-	-	-	<0.5	-	-	-	<0.5
	1,2-dichloropropane	mg/kg	0.5			-	-	-	-	-	-	-	<0.5	-	-	-	<0.5
	1,3,5-trimethylbenzene	mg/kg	0.5			-	-	-	-	-	-	-	<0.5	-	-	-	3
	1,3-dichlorobenzene	mg/kg	0.5			-	-	-	-	-	-	-	<0.5	-	-	-	<0.5
	1,3-dichloropropane	mg/kg	0.5			-	-	-	-	-	-	-	<0.5	-	-	-	<0.5
	1,4-dichlorobenzene	mg/kg	0.5			-	-	-	-	-	-	-	<0.5	-	-	-	<0.5
	2,2-dichloropropane	mg/kg	0.5			-	-	-	-	-	-	-	<0.5	-	-	-	<0.5
	2-chlorotoluene	mg/kg	0.5			-	-	-	-	-	-	-	<0.5	-	-	-	<0.5
	4-chlorotoluene	mg/kg	0.5			-	-	-	-	-	-	-	<0.5	-	-	-	<0.5
	4-Methyl-2-pentanone	mg/kg	5			-	-	-	-	-	-	-	<5	-	-	-	<5
	Bromobenzene	mg/kg	0.5			-	-	-	-	-	-	-	<0.5	-	-	-	<0.5
	Bromodichloromethane	mg/kg	0.5			-	-	-	-	-	-	-	<0.5	-	-	-	<0.5
	Bromoform	mg/kg	0.5			-	-	-	-	-	-	-	<0.5	-	-	-	<0.5
	Bromomethane	mg/kg	5			-	-	-	-	-	-	-	<5	-	-	-	<5
	Carbon disulfide	mg/kg	0.5			-	-	-	-	-	-	-	<0.5	-	-	-	<0.5
	Carbon tetrachloride	mg/kg	0.5			-	-	-	-	-	-	-	<0.5	-	-	-	<0.5
	Chlorobenzene	mg/kg	0.5			-	-	-	-	-	-	-	<0.5	-	-	-	<0.5
	Chlorodibromomethane	mg/kg	0.5			-	-	-	-	-	-	-	<0.5	-	-	-	<0.5
	Chloroethane	mg/kg	5			-	-	-	-	-	-	-	<5	-	-	-	<5
	Chloroform	mg/kg	0.5			-	-	-	-	-	-	-	<0.5	-	-	-	<0.5
	Chloromethane	mg/kg	5			-	-	-	-	-	-	-	<5	-	-	-	<5
	cis-1,3-dichloropropene	mg/kg	0.5			-	-	-	-	-	-	-	<0.5	-	-	-	<0.5
	cis-1,4-Dichloro-2-butene	mg/kg	0.5			-	-	-	-	-	-	-	<0.5	-	-	-	<0.5
	Dibromomethane	mg/kg	0.5			-	-	-	-	-	-	-	<0.5	-	-	-	<0.5
	Dichlorodifluoromethane	mg/kg	5			-	-	-	-	-	-	-	<5	-	-	-	<5
	Hexachlorobutadiene	mg/kg	0.5			-	-	-	-	-	-	-	<0.5	-	-	-	<0.5
	Iodomethane	mg/kg	0.5			-	-	-	-	-	-	-	<0.5	-	-	-	<0.5
	Isophorone	mg/kg	0.5			-	-	-	-	-	-	-	<0.5	-	-	-	<0.5
	Isopropylbenzene	mg/kg	0.5			-	-	-	-	-	-	-	<0.5	-	-	-	<0.5
	n-butylbenzene	mg/kg	0.5			-	-	-	-	-	-	-	<0.5	-	-	-	<0.5
	n-propylbenzene	mg/kg	0.5			-	-	-	-	-	-	-	<0.5	-	-	-	<0.5
	Pentachloroethane	mg/kg	0.5			-	-	-	-	-	-	-	<0.5	-	-	-	<0.5
	p-isopropyltoluene	mg/kg	0.5			-	-	-	-	-	-	-	<0.5	-	-	-	<0.5

Field_ID	QC70	QC71	BH39-11.5-11.7	BH39-16.0-16.2	QC101	QC102	BH39-2.5-2.7	BH39-20.5-20.7	BH39-4.0-4.2	BH39-7.0-7.2	BH40_13.0-13.2	BH40_16.5-16.7
Lab_Report_Number	ES1003391	ES1003391	ES1003671	ES1003671	ES1003671	47097	ES1003671	ES1003671	ES1003671	ES1003671	ES1003390	ES1003390
Location_Code	AECOM_BH38	AECOM_BH38	AECOM_BH39	AECOM_BH39	AECOM_BH39	AECOM_BH39	AECOM_BH39	AECOM_BH39	AECOM_BH39	AECOM_BH39	AECOM_BH40	AECOM_BH40
Sample_Depth_Range	8.5-8.7	8.5-8.7	11.5-11.7	16-16.2	16-16.2	16-16.2	2.5-2.7	20.5-20.7	4-4.2	7-7.2	13-13.2	16.5-16.7
Sampled_Date_Time	19/02/2010	19/02/2010	24/02/2010	24/02/2010	24/02/2010	24/02/2010	23/02/2010	24/02/2010	24/02/2010	24/02/2010	18/02/2010	18/02/2010
Sample_Type	Field_D	Interlab_D	Normal	Normal	Field_D	Interlab_D	Normal	Normal	Normal	Normal	Normal	Normal

Chem_Group	ChemName	output unit	EQL	ISQG-High	SSTC-A & B											
	sec-butylbenzene	mg/kg	0.5			-	-	-	-	-	-	-	<0.5	-	-	-	<0.5
	Styrene	mg/kg	0.5			-	-	-	-	-	-	-	<0.5	-	-	-	6.7
	tert-butylbenzene	mg/kg	0.5			-	-	-	-	-	-	-	<0.5	-	-	-	<0.5
	trans-1,2-dichloroethene	mg/kg	0.5			-	-	-	-	-	-	-	<0.5	-	-	-	<0.5
	trans-1,3-dichloropropene	mg/kg	0.5			-	-	-	-	-	-	-	<0.5	-	-	-	<0.5
	trans-1,4-Dichloro-2-butene	mg/kg	0.5			-	-	-	-	-	-	-	<0.5	-	-	-	<0.5
	Trichlorofluoromethane	mg/kg	5			-	-	-	-	-	-	-	<5	-	-	-	<5
	Vinyl acetate	mg/kg	5			-	-	-	-	-	-	-	<5	-	-	-	<5

Notes:
All soil criteria in mg/kg
SSTC - Site Specific Target Criteria for Land Use Scenario
TPH - Total Petroleum Hydrocarbons
PAHs - Polycylic Aromatic Hydrocarbons
VOCs - Volatile Organic Compounds
SPOCAS - Suspension Peroxide Oxidation Combined Acidity & Sulfur
CPAH= Sum of 8 carcinogenic PAH Compounds (Benz(a)anthracene Benzo(a) pyrene; Benzo(b)fluoranthene; Benzo(g,h,i)perylene; Benzo(k)fluoranthene; Chrysene; Dibenz(a,h)anthracene; Indeno(1,2,3-

Field_ID	BH40_17.8-18.0	BH40_17.8-18.0	BH40_19.0-19.4	BH40_7.0-7.2	BH40_8.5-8.7	QC54	BH46-14.5-14.7	BH46-19.0-19.2	BH46-19.0-19.2	BH46-20.5-20.7	BH46-23.5-23.7
Lab_Report_Number	ES1003390	ES1003431	ES1003390	ES1003390	ES1003390	ES1003390	ES1003671	ES1003671	ES1003673	ES1003671	ES1003671
Location_Code	AECOM_BH40	AECOM_BH40	AECOM_BH40	AECOM_BH40	AECOM_BH40	AECOM_BH40	AECOM_BH46	AECOM_BH46	AECOM_BH46	AECOM_BH46	AECOM_BH46
Sample_Depth_Range	17.8-18	17.8-18	19-19.4	7-7.2	8.5-8.7	8.5-8.7	14.5-14.7	19-19.2	19-19.2	20.5-20.7	23.5-23.7
Sampled_Date_Time	18/02/2010	18/02/2010	18/02/2010	18/02/2010	18/02/2010	18/02/2010	23/02/2010	23/02/2010	23/02/2010	23/02/2010	23/02/2010
Sample_Type	Normal	Normal	Normal	Normal	Normal	Field_D	Normal	Normal	Normal	Normal	Normal

Chem_Group	ChemName	output unit	EQL	ISQG-High	SSTC-A & B										
	CPAH (ESDAT)	mg/kg			130	<3	-	4.3	<4	-	<4	67.7	<3	-	<4	<4
	Pronamide	mg/kg	0.5			<0.5	-	-	-	-	-	-	<0.5	-	-	-
PAHs	CPAH (TEF)	mg/kg				<1.11	-	1.042	<1.21	-	<1.21	15.455	<1.11	-	<1.21	<1.21
	PAH (ESDAT TOTAL)	mg/kg				2.2	-	35.3	<8	-	<8	385.9	<7	-	<8	<8
	PAH (total, NSW Waste 2008)	mg/kg				2.2	-	35.3	<8	-	<8	385.9	<7	-	<8	<8
	Sum of 10 PAHs	mg/kg				<4	-	11.5	<5	-	<5	138.1	<4	-	<5	<5
	Sum of 5 PAHs	mg/kg				2.2	-	23.8	<3	-	<3	247.8	<3	-	<3	<3
	2-chloronaphthalene	mg/kg	0.5			<0.5	-	-	-	-	-	-	<0.5	-	-	-
	2-methylnaphthalene	mg/kg	0.5			0.5	-	-	-	-	-	-	<0.5	-	-	-
	3-methylcholanthrene	mg/kg	0.5			<0.5	-	-	-	-	-	-	<0.5	-	-	-
	Acenaphthene	mg/kg	0.5	**0.5**		<0.5	-	<0.5	<0.5	-	<0.5	4.5	<0.5	-	<0.5	<0.5
	Acenaphthylene	mg/kg	0.5	**0.64**		<0.5	-	2	<0.5	-	<0.5	26.8	<0.5	-	<0.5	<0.5
	Acetophenone	mg/kg	0.5			<0.5	-	-	-	-	-	-	<0.5	-	-	-
	Anthracene	mg/kg	0.5	**1.1**		<0.5	-	2	<0.5	-	<0.5	20.7	<0.5	-	<0.5	<0.5
	Benz(a)anthracene	mg/kg	0.5	**1.6**		<0.5	-	1.4	<0.5	-	<0.5	17.1	<0.5	-	<0.5	<0.5
	Benzo(a) pyrene	mg/kg	0.5	**1.6**		<0.5	-	0.8	<0.5	-	<0.5	10.1	<0.5	-	<0.5	<0.5
	Benzo(b)&(k)fluoranthene	mg/kg	1			<1	-	-	-	-	-	-	<1	-	-	-
	Benzo(b)fluoranthene	mg/kg	0.5			-	-	0.9	<0.5	-	<0.5	14.7	-	-	<0.5	<0.5
	Benzo(g,h,i)perylene	mg/kg	0.5			<0.5	-	<0.5	<0.5	-	<0.5	4.5	<0.5	-	<0.5	<0.5
	Benzo(k)fluoranthene	mg/kg	0.5			-	-	<0.5	<0.5	-	<0.5	4.4	-	-	<0.5	<0.5
	Chrysene	mg/kg	0.5	**2.8**		<0.5	-	1.2	<0.5	-	<0.5	**12**	<0.5	-	<0.5	<0.5
	Dibenz(a,h)anthracene	mg/kg	0.5	**0.26**		<0.5	-	<0.5	<0.5	-	<0.5	1.2	<0.5	-	<0.5	<0.5
	Fluoranthene	mg/kg	0.5	**5.1**		<0.5	-	3.8	<0.5	-	<0.5	**38.3**	<0.5	-	<0.5	<0.5
	Fluorene	mg/kg	0.5	**0.54**		<0.5	-	2.7	<0.5	-	<0.5	25.9	<0.5	-	<0.5	<0.5
	Indeno(1,2,3-c,d)pyrene	mg/kg	0.5			<0.5	-	<0.5	<0.5	-	<0.5	3.7	<0.5	-	<0.5	<0.5
	Naphthalene	mg/kg	0.5	**2.1**	320	1.4	-	10.5	<0.5	-	<0.5	114	<0.5	-	<0.5	<0.5
	PAHs (Sum of total)	mg/kg				-	-	-	-	-	-	-	-	-	-	-
	Phenanthrene	mg/kg	0.5	**1.5**		0.8	-	6.6	<0.5	-	<0.5	55.9	<0.5	-	<0.5	<0.5
	Pyrene	mg/kg	0.5	**2.6**		<0.5	-	**3.4**	<0.5	-	<0.5	**32.1**	<0.5	-	<0.5	<0.5
Phenols	2,4-dimethylphenol	mg/kg	0.5		36000	1	-	3.1	<0.5	-	<0.5	<0.5	2.2	-	0.7	<0.5
	2-methylphenol	mg/kg	0.5			<0.5	-	1.3	<0.5	-	<0.5	<0.5	0.8	-	<0.5	<0.5
	3-&4-methylphenol	mg/kg	0.5			0.6	-	2.7	<1	-	<1	<1	1.4	-	<1	<1
	Total Cresols	mg/kg	0.5		61,000	0.6	-	4	<0.5	-	<0.5	<0.5	2.2	-	<0.5	<0.5
	2-nitrophenol	mg/kg	0.5			<0.5	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5
	4-chloro-3-methylphenol	mg/kg	0.5			<0.5	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5
	Phenol	mg/kg	0.5			<0.5	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5
	Phenolics Total	mg/kg				-	-	-	-	-	-	-	-	-	-	-
TPH	TPH C15-C36	mg/kg				-	-	<200	<200	-	<200	760	<200	-	<200	<200
	TPH C10 - C14	mg/kg	50		19,000	-	-	<50	<50	-	<50	200	<50	-	<50	<50
	TPH C15-C28	mg/kg	100			-	-	<100	<100	-	<100	560	<100	-	<100	<100
	TPH C29-C36	mg/kg	100			-	-	<100	<100	-	<100	200	<100	-	<100	<100
	TPH C6 - C9	mg/kg	2			-	-	<10	<10	-	<10	<10	<10	-	<10	<10
	TPH+C10 - C36 (Sum of total)	mg/kg	50			-	-	<50	<50	-	<50	960	<50	-	<50	<50
BTEX	Total Xylene (ESDAT)	mg/kg				3.4	-	<1	<1	-	<1	<1	<1	-	<1	<1
	Benzene	mg/kg	0.2		380	0.8	-	0.6	<0.2	-	<0.2	<0.2	<0.2	-	0.4	<0.2
	Ethylbenzene	mg/kg	0.2			<0.5	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5
	Toluene	mg/kg	0.2			1.5	-	0.6	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5
	Xylene (m & p)	mg/kg	0.2			2.4	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5
	Xylene (o)	mg/kg	0.2			1	-	<0.5	<0.5	-	<0.5	<0.5	<0.5	-	<0.5	<0.5
Cyanides	Cyanide (WAD)	mg/kg	1			-	-	-	-	-	-	-	-	-	-	-
Herbicides	Diallate	mg/kg	0.5			-	-	-	-	-	-	-	<0.5	-	-	-
Inorganics	Cyanide (Free)	mg/kg	1			<1	-	-	-	-	-	<1	<1	-	<1	-
	Cyanide Total	mg/kg	1			<1	-	-	-	-	-	-	-	-	-	-
	Weak Acid Dissociable Cyanide	mg/kg	1			-	-	-	-	-	-	<1	<1	-	<1	-
Metals	Arsenic	mg/kg	1			<5	-	38	<5	-	<5	<5	<5	-	<5	<5
	Barium	mg/kg	5			10	-	20	20	-	20	<10	10	-	<10	120
	Beryllium	mg/kg	1			<1	-	<1	<1	-	<1	<1	<1	-	<1	<1
	Cadmium	mg/kg	0.1	**10**		<1	-	<1	<1	-	<1	<1	<1	-	<1	<1
	Chromium	mg/kg	1	**370**		5	-	28	7	-	7	8	5	-	7	12
	Chromium (hexavalent)	mg/kg	0.5			<0.5	-	<0.5	-	-	-	<0.5	<0.5	-	<0.5	-
	Cobalt	mg/kg	1			<2	-	<2	4	-	2	<2	<2	-	<2	<2
	Copper	mg/kg	2	**270**		<5	-	<5	<5	-	<5	<5	<5	-	<5	<5
	Iron	mg/kg	10			890	-	24,500	-	-	-	5210	480	-	12,800	-
	Lead	mg/kg	2	**220**	11000	6	-	8	7	-	7	6	6	-	<5	11
	Manganese	mg/kg	5			<5	-	9	180	-	115	<5	<5	-	5	9
	Mercury	mg/kg	0.05	**1**		<0.1	-	<0.1	<0.1	-	<0.1	<0.1	<0.1	-	<0.1	<0.1
	Nickel	mg/kg	1	**52**		<2	-	2	5	-	3	<2	<2	-	<2	<2
	Vanadium	mg/kg	5			6	-	116	9	-	10	13	<5	-	18	17
	Zinc	mg/kg	5	**410**		<5	-	8	30	-	15	<5	<5	-	<5	<5

Field_ID	BH40_17.8-18.0	BH40_17.8-18.0	BH40_19.0-19.4	BH40_7.0-7.2	BH40_8.5-8.7	QC54	BH46-14.5-14.7	BH46-19.0-19.2	BH46-19.0-19.2	BH46-20.5-20.7	BH46-23.5-23.7
Lab_Report_Number	ES1003390	ES1003431	ES1003390	ES1003390	ES1003390	ES1003390	ES1003671	ES1003671	ES1003673	ES1003671	ES1003671
Location_Code	AECOM_BH40	AECOM_BH40	AECOM_BH40	AECOM_BH40	AECOM_BH40	AECOM_BH40	AECOM_BH46	AECOM_BH46	AECOM_BH46	AECOM_BH46	AECOM_BH46
Sample_Depth_Range	17.8-18	17.8-18	19-19.4	7-7.2	8.5-8.7	8.5-8.7	14.5-14.7	19-19.2	19-19.2	20.5-20.7	23.5-23.7
Sampled_Date_Time	18/02/2010	18/02/2010	18/02/2010	18/02/2010	18/02/2010	18/02/2010	23/02/2010	23/02/2010	23/02/2010	23/02/2010	23/02/2010
Sample_Type	Normal	Normal	Normal	Normal	Normal	Field_D	Normal	Normal	Normal	Normal	Normal

Chem_Group	ChemName	output unit	EQL	ISQG-High	SSTC-A & B										
SPOCAS	Acid Reacted Calcium	%	0.02			-	-	-	-	-	-	-	-	-	-	-
	acidity - Acid Reacted Calcium	mole H+/t	10			-	-	-	-	-	-	-	-	-	-	-
	acidity - Acid Reacted Magnesium	mole H+/t	10			-	-	-	-	-	-	-	-	-	-	-
	acidity - Peroxide Oxidisable Sulfur	mole H+/t	10			-	-	-	-	-	-	-	-	-	-	-
	ANC Fineness Factor	-	0.5			-	-	-	-	-	-	-	-	-	-	-
	Calcium in Peroxide	%	0.02			-	-	-	-	-	-	-	-	-	-	-
	KCl Extractable Calcium	%	0.02			-	-	-	-	-	-	-	-	-	-	-
	KCl Extractable Magnesium	%	0.02			-	-	-	-	-	-	-	-	-	-	-
	Liming Rate	kg CaCO3/t	1			-	-	-	-	-	-	-	-	-	-	-
	Magnesium in Peroxide	%	0.02			-	-	-	-	-	-	-	-	-	-	-
	Net Acidity (acidity units)	mole H+/t	10			-	-	-	-	-	-	-	-	-	-	-
	Net Acidity (sulfur units)	%S	0.02			-	-	-	-	-	-	-	-	-	-	-
	Peroxide Oxidisable Sulfur	%	0.02			-	-	-	-	-	-	-	-	-	-	-
	pH (KCl)	pH Unit	0.1			-	-	-	-	-	-	-	-	-	-	-
	pH (Ox)	pH Unit	0.1			-	-	-	-	-	-	-	-	-	-	-
	sulfidic - Acid Reacted Calcium	% S	0.02			-	-	-	-	-	-	-	-	-	-	-
	sulfidic - Acid Reacted Magnesium	%S	0.02			-	-	-	-	-	-	-	-	-	-	-
	sulfidic - Titratable Actual Acidity	%S	0.02			-	-	-	-	-	-	-	-	-	-	-
	sulfidic - Titratable Peroxide Acidity	%S	0.02			-	-	-	-	-	-	-	-	-	-	-
	sulfidic - Titratable Sulfidic Acidity	%S	0.02			-	-	-	-	-	-	-	-	-	-	-
	Sulfur in Peroxide	%	0.02			-	-	-	-	-	-	-	-	-	-	-
	Titratable Actual Acidity	mole H+/t	2			-	-	-	-	-	-	-	-	-	-	-
VOCs	1,1,1,2-tetrachloroethane	mg/kg	0.5			<0.5	-	-	-	-	-	-	<0.5	-	-	-
	1,1,1-trichloroethane	mg/kg	0.5			<0.5	-	-	-	-	-	-	<0.5	-	-	-
	1,1,2,2-tetrachloroethane	mg/kg	0.5			<0.5	-	-	-	-	-	-	<0.5	-	-	-
	1,1,2-trichloroethane	mg/kg	0.5			<0.5	-	-	-	-	-	-	<0.5	-	-	-
	1,1-dichloroethane	mg/kg	0.5			<0.5	-	-	-	-	-	-	<0.5	-	-	-
	1,1-dichloroethene	mg/kg	0.5			<0.5	-	-	-	-	-	-	<0.5	-	-	-
	1,1-dichloropropene	mg/kg	0.5			<0.5	-	-	-	-	-	-	<0.5	-	-	-
	1,2,3-trichlorobenzene	mg/kg	0.5			<0.5	-	-	-	-	-	-	<0.5	-	-	-
	1,2,3-trichloropropane	mg/kg	0.5			<0.5	-	-	-	-	-	-	<0.5	-	-	-
	1,2,4-trichlorobenzene	mg/kg	0.5			<0.5	-	-	-	-	-	-	<0.5	-	-	-
	1,2,4-trimethylbenzene	mg/kg	0.5		70	1.3	-	-	-	-	-	-	<0.5	-	-	-
	1,2-dibromo-3-chloropropane	mg/kg	0.5			<0.5	-	-	-	-	-	-	<0.5	-	-	-
	1,2-dibromoethane	mg/kg	0.5			-	-	-	-	-	-	-	<0.5	-	-	-
	1,2-dichlorobenzene	mg/kg	0.5			<0.5	-	-	-	-	-	-	<0.5	-	-	-
	1,2-dichloroethane	mg/kg	0.5			<0.5	-	-	-	-	-	-	<0.5	-	-	-
	1,2-dichloropropane	mg/kg	0.5			<0.5	-	-	-	-	-	-	<0.5	-	-	-
	1,3,5-trimethylbenzene	mg/kg	0.5			0.6	-	-	-	-	-	-	<0.5	-	-	-
	1,3-dichlorobenzene	mg/kg	0.5			<0.5	-	-	-	-	-	-	<0.5	-	-	-
	1,3-dichloropropane	mg/kg	0.5			<0.5	-	-	-	-	-	-	<0.5	-	-	-
	1,4-dichlorobenzene	mg/kg	0.5			<0.5	-	-	-	-	-	-	<0.5	-	-	-
	2,2-dichloropropane	mg/kg	0.5			<0.5	-	-	-	-	-	-	<0.5	-	-	-
	2-chlorotoluene	mg/kg	0.5			<0.5	-	-	-	-	-	-	<0.5	-	-	-
	4-chlorotoluene	mg/kg	0.5			<0.5	-	-	-	-	-	-	<0.5	-	-	-
	4-Methyl-2-pentanone	mg/kg	5			<5	-	-	-	-	-	-	<5	-	-	-
	Bromobenzene	mg/kg	0.5			<0.5	-	-	-	-	-	-	<0.5	-	-	-
	Bromodichloromethane	mg/kg	0.5			<0.5	-	-	-	-	-	-	<0.5	-	-	-
	Bromoform	mg/kg	0.5			<0.5	-	-	-	-	-	-	<0.5	-	-	-
	Bromomethane	mg/kg	5			<5	-	-	-	-	-	-	<5	-	-	-
	Carbon disulfide	mg/kg	0.5			<0.5	-	-	-	-	-	-	<0.5	-	-	-
	Carbon tetrachloride	mg/kg	0.5			<0.5	-	-	-	-	-	-	<0.5	-	-	-
	Chlorobenzene	mg/kg	0.5			<0.5	-	-	-	-	-	-	<0.5	-	-	-
	Chlorodibromomethane	mg/kg	0.5			<0.5	-	-	-	-	-	-	<0.5	-	-	-
	Chloroethane	mg/kg	5			<5	-	-	-	-	-	-	<5	-	-	-
	Chloroform	mg/kg	0.5			<0.5	-	-	-	-	-	-	<0.5	-	-	-
	Chloromethane	mg/kg	5			<5	-	-	-	-	-	-	<5	-	-	-
	cis-1,3-dichloropropene	mg/kg	0.5			<0.5	-	-	-	-	-	-	<0.5	-	-	-
	cis-1,4-Dichloro-2-butene	mg/kg	0.5			<0.5	-	-	-	-	-	-	<0.5	-	-	-
	Dibromomethane	mg/kg	0.5			<0.5	-	-	-	-	-	-	<0.5	-	-	-
	Dichlorodifluoromethane	mg/kg	5			<5	-	-	-	-	-	-	<5	-	-	-
	Hexachlorobutadiene	mg/kg	0.5			<0.5	-	-	-	-	-	-	<0.5	-	-	-
	Iodomethane	mg/kg	0.5			<0.5	-	-	-	-	-	-	<0.5	-	-	-
	Isophorone	mg/kg	0.5			<0.5	-	-	-	-	-	-	<0.5	-	-	-
	Isopropylbenzene	mg/kg	0.5			<0.5	-	-	-	-	-	-	<0.5	-	-	-
	n-butylbenzene	mg/kg	0.5			<0.5	-	-	-	-	-	-	<0.5	-	-	-
	n-propylbenzene	mg/kg	0.5			<0.5	-	-	-	-	-	-	<0.5	-	-	-
	Pentachloroethane	mg/kg	0.5			<0.5	-	-	-	-	-	-	<0.5	-	-	-
	p-isopropyltoluene	mg/kg	0.5			<0.5	-	-	-	-	-	-	<0.5	-	-	-

Field_ID	BH40_17.8-18.0	BH40_17.8-18.0	BH40_19.0-19.4	BH40_7.0-7.2	BH40_8.5-8.7	QC54	BH46-14.5-14.7	BH46-19.0-19.2	BH46-19.0-19.2	BH46-20.5-20.7	BH46-23.5-23.7
Lab_Report_Number	ES1003390	ES1003431	ES1003390	ES1003390	ES1003390	ES1003390	ES1003671	ES1003671	ES1003673	ES1003671	ES1003671
Location_Code	AECOM_BH40	AECOM_BH40	AECOM_BH40	AECOM_BH40	AECOM_BH40	AECOM_BH40	AECOM_BH46	AECOM_BH46	AECOM_BH46	AECOM_BH46	AECOM_BH46
Sample_Depth_Range	17.8-18	17.8-18	19-19.4	7-7.2	8.5-8.7	8.5-8.7	14.5-14.7	19-19.2	19-19.2	20.5-20.7	23.5-23.7
Sampled_Date_Time	18/02/2010	18/02/2010	18/02/2010	18/02/2010	18/02/2010	18/02/2010	23/02/2010	23/02/2010	23/02/2010	23/02/2010	23/02/2010
Sample_Type	Normal	Normal	Normal	Normal	Normal	Field_D	Normal	Normal	Normal	Normal	Normal

Chem_Group	ChemName	output unit	EQL	ISQG-High	SSTC-A & B										
	sec-butylbenzene	mg/kg	0.5			<0.5	-	-	-	-	-	-	<0.5	-	-	-
	Styrene	mg/kg	0.5			0.9	-	-	-	-	-	-	<0.5	-	-	-
	tert-butylbenzene	mg/kg	0.5			<0.5	-	-	-	-	-	-	<0.5	-	-	-
	trans-1,2-dichloroethene	mg/kg	0.5			<0.5	-	-	-	-	-	-	<0.5	-	-	-
	trans-1,3-dichloropropene	mg/kg	0.5			<0.5	-	-	-	-	-	-	<0.5	-	-	-
	trans-1,4-Dichloro-2-butene	mg/kg	0.5			<0.5	-	-	-	-	-	-	<0.5	-	-	-
	Trichlorofluoromethane	mg/kg	5			<5	-	-	-	-	-	-	<5	-	-	-
	Vinyl acetate	mg/kg	5			<5	-	-	-	-	-	-	<5	-	-	-

Notes:
All soil criteria in mg/kg
SSTC - Site Specific Target Criteria for Land Use Scenario
TPH - Total Petroleum Hydrocarbons
PAHs - Polycylic Aromatic Hydrocarbons
VOCs - Volatile Organic Compounds
SPOCAS - Suspension Peroxide Oxidation Combined Acidity & Sulfur
CPAH= Sum of 8 carcinogenic PAH Compounds (Benz(a)anthracene Benzo(a) pyrene; Benzo(b)fluoranthene; Benzo(g,h,i)perylene; Benzo(k)fluoranthene; Chrysene; Dibenz(a,h)anthracene; Indeno(1,2,3-

Field_ID	BH46-4.0-4.2	BH46-7.0-7.2	QC57	QC58
Lab_Report_Number	ES1003671	ES1003671	ES1003671	47097
Location_Code	AECOM_BH46	AECOM_BH46	AECOM_BH46	AECOM_BH46
Sample_Depth_Range	4-4.2	7-7.2	7-7.2	7-7.2
Sampled_Date_Time	23/02/2010	23/02/2010	23/02/2010	23/02/2010
Sample_Type	Normal	Normal	Field_D	Interlab_D

Chem_Group	ChemName	output unit	EQL	ISQG-High	SSTC-A & B				
	CPAH (ESDAT)	mg/kg			130	-	<4	<4	<3
	Pronamide	mg/kg	0.5			-	-	-	-
PAHs	CPAH (TEF)	mg/kg				-	<1.21	<1.21	<1.11
	PAH (ESDAT TOTAL)	mg/kg				-	<8	<8	<7
	PAH (total, NSW Waste 2008)	mg/kg				-	<8	<8	<7
	Sum of 10 PAHs	mg/kg				-	<5	<5	<4
	Sum of 5 PAHs	mg/kg				-	<3	<3	<3
	2-chloronaphthalene	mg/kg	0.5			-	-	-	-
	2-methylnaphthalene	mg/kg	0.5			-	-	-	-
	3-methylcholanthrene	mg/kg	0.5			-	-	-	-
	Acenaphthene	mg/kg	0.5	**0.5**		-	<0.5	<0.5	<0.5
	Acenaphthylene	mg/kg	0.5	**0.64**		-	<0.5	<0.5	<0.5
	Acetophenone	mg/kg	0.5			-	-	-	-
	Anthracene	mg/kg	0.5	**1.1**		-	<0.5	<0.5	<0.5
	Benz(a)anthracene	mg/kg	0.5	**1.6**		-	<0.5	<0.5	<0.5
	Benzo(a) pyrene	mg/kg	0.5	**1.6**		-	<0.5	<0.5	<0.5
	Benzo(b)&(k)fluoranthene	mg/kg	1			-	-	-	<1
	Benzo(b)fluoranthene	mg/kg	0.5			-	<0.5	<0.5	-
	Benzo(g,h,i)perylene	mg/kg	0.5			-	<0.5	<0.5	<0.5
	Benzo(k)fluoranthene	mg/kg	0.5			-	<0.5	<0.5	-
	Chrysene	mg/kg	0.5	**2.8**		-	<0.5	<0.5	<0.5
	Dibenz(a,h)anthracene	mg/kg	0.5	**0.26**		-	<0.5	<0.5	<0.5
	Fluoranthene	mg/kg	0.5	**5.1**		-	<0.5	<0.5	<0.5
	Fluorene	mg/kg	0.5	**0.54**		-	<0.5	<0.5	<0.5
	Indeno(1,2,3-c,d)pyrene	mg/kg	0.5			-	<0.5	<0.5	<0.5
	Naphthalene	mg/kg	0.5	**2.1**	320	-	<0.5	<0.5	<0.5
	PAHs (Sum of total)	mg/kg				-	-	-	0
	Phenanthrene	mg/kg	0.5	**1.5**		-	<0.5	<0.5	<0.5
	Pyrene	mg/kg	0.5	**2.6**		-	<0.5	<0.5	<0.5
Phenols	2,4-dimethylphenol	mg/kg	0.5		36000	-	<0.5	<0.5	<0.5
	2-methylphenol	mg/kg	0.5			-	<0.5	<0.5	<0.5
	3-&4-methylphenol	mg/kg	0.5			-	<1	<1	<1
	Total Cresols	mg/kg	0.5		61,000	-	<0.5	<0.5	<0.5
	2-nitrophenol	mg/kg	0.5			-	<0.5	<0.5	<0.5
	4-chloro-3-methylphenol	mg/kg	0.5			-	<0.5	<0.5	<0.5
	Phenol	mg/kg	0.5			-	<0.5	<0.5	<0.5
	Phenolics Total	mg/kg				-	-	-	0
TPH	TPH C15-C36	mg/kg				-	<200	<200	<200
	TPH C10 - C14	mg/kg	50		19,000	-	<50	<50	<50
	TPH C15-C28	mg/kg	100			-	<100	<100	<100
	TPH C29-C36	mg/kg	100			-	<100	<100	<100
	TPH C6 - C9	mg/kg	2			-	<10	<10	<10
	TPH+C10 - C36 (Sum of total)	mg/kg	50			-	<50	<50	<250 - 0
BTEX	Total Xylene (ESDAT)	mg/kg				-	<1	<1	<1.5 - 0
	Benzene	mg/kg	0.2		380	-	<0.2	<0.2	<0.2
	Ethylbenzene	mg/kg	0.2			-	<0.5	<0.5	<0.5
	Toluene	mg/kg	0.2			-	<0.5	<0.5	<0.5
	Xylene (m & p)	mg/kg	0.2			-	<0.5	<0.5	<1
	Xylene (o)	mg/kg	0.2			-	<0.5	<0.5	<0.5
Cyanides	Cyanide (WAD)	mg/kg	1			-	-	-	<1
Herbicides	Diallate	mg/kg	0.5			-	-	-	-
Inorganics	Cyanide (Free)	mg/kg	1			-	<1	<1	<1
	Cyanide Total	mg/kg	1			-	-	-	-
	Weak Acid Dissociable Cyanide	mg/kg	1			-	<1	<1	-
Metals	Arsenic	mg/kg	1			<5	<5	<5	2
	Barium	mg/kg	5			50	50	20	22
	Beryllium	mg/kg	1			<1	<1	<1	<1
	Cadmium	mg/kg	0.1	**10**		<1	<1	<1	<0.1
	Chromium	mg/kg	1	**370**		8	7	8	7
	Chromium (hexavalent)	mg/kg	0.5			-	-	-	-
	Cobalt	mg/kg	1			5	3	6	4
	Copper	mg/kg	2	**270**		8	6	6	12
	Iron	mg/kg	10			-	-	-	-
	Lead	mg/kg	2	**220**	11000	6	12	10	11
	Manganese	mg/kg	5			130	154	144	121
	Mercury	mg/kg	0.05	**1**		<0.1	<0.1	<0.1	<0.05
	Nickel	mg/kg	1	**52**		6	4	6	4
	Vanadium	mg/kg	5			11	12	15	10
	Zinc	mg/kg	5	**410**		24	27	38	36

Field_ID	BH46-4.0-4.2	BH46-7.0-7.2	QC57	QC58
Lab_Report_Number	ES1003671	ES1003671	ES1003671	47097
Location_Code	AECOM_BH46	AECOM_BH46	AECOM_BH46	AECOM_BH46
Sample_Depth_Range	4-4.2	7-7.2	7-7.2	7-7.2
Sampled_Date_Time	23/02/2010	23/02/2010	23/02/2010	23/02/2010
Sample_Type	Normal	Normal	Field_D	Interlab_D

Chem_Group	ChemName	output unit	EQL	ISQG-High	SSTC-A & B				
SPOCAS	Acid Reacted Calcium	%	0.02			-	-	-	-
	acidity - Acid Reacted Calcium	mole H+/t	10			-	-	-	-
	acidity - Acid Reacted Magnesium	mole H+/t	10			-	-	-	-
	acidity - Peroxide Oxidisable Sulfur	mole H+/t	10			-	-	-	-
	ANC Fineness Factor	-	0.5			-	-	-	-
	Calcium in Peroxide	%	0.02			-	-	-	-
	KCl Extractable Calcium	%	0.02			-	-	-	-
	KCl Extractable Magnesium	%	0.02			-	-	-	-
	Liming Rate	kg CaCO3/t	1			-	-	-	-
	Magnesium in Peroxide	%	0.02			-	-	-	-
	Net Acidity (acidity units)	mole H+/t	10			-	-	-	-
	Net Acidity (sulfur units)	%S	0.02			-	-	-	-
	Peroxide Oxidisable Sulfur	%	0.02			-	-	-	-
	pH (KCl)	pH Unit	0.1			-	-	-	-
	pH (Ox)	pH Unit	0.1			-	-	-	-
	sulfidic - Acid Reacted Calcium	% S	0.02			-	-	-	-
	sulfidic - Acid Reacted Magnesium	%S	0.02			-	-	-	-
	sulfidic - Titratable Actual Acidity	%S	0.02			-	-	-	-
	sulfidic - Titratable Peroxide Acidity	%S	0.02			-	-	-	-
	sulfidic - Titratable Sulfidic Acidity	%S	0.02			-	-	-	-
	Sulfur in Peroxide	%	0.02			-	-	-	-
	Titratable Actual Acidity	mole H+/t	2			-	-	-	-
VOCs	1,1,1,2-tetrachloroethane	mg/kg	0.5			-	-	-	-
	1,1,1-trichloroethane	mg/kg	0.5			-	-	-	-
	1,1,2,2-tetrachloroethane	mg/kg	0.5			-	-	-	-
	1,1,2-trichloroethane	mg/kg	0.5			-	-	-	-
	1,1-dichloroethane	mg/kg	0.5			-	-	-	-
	1,1-dichloroethene	mg/kg	0.5			-	-	-	-
	1,1-dichloropropene	mg/kg	0.5			-	-	-	-
	1,2,3-trichlorobenzene	mg/kg	0.5			-	-	-	-
	1,2,3-trichloropropane	mg/kg	0.5			-	-	-	-
	1,2,4-trichlorobenzene	mg/kg	0.5			-	-	-	-
	1,2,4-trimethylbenzene	mg/kg	0.5		70	-	-	-	-
	1,2-dibromo-3-chloropropane	mg/kg	0.5			-	-	-	-
	1,2-dibromoethane	mg/kg	0.5			-	-	-	-
	1,2-dichlorobenzene	mg/kg	0.5			-	-	-	-
	1,2-dichloroethane	mg/kg	0.5			-	-	-	-
	1,2-dichloropropane	mg/kg	0.5			-	-	-	-
	1,3,5-trimethylbenzene	mg/kg	0.5			-	-	-	-
	1,3-dichlorobenzene	mg/kg	0.5			-	-	-	-
	1,3-dichloropropane	mg/kg	0.5			-	-	-	-
	1,4-dichlorobenzene	mg/kg	0.5			-	-	-	-
	2,2-dichloropropane	mg/kg	0.5			-	-	-	-
	2-chlorotoluene	mg/kg	0.5			-	-	-	-
	4-chlorotoluene	mg/kg	0.5			-	-	-	-
	4-Methyl-2-pentanone	mg/kg	5			-	-	-	-
	Bromobenzene	mg/kg	0.5			-	-	-	-
	Bromodichloromethane	mg/kg	0.5			-	-	-	-
	Bromoform	mg/kg	0.5			-	-	-	-
	Bromomethane	mg/kg	5			-	-	-	-
	Carbon disulfide	mg/kg	0.5			-	-	-	-
	Carbon tetrachloride	mg/kg	0.5			-	-	-	-
	Chlorobenzene	mg/kg	0.5			-	-	-	-
	Chlorodibromomethane	mg/kg	0.5			-	-	-	-
	Chloroethane	mg/kg	5			-	-	-	-
	Chloroform	mg/kg	0.5			-	-	-	-
	Chloromethane	mg/kg	5			-	-	-	-
	cis-1,3-dichloropropene	mg/kg	0.5			-	-	-	-
	cis-1,4-Dichloro-2-butene	mg/kg	0.5			-	-	-	-
	Dibromomethane	mg/kg	0.5			-	-	-	-
	Dichlorodifluoromethane	mg/kg	5			-	-	-	-
	Hexachlorobutadiene	mg/kg	0.5			-	-	-	-
	Iodomethane	mg/kg	0.5			-	-	-	-
	Isophorone	mg/kg	0.5			-	-	-	-
	Isopropylbenzene	mg/kg	0.5			-	-	-	-
	n-butylbenzene	mg/kg	0.5			-	-	-	-
	n-propylbenzene	mg/kg	0.5			-	-	-	-
	Pentachloroethane	mg/kg	0.5			-	-	-	-
	p-isopropyltoluene	mg/kg	0.5			-	-	-	-

Field_ID	BH46-4.0-4.2	BH46-7.0-7.2	QC57	QC58
Lab_Report_Number	ES1003671	ES1003671	ES1003671	47097
Location_Code	AECOM_BH46	AECOM_BH46	AECOM_BH46	AECOM_BH46
Sample_Depth_Range	4-4.2	7-7.2	7-7.2	7-7.2
Sampled_Date_Time	23/02/2010	23/02/2010	23/02/2010	23/02/2010
Sample_Type	Normal	Normal	Field_D	Interlab_D

Chem_Group	ChemName	output unit	EQL	ISQG-High	SSTC-A & B				
	sec-butylbenzene	mg/kg	0.5			-	-	-	-
	Styrene	mg/kg	0.5			-	-	-	-
	tert-butylbenzene	mg/kg	0.5			-	-	-	-
	trans-1,2-dichloroethene	mg/kg	0.5			-	-	-	-
	trans-1,3-dichloropropene	mg/kg	0.5			-	-	-	-
	trans-1,4-Dichloro-2-butene	mg/kg	0.5			-	-	-	-
	Trichlorofluoromethane	mg/kg	5			-	-	-	-
	Vinyl acetate	mg/kg	5			-	-	-	-

Notes:
All soil criteria in mg/kg
SSTC - Site Specific Target Criteria for Land Use Scenario
TPH - Total Petroleum Hydrocarbons
PAHs - Polycylic Aromatic Hydrocarbons
VOCs - Volatile Organic Compounds
SPOCAS - Suspension Peroxide Oxidation Combined Acidity & Sulfur
CPAH= Sum of 8 carcinogenic PAH Compounds (Benz(a)anthracene Benzo(a) pyrene; Benzo(b)fluoranthene; Benzo(g,h,i)perylene; Benzo(k)fluoranthene; Chrysene; Dibenz(a,h)anthracene; Indeno(1,2,3-

Field_ID	BH38_2.5-2.7
Lab_Report_Number	ES1003391
Location_Code	AECOM_BH38
Sample_Depth_Range	2.5-2.7
Sampled_Date_Time	19/02/2010
Sample_Type	Normal

Chem_Group	ChemName	output unit	EQL	
Asbestos	Asbestos fibres	-	0.1	ND

					Field_ID	MW09	MW09	MW09	MW09	MW09	MW09	QC311	MW22	MW22	MW22	MW22	MW22	MW22	MW40
					Location_Code	BH047	BH047	BH047	BH047	BH047	BH047	BH047	BH116	BH116	BH116	BH116	BH116	BH116	AECOM_BH40
					Sampled_Date_Time	19/07/2006	19/07/2006	15/08/2007	9/05/2008	5/09/2008	15/03/2010	15/03/2010	17/07/2006	17/07/2006	7/05/2008	5/07/2008	15/03/2010	15/03/2010	20/03/2010
					Sample_Type	Normal	Normal	Normal	Normal	Normal	Normal	Field_D	Normal	Normal	Normal	Normal	Normal	Normal	Normal
					Lab_Report_Number	ES0608799	ES0609802	ES0711324		ES0806586	ES1004783	ES1004783	ES0608744	ES0609802	ES0806416		ES1004782	ES1005579	ES1005391
					Well	MW09	MW09	MW09	MW09	MW09	MW09	MW09	MW22	MW22	MW22	MW22	MW22	MW22	MW40
Chem_Group	**ChemName**	**output**	**EQL**	**MWQC**	**SSTC-A**														
	CPAH (ESDAT)	µg/L				<7.5	-	<7.5	-	<7.5	<7.5	<7.5	<7.5	-	<7.5	-	<12	-	<5.4
	Pronamide	µg/L	0.5			-	-	-	-	-	-	-	-	-	-	-	<2	-	<0.9
	TRH C10-C14	mg/L	0.05	**0.04**		**<0.05**	-	**<0.05**	-	**<0.05**	**<0.05**	**<0.05**	**0.09**	-	**0.1**	-	**<0.05**	-	-
	TRH C15-C28	mg/L	0.1			0.5	-	<0.1	-	<0.1	<0.1	<0.1	0.4	-	0.2	-	<0.1	-	-
	TRH C29-C36	mg/L	0.05			0.46	-	<0.05	-	<0.05	<0.05	<0.05	<0.05	-	<0.05	-	<0.05	-	-
	TRH C6-C9	mg/L	0.02			<0.02	-	<0.02	-	<0.02	<0.02	<0.02	0.03	-	0.03	-	<0.02	-	-
PAHs	CPAH (TEF)	µg/L				<1.92	-	<1.92	-	<1.92	<1.92	<1.92	<1.92	-	<1.92	-	<4.44	-	<1.998
	PAH (ESDAT TOTAL)	µg/L				<15.5	-	16.4	-	<15.5	<15.5	<15.5	14.9	-	<15.5	-	<28	-	297
	PAH (total, NSW Waste 2008)	µg/L				<15.5	-	16.4	-	<15.5	<15.5	<15.5	14.9	-	<15.5	-	<28	-	297
	Sum of 10 PAHs	µg/L				<9.5	-	<9.5	-	<9.5	<9.5	<9.5	<9.5	-	<9.5	-	<16	-	4
	Sum of 5 PAHs	µg/L				<6	-	16.4	-	<6	<6	<6	14.9	-	<6	-	<12	-	293
	2-chloronaphthalene	µg/L	0.5			-	-	-	-	-	-	-	-	-	-	-	<2	-	<0.9
	2-methylnaphthalene	µg/L	0.5	**2.1**	22000	-	-	-	-	-	-	-	-	-	-	-	<2	-	**36**
	3-methylcholanthrene	µg/L	0.5			-	-	-	-	-	-	-	-	-	-	-	<2	-	<0.9
	Acenaphthene	µg/L	0.5	**5.8**	35000	<1	-	<1	-	<1	<1	<1	1.2	-	<1	-	<2	-	4
	Acenaphthylene	µg/L	0.5	**5.8**	33000	<1	-	<1	-	<1	<1	<1	1.1	-	<1	-	<2	-	**16**
	Acetophenone	µg/L	0.5			-	-	-	-	-	-	-	-	-	-	-	<2	-	<0.9
	Anthracene	µg/L	0.5	**0.01**		**<1**	-	**<1**	-	**<1**	**<1**	**<1**	**<1**	-	**<1**	-	**<2**	-	**3**
	Benz(a)anthracene	µg/L	0.5	**0.01**		**<1**	-	**<1**	-	**<1**	**<1**	**<1**	**<1**	-	**<1**	-	**<2**	-	**<0.9**
	Benzo(a) pyrene	µg/L	0.3	**0.1**		**<0.5**	-	**<0.5**	-	**<0.5**	**<0.5**	**<0.5**	**<0.5**	-	**<0.5**	-	**<2**	-	**<0.9**
	Benzo(b)&(k)fluoranthene	µg/L	1	**0.01**		-	-	-	-	-	-	-	-	-	-	-	**<4**	-	**<2**
	Benzo(b)fluoranthene	µg/L	1	**0.01**		**<1**	-	**<1**	-	**<1**	**<1**	**<1**	**<1**	-	**<1**	-	-	-	-
	Benzo(g,h,i)perylene	µg/L	0.5	**0.001**		**<1**	-	**<1**	-	**<1**	**<1**	**<1**	**<1**	-	**<1**	-	**<2**	-	**<0.9**
	Benzo(k)fluoranthene	µg/L	1	**0.01**		**<1**	-	**<1**	-	**<1**	**<1**	**<1**	**<1**	-	**<1**	-	-	-	-
	Chrysene	µg/L	0.5	**0.001**		**<1**	-	**<1**	-	**<1**	**<1**	**<1**	**<1**	-	**<1**	-	**<2**	-	**<0.9**
	Dibenz(a,h)anthracene	µg/L	0.5	**0.1**		**<1**	-	**<1**	-	**<1**	**<1**	**<1**	**<1**	-	**<1**	-	**<2**	-	**<0.9**
	Fluoranthene	µg/L	0.5	**1**		<1	-	<1	-	<1	<1	<1	<1	-	<1	-	**<2**	-	**2**
	Fluorene	µg/L	0.5	**3**		<1	-	<1	-	<1	<1	<1	1.4	-	<1	-	<2	-	**12**
	Indeno(1,2,3-c,d)pyrene	µg/L	0.5	**0.01**		**<1**	-	**<1**	-	**<1**	**<1**	**<1**	**<1**	-	**<1**	-	**<2**	-	**<0.9**
	Naphthalene	µg/L	0.5	**70**	1300	<1	-	16.4	-	<1	<1	<1	9.9	-	<1	-	<2	-	**244**
	PAHs (Sum of total)	µg/L	0.5			-	-	-	-	-	-	-	-	-	-	-	<2	-	297
	Phenanthrene	µg/L	0.5	**0.6**		**<1**	-	**<1**	-	**<1**	**<1**	**<1**	**1.3**	-	**<1**	-	**<2**	-	**14**
	Pyrene	µg/L	0.5	**0.025**		**<1**	-	**<1**	-	**<1**	**<1**	**<1**	**<1**	-	**<1**	-	**<2**	-	**2**
Phenols	2,4-dimethylphenol	µg/L	0.5	**2**	430000	-	-	<1	-	<1	<1	<1	-	-	<1	-	<2	-	**69**
	2-methylphenol	µg/L	0.5	**13**		-	-	<1	-	<1	<1	<1	-	-	<1	-	<2	-	**15**
	2-nitrophenol	µg/L	0.5			-	-	<1	-	<1	<1	<1	-	-	<1	-	<2	-	<0.9
	3-&4-methylphenol	µg/L	0.5	**13**		-	-	<2	-	<2	<2	<2	-	-	<2	-	<4	-	**20**
	4-chloro-3-methylphenol	µg/L	0.3			-	-	<1	-	<1	<1	<1	-	-	<1	-	<2	-	<0.9
	Phenol	µg/L	0.5	**400**	340000	-	-	<1	-	<1	<1	<1	-	-	<1	-	<2	-	2
BTEX	Total Xylene (ESDAT)	ug/L				<4	-	2	-	<4	<4	<4	2	-	<4	-	<4	-	38
	Benzene	ug/L	1	**700**	7000	<1	-	1	-	<1	<1	<1	5	-	2	-	<1	-	52
	Ethylbenzene	ug/L	2	**80**	100000	<2	-	<2	-	<2	<2	<2	<2	-	<2	-	<2	-	2
	Toluene	ug/L	2	**180**	370000	<2	-	<2	-	<5	<5	<5	4	-	<5	-	<5	-	46
	Xylene (m & p)	ug/L	2	**75**		<2	-	2	-	<2	<2	<2	2	-	<2	-	<2	-	26
	Xylene (o)	ug/L	2	**75**		<2	-	<2	-	<2	<2	<2	<2	-	<2	-	<2	-	12
Inorganics	Alkalinity as CaCO3	mg/L	1			-	-	143	-	152	160	159	-	-	233	-	191	-	556
	Ammonia as N	mg/L	0.01	**0.91**		-	-	<0.1	-	0.237	<0.1	<0.1	-	-	**1.24**	-	**2.7**	-	**9.7**
	Anions Total	meq/L	0.01			-	-	554	-	-	574	608	-	-	544	-	627	-	434
	Bicarbonate	mg/L	1			-	-	143	-	152	-	-	-	-	233	-	-	-	-
	Bicarbonate as CaCO3	mg/L	1			-	-	-	-	-	160	159	-	-	-	-	191	-	556
	Carbonate	mg/L	1			-	-	<1	-	<1	<1	<1	-	-	<1	-	<1	-	<1
	Cations Total	meq/L	0.01			-	-	588	-	-	544	563	-	-	515	-	632	-	456
	Chloride	mg/L	0.5			-	-	17,600	-	16,300	19,600	20,700	-	-	17,300	-	20,500	-	14,500
	Cyanide (Free)	mg/L	0.004	**0.004**		-	-	<0.004	-	-	<0.004	<0.004	-	-	-	-	-	-	-
	Cyanide Total	mg/L	0.004	**0.004**		**0.005**	-	-	-	<0.004	-	-	**0.014**	-	<0.004	-	-	-	-
	Ferrous Iron	mg/L	0.05			-	-	-	-	-	24.3	23.5	-	-	-	-	3.56	-	-
	Hydroxide Alkalinity as CaCO3	mg/L	1			-	-	<1	-	<1	<1	<1	-	-	<1	-	<1	-	<1
	Ionic Balance	%	0.01			-	-	2.96	-	-	2.72	3.85	-	-	2.8	-	0.37	-	2.4
	Nitrate (as N)	mg/L	0.01			-	-	-	-	-	0.03	0.02	-	-	-	-	<0.01	-	<0.01
	Nitrite (as N)	mg/L	0.01			-	-	-	-	-	<0.01	<0.01	-	-	-	-	<0.01	-	<0.01
	Nitrogen (Total Oxidised)	mg/L	0.01			-	-	-	-	-	0.03	0.02	-	-	-	-	<0.01	-	<0.01
	pH (Lab)	pH_Units	0.01			-	-	-	-	-	5.49	5.46	-	-	-	-	7.24	-	-
	Sulphate	mg/L	0.5			-	-	2580	-	3000	850	1020	2140	-	2480	-	2220	-	687
	Sulphate (Filtered)	mg/L	1			2700	-	-	-	-	-	-	-	-	-	-	-	-	-
	TOC	mg/L	1			-	-	-	-	-	<1	<1	-	-	-	-	3	-	8
	Weak Acid Dissociable Cyanide	mg/L	0.004			-	-	-	-	-	<0.004	<0.004	-	-	-	-	-	-	-

					Field_ID	MW09	MW09	MW09	MW09	MW09	MW09	QC311	MW22	MW22	MW22	MW22	MW22	MW22	MW40
					Location_Code	BH047	BH047	BH047	BH047	BH047	BH047	BH047	BH116	BH116	BH116	BH116	BH116	BH116	AECOM_BH40
					Sampled_Date_Time	19/07/2006	19/07/2006	15/08/2007	9/05/2008	5/09/2008	15/03/2010	15/03/2010	17/07/2006	17/07/2006	7/05/2008	5/07/2008	15/03/2010	15/03/2010	20/03/2010
					Sample_Type	Normal	Normal	Normal	Normal	Normal	Normal	Field_D	Normal	Normal	Normal	Normal	Normal	Normal	Normal
					Lab_Report_Number	ES0608799	ES0609802	ES0711324		ES0806586	ES1004783	ES1004783	ES0608744	ES0609802	ES0806416		ES1004782	ES1005579	ES1005391
					Well	MW09	MW09	MW09	MW09	MW09	MW09	MW09	MW22	MW22	MW22	MW22	MW22	MW22	MW40
Chem_Group	**ChemName**	**output**	**EQL**	**MWQC**	**SSTC-A**														
	Vinyl acetate	ug/L	50			-	-	-	-	-	-	-	-	-	-	-	<50	-	<50

SITE AREA	MATERIAL TYPE	BASE DEPTH	OBSERVATIONS OF GASWORK RELATED IMPACTS
BARANGAROO ORWN			
BH01	**Fill**	**17.5**	**At 2m very slight hydrocarbon odour**
BH01	**Marine sediments**	**25.4**	**NOC**
BH404	Fill	16.0	0.1m mild hydrocarbon odour, 7m hydrocarbon odour and sheen, 14m hydrocarbon odour and staining, 15m hydrocarbon odour
BH017	Fill	21.0	1m faint hydrocarbon odour between 1.0m and 2.2m
BH017	Marine sediments	23.6	No Observed Contaminatin (NOC)
BH017	Bedrock	24.6	NOC
BH021	Fill	15.0	6m faint hydrocarbon odour between 6m and 20m
BH021	Marine sediments	20.8	NOC
BH035	**Fill**	**15.5**	**NOC**
BH035	**Marine sediments**	**21.2**	**NOC**
BH38	**Fill**	**17.5**	**NOC**
BH38	**Marine sediments**	**20.7**	**NOC**
BH39	**Fill**	**23.5**	**NOC**
BH39	**Marine sediments**	**25.0**	**NOC**
BH40	Fill	14.3	NOC
BH40	**Marine sediments**	**20.1**	**16.5m black stained veins of tar with sheen, strong chemical odour,**
BH40	**Bedrock**	**20.5**	**NOC**
BH46	Fill	19.0	14.5m very strong chemical odour
BH46	Marine sediments	23.7	19m very strong chemical odour, 20.5m chemical odour
BH47	Fill	16.0	4 to 7m slight hydrocarbon odour, 5.5m black staining, 10 to 11m slight hydrocarbon odour, 13m moderate hydrocarbon odour,
BH47	Marine sediments	18.6	16m slight hydrocarbon odour
BH47	Bedrock	19.1	NOC
BH049	**Fill**	**18.0**	**NOC**
BH049	**Marine sediments**	**27.5**	**NOC**
BH053/MW11	Fill	15.5	3m to 3.28m faint hydrogen sulphide odour
BH053/MW11	Marine sediments	21.0	NOC
BH053/MW11	Bedrock	22.4	NOC
BH054	Fill	8.5	2.5m slight to moderate hydrocarbon odour
BH56	Fill	17.5	7m tar odour
BH56	Marine sediments	21.4	19m moderate tar odour
BH56	Bedrock	21.4	NOC
BH57	Fill	15.8	NOC
BH57	Marine sediments	18.3	NOC
BH60	Fill	16.0	2.5m very slight tar odour
BH60	Marine sediments	25.0	16m strong tar odour and black staining, 17.5m strong tar odour and tar mottles, 20.5m strong tar odour, 22m slight tar odour
BH063	Fill	10.0	0.2m slight hydrocarbon odour
BH064	Fill	18.0	NOC
BH068	Fill	10.0	3m moderate hydrocarbon odour
BH72	Fill	13.0	NOC
BH72	Marine sediments	20.5	16m slight chemical odour
BH72	Bedrock	20.7	NOC
BH076/MW14	Fill	16.0	NOC
BH076/MW14	Marine sediments	25.2	NOC
BH116	Fill	26.4	NOC
BH142	Fill	10.0	NOC
BH143	Fill	16.5	NOC
BH143	Marine sediments	20.0	16.5m slight hydrocarbon odour
BH143	Bedrock	24.0	NOC
BH191	Fill	11.5	3.6m slight hydrocarbon odour and black staining, 5m strong hydrocarbon/tar odour and black staining, 7m slight hydrocarbon odour and black staining
BH191	Marine sediments	26.5	11.5m sulfurous odour, 17.95m to 18.4m dark brown tarry substance
BH212	Fill	17.5	1.4m black staining, 1.85m to 2.0m slight hydrocarbon odour and black staining, 2.5m trace black staining, 7.2m trace black staining, 12.6m slag/furnace waste, 15.5m black staining
BH212	Marine sediments	33.8	NOC
IT01	Fill	15.5	5m slight tar odour
IT01	Marine sediments	17.6	NOC
IT02	Fill	16.9	NOC
IT02	Marine sediments	17.5	NOC
BH410/IT04	Fill	17.0	NOC
BH410/IT04	Marine sediments	32.2	17m hydrocarbon odour and minor black staining
BH411/IT05	Fill	18.0	NOC
BH411/IT05	Marine sediments	27.0	NOC
SV08	Fill	2.2	0.8m slight naphthalene odour

Key Chemical	Criteria for Protection of Plants and Soil (mg/kg)	Grouped Criteria (mg/kg)	Data Sources/Notes
Metals and inorganics			
Arsenic[1]	100		ASC NEPM (2013) Schedule 1B, Table 1B(5) Generic EIL - Urban residential and public open space
Cadmium	10		CCME (1999) Soil Quality Guidelines - Residential / Parkland
Chromium	Clay content (%) required criterion TBD		ASC NEPM (2013) Schedule 1B, Table 1B(3) Soil-specific added contaminant limit - Urban residential and public open space
Copper[1]	CEC and pH required criterion TBD		ASC NEPM (2013) Schedule 1B, Table 1B(2) Soil-specific added contaminant limit - Urban residential and public open space
Lead[1]	1100		ASC NEPM (2013) Schedule 1B, Table 1B(4) Generic added contaminant limit - Urban residential and public open space
Mercury	6.6		CCME (1999) Soil Quality Guidelines - Residential / Parkland
Nickel	CEC required criterion TBD		ASC NEPM (2013) Schedule 1B, Table 1B(3) Soil-specific added contaminant limit - Urban residential and public open space
Zinc	CEC and pH required criterion TBD		ASC NEPM (2013) Schedule 1B, Table 1B(1) Soil-specific added contaminant limit - Urban residential and public open space
Cyanide (if free)	0.9		CCME (1997) Soil Quality Guidelines - Residential / Parkland
Ammonia			Calculate based on irrigation guideline of 5 mg/L as N (based on protection of plants)
Petroleum Hydrocarbons			
TRH C6 -C10	180		ASC NEPM (2013) Schedule 1B, Table 1B(6) ESLs - Urban residential and public open space - Coarse soil - moderate reliability
TRH C10 - C16	120		ASC NEPM (2013) Schedule 1B, Table 1B(6) ESLs - Urban residential and public open space - Coarse soil - moderate reliability
TRH C16 - C34	300		ASC NEPM (2013) Schedule 1B, Table 1B(6) ESLs - Urban residential and public open space - Coarse soil
TRH C34 - C40	2800		ASC NEPM (2013) Schedule 1B, Table 1B(6) ESLs - Urban residential and public open space - Coarse soil
Benzene	50		ASC NEPM (2013) Schedule 1B, Table 1B(6) ESLs - Urban residential and public open space - Coarse soil
Toluene	85		ASC NEPM (2013) Schedule 1B, Table 1B(6) ESLs - Urban residential and public open space - Coarse soil
Ethylbenzene	70		ASC NEPM (2013) Schedule 1B, Table 1B(6) ESLs - Urban residential and public open space - Coarse soil
Xylenes	105		ASC NEPM (2013) Schedule 1B, Table 1B(6) ESLs - Urban residential and public open space - Coarse soil
Low MWT PAHs			
Acenaphthene[1]		sum - 50 b	a: CCME (1999b)
Acenaphthylene[1]			b: Total PAHs (excluding carcinogenic PAHs), from USEPA Eco SSLs of 48mg/kg rounded to 50mg/kg
Anthracene			
Fluorene[1]			
Phenanthrene	22 a		
Naphthalene[1]	170		ASC NEPM (2013) Schedule 1B, Table 1B(5) Generic EIL - Urban residential and public open space
High MWT PAHs			
			c: Criteria derived from 0.7 mg/kg for benzo(a)pyrene and applied using the following TEFs from ASC NEPM (2013), Schedule 1B, Table 1B(6) ESLs - Urban residential and public open space - coarse soil:
Benzo[a]anthracene	0.07 c		- benzo[a]anthracene, 0.1
Benzo[a]pyrene	0.7 c		- benzo[a]pyrene, 1
Benzo[b]fluoranthene	0.07 c		- benzo[b]fluoranthene, 0.1
Benzo[k]fluoranthene	0.07 c		- benzo[k]fluoranthene, 0.1
Benzo[ghi]perylene	0.007 c		- benzo[ghi]perylene, 0.01
Chrysene	0.007 c		- chrysene, 0.01
Dibenz[ah]anthracene	0.7 c		- dibenz[ah]anthracene, 1
Fluoranthene	- c		TEFs for fluoranthene and pyrene not used by CCME (2008b)
Indeno[123cd]pyrene	0.07 c		- indeno[123cd]pyrene, 0.1
Pyrene	- c		TEFs for fluoranthene and pyrene not used by CCME (2008b)
Phenols			
Phenol	3.8		CCME (1997) Soil Quality Guidelines - Residential / Parkland
2,4dimethylphenol	3.8		CCME (1997) Soil Quality Guidelines - Residential / Parkland
2-methylphenol	3.8		CCME (1997) Soil Quality Guidelines - Residential / Parkland
3&4-methylphenol	3.8		CCME (1997) Soil Quality Guidelines - Residential / Parkland

Note:
[1] Where the TSC are greater than the derived leachability based soil SSESC (refer to Section 5.7.3.3, ORWS HHERA Addendum) the relevant soil SSESC will be adopted.

Analyte	Criteria (µg/L)	Source
Metals and Inorganics		
Arsenic	2.3	ANZECC (2000) 95% Marine Water Environmental Concern Level
Cadmium	0.7	ANZECC (2000) 99% Marine Water Trigger Value
Chromium (hexavalent)	4.4	ANZECC (2000) 95% Marine Water Trigger Value
Chromium III	27.4	ANZECC (2000) 95% Marine Water Trigger Value
Cobalt	1	ANZECC (2000) 95% Marine Water Trigger Value
Copper	1.3	ANZECC (2000) 95% Marine Water Trigger Value
Lead	4.4	ANZECC (2000) 95% Marine Water Trigger Value
Mercury	0.1	ANZECC (2000) 99% Marine Water Trigger Value
Nickel	70	ANZECC (2000) 95% Marine Water Trigger Value
Vanadium	100	ANZECC (2000) 95% Marine Water Trigger Value
Zinc	15	ANZECC (2000) 95% Marine Water Trigger Value
Ammonia	910	ANZECC (2000) 95% Marine Water Trigger Value
Cyanide	4	ANZECC (2000) 95% Marine Water Trigger Value
Low MW PAHs		
Acenaphthene	5.8	CCME (1999) Freshwater Guideline
Acenaphthylene	5.8	Adopted criteria for Acenaphthene as surrogate
Anthracene	0.01 [a]	ANZECC (2000) 99% Marine Water Trigger Value
Fluorene	3	CCME (1999) Freshwater Guideline
Naphthalene	70	ANZECC (2000) 95% Marine Water Trigger Value, moderate reliability
Phenanthrene	0.6 [a]	ANZECC (2000) 99% Marine Water Trigger Value
2-methylnaphthalene	2.1	Oakridge Secondary Chronic Value (1996) for 1-methylnaphthalene
High MW PAHs		
Benz(a)anthracene	0.1 [a,b]	Value for high molecular weight PAHs is based off the ANZECC (2000) 99% Marine Water Trigger Values for benzo(a)pyrene. A TEF approach is presented below in accordance with NEPC (2013), CCME (2010) and the *Declaration Site HHERA* (AECOM, 2011a) *Appendix K*, toxicity profile for PAHs:
		- Benzo(a)anthracene (0.1)
Benzo(a)pyrene		- Benzo(a)pyrene (1)
Benzo(b)fluoranthene		- Benzo(b)fluoranthene (0.1)
Benzo(g,h,i)perylene		- Benzo(g,h,i)perylene (0.01)
Benzo(k)fluoranthene		- Benzo(k)fluoranthene (0.1)
Chrysene		- Chrysene (0.01)
Dibenz(a,h)anthracene		- Dibenzo (a,h) anthracene (1)
Indeno(1,2,3-c,d)pyrene		- Indeno (1,2,3-cd)pyrene (0.1)
Fluoranthene	1	ANZECC (2000) 99% Marine Water Trigger Value
Pyrene	0.025 [a]	CCME (1999) Freshwater Guideline
Other Organics		
2,4-dimethylphenol	2	ANZECC (2000) 95% Marine Water Trigger Value, low reliability
2-methylphenol	13	Oakridge Secondary Chronic Value (1996)
3-&4-methylphenol	13	Adopted value for 2-methylphenol as surrogate
Dibenzofuran	3.7	Oakridge Secondary Chronic Value (1996)
Pentachlorophenol	22	ANZECC (2000) 95% Marine Water Trigger Value
Phenol	400	ANZECC (2000) 95% Marine Water Trigger Value
2,4 dinitrophenol	45	ANZECC (2000) 95% Fresh Water Trigger Value
Styrene	72	CCME (1999) Freshwater Guideline

Petroleum Hydrocarbons		
Benzene	700	ANZECC (2000) 95% Marine Water Trigger Value, moderate reliability
Ethylbenzene	80	ANZECC (2000) 95% Fresh Water Trigger Value
Toluene	180	ANZECC (2000) 95% Marine Water Trigger Value, low reliability
Xylene (m & p)	75	ANZECC (2000) 95% Marine Water Trigger Value, low reliability for m-xylene.
Xylene (o)	350	ANZECC (2000) 95% Marine Water Trigger Value, low reliability for o-xylene.
TPH C_6 - C_9	110	CCME (2008 Canada-Wide Standard for Petroleum Hydrocarbons (PHC) in Soil – Table B-9 values for TPH C_6 to C_8 and $>C_8$ to C_{10}. Criteria calculated from a weighted average assuming a Coal Tar composition of 25% aliphatic and 75% aromatic components
TPH C_{10} - C_{14}	40	CCME (2008) Canada-Wide Standard for Petroleum Hydrocarbons (PHC) in Soil – Table B-9 values for TPH $>C_{10}$ to C_{12} and $>C_{12}$ to C_{16}. Criteria calculated from a weighted average assuming a Coal Tar composition of 25% aliphatic and 75% aromatic components
TPH C_{15} - C_{28}	-	No guidelines values available
TPH C_{29} - C_{36}	-	No guidelines values available

Notes:

Taken from the ORNW HHERA (AECOM, 2013)

All criteria in ug/L

(a) It is noted that these MWQC are less than the laboratory standard LOR. The laboratory standard LOR will be adopted in place of the MWQC where: (i) analysis of these chemicals is required; or, (ii) where the MWQC are considered in derivation of risk based criteria. This approach is consistent with Section 3.4.3.2 and Section 8.3.5.4 of ANZECC (2000) and has been agreed with the Auditor and the NSW EPA. It is noted that it is not practical to use the laboratory ultra-trace LOR because: (i) the high salinity present in the water (particularly in areas close to the harbour) will cause interferences in the reporting of some analytes and therefore an increased LOR; (ii) the presence of other contaminants (matrix interference) will raise the LOR; and (iii) groundwater turbidity can lead to raised LOR.

(b) In the case of high molecular weight PAHs the standard limit of reporting is greater than the adopted MWQC above which is based on B(a)P (99% Marine Water Guideline). Therefore it is considered appropriate to adopt the standard laboratory limit of reporting for these compounds in applying the TEF approach outlined in CCME, 2010 (Appendix I PAH Toxicity Profile).

Appendix B

Figures

Appendix B Figures

G:\Projects\602 Projects\60247139 Barangaroo\FIGURES\Stage 1B Public Domain RAP\60247139 F1 Site Location 20 03 2015 TO

AECOM

SITE LOCATION

Barangaroo

Hickson Road, Millers Point NSW

FIGURE F1

CAD Ref: P:\602X\60247139\CAD\07-FIGURES\60247139-DRG-20-ORWN-FIG-2.dwg Last modified: 09 Sep 15 - 10:18

LEGEND:
- DECLARATION AREA
- APPROXIMATE EXTENT OF FORMER GASWORKS FEATURES
- CROWN DEVELOPMENT SITE
- VMP / BLOCK 4 RAP AREA
- ORWS RAP AREA
- ORWN AREA/STAGE 1B PUBLIC DOMAIN (THE SITE)

KENT STREET

HICKSON ROAD

HICKSON RD

SUSSEX STREET

SHELLEY STREET

LIME STREET

MAIN GASHOLDER ANNULUS
TAR TANK
METER HOUSE
CONDENSERS
ENGINE HOUSE
1870 GASHOLDER
PURIFYING SHEDS
SMALL GASHOLDER
PURIFIERS

LOT 3
D.P. 876514

BLOCK 5

BLOCK 4

1868 RETORT HOUSE EXTENSION

RETORT HOUSE

DECLARATION AREA BOUNDARY

PART LOT 5
D.P. 876514

PART LOT 5
D.P. 876514

LOT 6
D.P. 876514

THE SITE

HARBOUR HEAT REJECTION AREA

TEMPORARY OVERSEAS PASSENGER TERMINAL (No Access)

BARANGAROO CENTRAL

BARANGAROO SOUTH

Darling Harbour

FOR INFORMATION ONLY

This drawing is confidential and shall only be used for the purposes of this project.

REVISIONS				
No.	BY	DATE	DESCRIPTION	APPD
01	PAS	20.03.15	DRAFT ISSUE	

SCALES: 20 0 20 40 60 80m — 1:2000 FULL SIZE A3

THE SIGNING OF THIS TITLE BLOCK CONFIRMS THE DESIGN AND DRAFTING OF THIS PROJECT HAVE BEEN PREPARED AND CHECKED IN ACCORDANCE WITH THE AECOM QUALITY ASSURANCE SYSTEM TO ISO 9001-2000

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DRAWN	PAS	CHECKED	
APPROVED		DATE	

CONTRACTOR:

DESIGNER: AECOM

AECOM Australia Pty Ltd A.B.N. 20 093 846 925

ORWN AREA/STAGE 1B PUBLIC DOMAIN RAP, BARANGAROO

FIGURE F2:
SITE LAYOUT AND SURROUNDING AREA

STATUS: DRAFT

DRAWING NO: 60247139-DRG-20-ORWN-FIG-2

REV: 01

09 Sep 15 - 10:43

60247139-DRG-20-ORWN-FIG-3.dwg

30-34 HICKSON ROAD
LOT 2 DP 873158

36 HICKSON ROAD
LOT 3 DP 873158

38 HICKSON ROAD
LOT 3 DP 873158

ALIGNMENT OF CROSS SECTION A-A' (REFER TO SECTION 1.4 OF THE REPORT)

A

HICKSON ROAD

BLOCK 5

BLOCK 4

CROWN BASEMENT (STAGE 1B)

LEND LEASE BASEMENT (STAGE 1B)

STAGE 1A

CROWN BASEMENT (STAGE 1C)

STAGE 1C (ORWN)

STAGE 1B & 1C BOUNDARY

ORWN AREA PUBLIC DOMAIN

ORWS BASEMENT

HARBOUR HEAT REJECTION AREA

PUBLICLY ACCESSIBLE WATERWAY (WATERMANS COVE)

CROWN HOTEL PODIUM AND TERRACE AREA

THE SITE

A'

EXISTING AREA OF SUSPENDED CONCRETE SLAB ON PILES OVER OPEN WATER AND THE HISTORIC SOUTHERN COVE EMBANKMENT

LEGEND:

- DECLARATION BOUNDARY
- CROWN DEVELOPMENT SITE
- EXISTING ORWS BASEMENT GROUNDWATER RETENTION WALL SYSTEM
- HARBOUR HEAT REJECTION INLET SYSTEM AREA
- APPROXIMATE EXTENT OF FORMER GASWORKS FEATURES
- CAISSON WALL
- BLOCK 4 AND 5 BOUNDARIES
- CROWN BASEMENT
- CROWN PODIUM AND TERRACE AREA
- LEND LEASE BASEMENT
- BLOCK 4 — PROPOSED DEVELOPMENT BLOCK AREA
- THE SITE BOUNDARY
- ORWN AREA PUBLIC DOMAIN
- PUBLICLY ACCESSIBLE WATERWAY

FOR INFORMATION ONLY

REVISIONS

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DESIGNER:

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ORWN AREA/STAGE 1B PUBLIC DOMAIN RAP, BARANGAROO

FIGURE F3:
PROPOSED FUTURE LAND USE -
ORWN AREA PUBLIC DOMAIN

STATUS: DRAFT

DRAWING NO: 60247139-DRG-20-ORWN-FIG-3

REV: 01

09 Sep 15 - 11:13

60247139-DRG-20-ORWN-FIG-4.dwg

N

30-34 HICKSON ROAD
LOT 2 DP 873158

36 HICKSON ROAD
LOT 3 DP 873158

38 HICKSON ROAD
LOT 3 DP 873158

MAIN GASHOLDER ANNULUS

SMALL GASHOLDER

TAR TANK

METER HOUSE

1870 GASHOLDER

HICKSON ROAD

BLOCK 5

BLOCK 4

PURIFIERS

CONDENSERS

ENGINE HOUSE

PURIFYING SHEDS

1880 EXTENSION

RETORT HOUSE

LEND LEASE BASEMENT (STAGE 1B)

STAGE 1A

CROWN BASEMENT

STAGE 1C (ORWN)

STAGE 1B & 1C BOUNDARY

OWRN AREA PUBLIC DOMAIN

BH047/MW09 (removed)

ORWS BASEMENT

HARBOUR HEAT REJECTION AREA

HOTEL PODIUM AND TERRACE AREA

THE SITE

PUBLICLY ACCESSIBLE WATERWAY (WATERMANS COVE)

LEGEND:

- COFFEY BOREHOLE LOCATION
- COFFEY GROUNDWATER WELL LOCATION (APPROXIMATE)
- ERM BOREHOLE LOCATION
- ERM GROUNDWATER MONITORING WELL LOCATION
- AECOM BOREHOLE LOCATION
- AECOM SUPPLEMENTARY DGI BOREHOLE LOCATION
- AECOM SUPPLEMENTARY VMP DGI INTERTIDAL WELL LOCATION
- AECOM GROUNDWATER MONITORING WELL LOCATION
- AECOM SOIL VAPOUR LOCATION
- AECOM INTERTIDAL WELL LOCATION
- AECOM STILLING WELL LOCATION
- AECOM TREE LOCATION
- DECLARATION BOUNDARY
- THE SITE BOUNDARY
- EXISTING ORWS BASEMENT GROUNDWATER RETENTION WALL SYSTEM
- HARBOUR HEAT REJECTION INLET SYSTEM AREA
- APPROXIMATE EXTENT OF FORMER GASWORKS FEATURES
- CAISSON WALL
- BLOCK 4 AND 5 BOUNDARIES
- CROWN BASEMENT
- LEND LEASE BASEMENT
- BLOCK 4 PROPOSED DEVELOPMENT BLOCK AREA

FOR INFORMATION ONLY

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DESIGNER: AECOM

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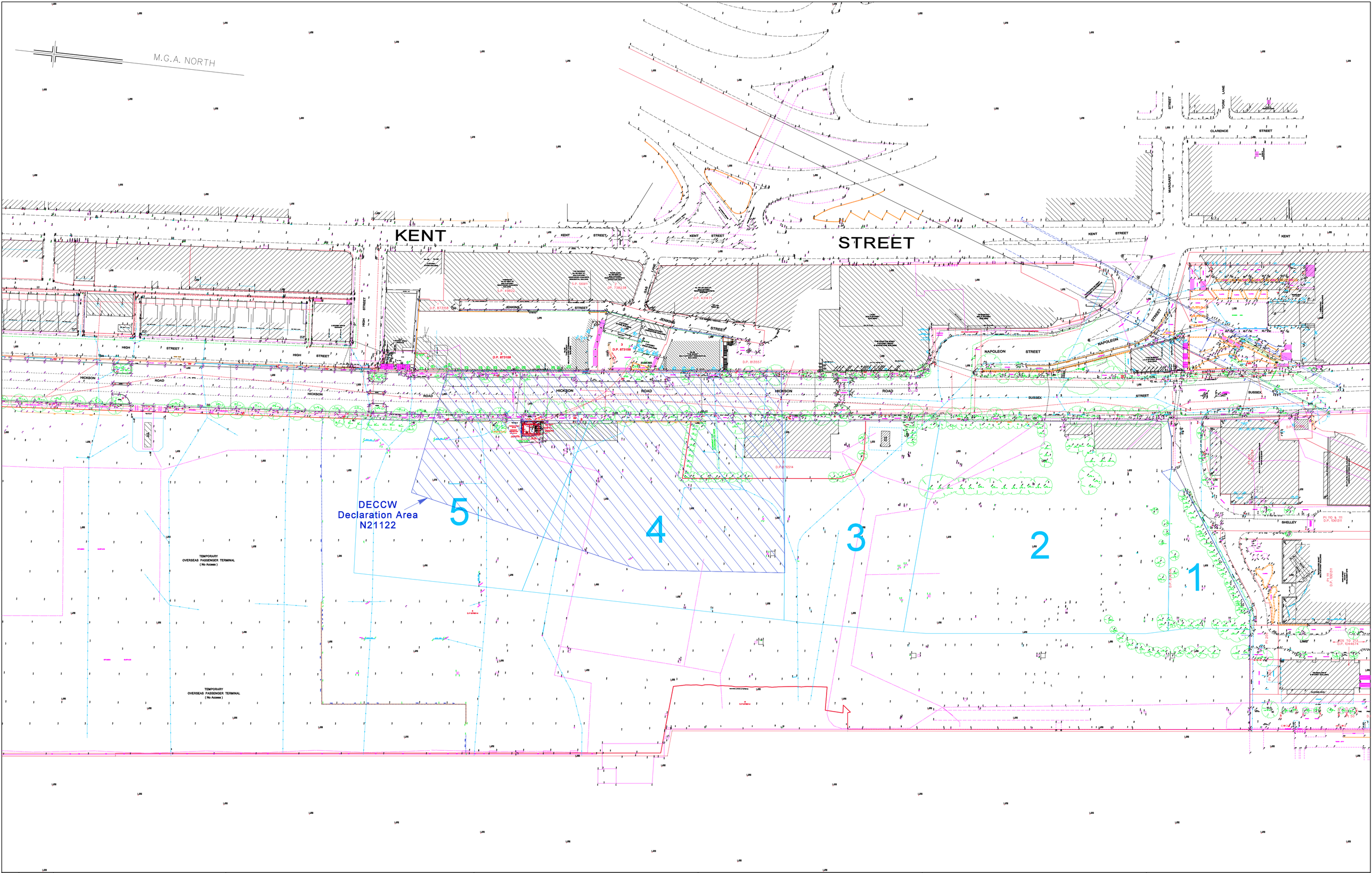
ORWN AREA/STAGE 1B PUBLIC DOMAIN RAP, BARANGAROO

FIGURE F4:
SITE PLAN AND SAMPLING LOCATIONS

STATUS: DRAFT

DRAWING NO: 60247139-DRG-20-ORWN-FIG-4

REV: 01



REV.	DATE	AMENDMENTS

0 100
REDUCTION RATIO 1: 1000 @ A1

THIS TITLE BLOCK AND NOTES FORM AN INTEGRAL PART OF THE PLAN AND MUST BE REPRODUCED IN ANY USE, DUPLICATION OR AMENDMENT.

DATUM : AUSTRALIAN HEIGHT DATUM
CONTOUR INTERVAL : N/A
ORIGIN OF LEVELS : S.S.M. 46693
R.L. 2.454 A.H.D.

RYGATE & COMPANY PTY. LIMITED
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SG	GD		

CLIENT
LEND LEASE (Millers Point) PTY. LTD.

LOCALITY
BARANGAROO

L.G.A.
CITY OF SYDNEY

PLAN
SHOWING DETAIL, LEVELS & SERVICES
LOTS 3 & 5 DP 876514
AND ALONG HICKSON ROAD

REFERENCE No.	PLAN No.	DATE	SHEET No. 1
74479	74479-1	18/10/2010	OF 1 SHEETS