13 August 2020

Infrastructure NSW
Attn: Jennifer Chang
19 Martin Place
Sydney NSW 2000
Attention: Jennifer Chang

By email: jennifer.chang@infrastructure.nsw.gov.au

Dear Jennifer,

RE: INTERIM AUDIT ADVICE LETTER NO. 1 - DATA GAP ASSESSMENT AND HAZARDOUS MATERIALS MANAGEMENT PLAN, THE NEW SYDNEY FISH MARKET

Ramboll Australia Pty Ltd
Level 3, 100 Pacific Highway
PO Box 560
North Sydney NSW 2060

T +61 2 9954 8100
www.ramboll.com

Ref 318000632

1. INTRODUCTION

1.1 Objective

As a NSW Environment Protection Authority (EPA) accredited Contaminated Sites Auditor, I am conducting an Audit in relation to the subject site. This initial review has been undertaken to provide an independent review of the suitability and appropriateness of a Data Gap Assessment (DGA) and Hazardous Materials Management Plan (HMMP).

The review was initially undertaken to address comments from the NSW EPA in letter '*The New Sydney Fish Market – Concept and Stage 1 (SSD 8924) and Stage 2 (SSD 8925) EPA comment on Response to Submissions'* (Document Reference: DOC20/229048), dated 20 March 2020. The NSW EPA reviewed the DGA and HMMP, as well as previously prepared documents, and provided the following comments that are addressed by this Interim Audit Advice (IAA) letter:

1. *"…the EPA recommends that an EPA-accredited site auditor be engaged to review the DGA and provide interim audit advice which comments on the appropriateness of the DGA report and the report's conclusions. If the site auditor finds any deficiencies in the report these must be addressed."*
2. *"The EPA recommends that an accredited site auditor is engaged to review the characterisation of fill materials in relation the presence of asbestos. The auditor must provide interim audit advice which comments on whether the characterisation is sufficient to ensure any asbestos containing materials in soils and at ground surface are managed appropriately. Any deficiencies in the characterisation of asbestos at the site that is identified by the site auditor must be addressed."*

3. *"The EPA recommends that an accredited site auditor is engaged to review the HMMP requirements for managing asbestos at ground surface and in soils. The auditor must provide interim audit advice which comments on whether the management requirements are appropriate. Any deficiencies in the asbestos management requirements by the site auditor must be addressed."*

Development Application SSD 8924 was subsequently approved by the Minister for Planning and Public Spaces on 12 June 2020. Condition B25 requires the Site Auditor to prepare an IAA letter commenting on the DGA (12 March 2019) and HMMP (8 April 2019) prepared by JBS&G Australia Pty Ltd (JBS&G) prior to the commencement of works. This IAA was prepared to satisfy this condition of the development consent.

1.2 Scope of Work

This IAA letter is based on a review of the documents listed below and observations made on a site visit on 5 March 2019, as well as discussions with Infrastructure NSW and JBS&G who undertook the investigation.

The reports reviewed were:

- 'Data Gap Assessment, The New Sydney Fish Market, 1A to 1C Bridge Rd, Glebe NSW', Report No. 54162/119400, 12 March 2019, JBS&G (*the DGA*).
- 'Hazardous Materials Management Plan, The New Sydney Fish Market, 1A to 1C Bridge Rd, Glebe and Part 56-60 Pyrmont Bridge Road, Pyrmont NSW', Report No. 54162/114239 (Rev 2), 8 April 2019, JBS&G (*the HMMP*).
- 'Hazardous Materials Removal Management Plan, New Sydney Fish Markets, 1A to 1C Bridge Road, Glebe and Part 56-60 Pyrmont Bridge Road, Pyrmont NSW', Report No. 54162/114239 (Rev 4), 12 August 2020, JBS&G (*the HMRMP*).

The HMRMP was prepared to address the findings of a draft version of this IAA and satisfy the requirements of Condition B28 of the development consent.

1.3 Background

I previously prepared 'Site Audit Report, The New Sydney Fish Market, 1A to 1C Bridge Road, Glebe and Part of 56-60 Pyrmont Bridge Road, Pyrmont, NSW' (the RAP SAR) and Section B Site Audit Statement (SAS) TO-054-A dated 25 September 2019 reviewing the suitability and appropriateness of a remedial action plan (RAP).

The RAP SAR reviewed the following reports:

- 'Environmental Site Investigation Blackwattle Bay Maritime Precinct, Blackwattle Bay Maritime Precinct, NSW', Report No. 2116954A PR_9459 Rev B, 9 March 2009, Parsons Brinkerhoff Australia Pty Ltd (PB)
- 'Preliminary Environmental Site Assessment for Proposed Redevelopment – Waterfront at Sydney Fish Markets, 56-60 Pyrmont Bridge Road, Pyrmont, NSW', Report No. E24125Krpt, August 2010, Environmental Investigation Services (EIS)
- 'Geotechnical Desktop Review', Report No. NB00046-300-ESG-RP-0001 / B, 6 August 2014, Jacobs Group (Australia) Pty Ltd (Jacobs)
- 'Environmental Site Assessment - The Bays Precinct Urban Transformation Area', Report No. 50460-101699 (Rev 1), 18 November 2015, JBS&G (JBS&G 2015(a))
- 'Site Wide Remedial Concept Plan – The Bays Precinct Urban Transformation Area', 4 December 2015, JBS&G (JBS&G 2015(b))

- 'Bays Market Precinct: Blackwattle Bay & Wentworth Park - History, Built Heritage, Archaeology & Landscape Study', Report No. H-16-237 (Rev 02), 17 July 2017, City Plan Heritage Pty Ltd (CPH)
- 'Contamination Investigation, The Bays Precinct – Separable Portion 1, Blackwattle Bay, Pyrmont, NSW', Report No. E29245KletRev1-SP1, 12 July 2017, Environmental Investigation Services (EIS)
- 'Revised Geotechnical Report to UrbanGrowth NSW on Geotechnical Investigation for Proposed Bays Market District at Blackwattle Bay & Wentworth Park, Pyrmont, NSW', Report No. 29245SrptRev2, 14 September 2017, JK Geotechnics
- 'Acid Sulfate Soil Management Plan, The New Sydney Fish Market, 1A to 1C Bridge Road, Glebe, NSW', Report No. 54162/113896 (Rev 2), 4 April 2019, JBS&G (the ASSMP)
- 'Hazardous Materials Management Plan, The New Sydney Fish Market, 1A to 1C Bridge Road, Glebe and Part 56-60 Pyrmont Bridge Road, Pyrmont, NSW', Report No. 54162/114239 (Rev 2), 8 April 2019, JBS&G (the HMMP)
- 'Environmental Site Assessment, The new Sydney Fish Market, 1A to 1C Bridge Road, Glebe and part 56-60 Pyrmont Bridge Road, Pyrmont, NSW', Report No. 54162 – 112239 (Rev 3), 4 April 2019, JBS&G (the ESA)
- 'Remedial Action Plan, The New Sydney Fish Market, 1A to 1C Bridge Road, Glebe and part 56-60 Pyrmont Bridge Road, Pyrmont, NSW', Report No. 54162/113808 (Rev 3), 4 April 2019, JBS&G (the RAP).

The various site investigations were completed prior to my engagement as Auditor, therefore discussions regarding the scope of work were not undertaken with the client or consultants. It is also noted that the PB (2009) Environmental Site Investigation referenced and reviewed six previous reports that were not provided for review.

The RAP SAR concluded that the site can be made suitable for the purposes of commercial/industrial land use (fish market) if remediated in accordance with the RAP, subject to compliance with the following conditions:

1. *"Assessment of data gaps prior to remediation commencing.*
2. *Preparation of a revised RAP or an addendum to the RAP should the data gap investigation identify contamination that was not anticipated in the RAP (if required).*
3. *Preparation of a Remediation Environmental Management Plan (REMP) prior to remediation commencing. The REMP is to be provided to the Auditor for review.*
4. *Preparation of a Construction Environmental Management Plan (CEMP). The CEMP is to be provided to the Auditor for review.*
5. *Preparation of a Site Audit Statement certifying suitability for the proposed use at the completion remediation and validation."*

The data gaps identified in the RAP SAR and the scope of the DGA are discussed in Section 6.

2. SITE DETAILS

2.1 Location

The site details are as follows:

Street address:	1A to 1C Bridge Road, Glebe, NSW 2037 and part 56-60 Pyrmont Bridge Road, Pyrmont, NSW 2009 (Attachment 1)
Identifier:	Lots 3-5 in DP 1064339, Part Lot 107 in DP 1076596, Part Lot 1 in DP 835794 (Attachment 2)
Local Government:	City of Sydney Council
Owner:	Roads and Maritime Services
Leaseholder:	Infrastructure NSW
Site Area:	Approximately 3.7 ha (approximately 0.76 ha land-based)
Zoning:	Ports and Employment under State Environmental Planning Policy (SEPP) No. 26 – City West and Maritime Waters under Sydney Regional Environmental Plan (Sydney Harbour Catchment) 2005.

The site boundaries are well defined by Bridge Road to the southeast and the existing fish market to the northeast. The site extends approximately 100 m into Blackwattle Bay and a further approximately 50 m at three areas comprising the footprint of wharf structures to be built as part of the proposed development (Attachment 2).

2.2 Adjacent Uses

The surrounding site uses include:

Northwest: Blackwattle Bay, part of Sydney Harbour

Northeast: the existing Sydney Fish Market

Southeast: Bridge Road, with Wentworth Park recreational area to the southeast

Southwest: Park area and Sydney Secondary College – Blackwattle Bay (Secondary School)

Blackwattle Bay represents a sensitive offsite receiving environment with estuarine waters of the bay connected to Rozelle Bay which flows into Darling Harbour and then into central Sydney Harbour.

2.3 Site Condition

A detailed description of the site condition is provided in the ESA and was summarised in the RAP SAR. The site is located within an area of commercial/industrial use and comprises four separate areas with different commercial/industrial uses.

The south-western portion of the site (Lot 5 DP 1064339) was occupied by a Hanson Cement concrete batching plant that was still operational at the time of the DGA assessment in March 2019 and at the time of the previous Audit (the RAP SAR) in September 2019. The central premises of the site (Lot 4 DP 1064339) comprised infrastructure associated with commercial hire boat operations and the remnants of the former Jones Brothers coal loader facilities (Lot 3 DP 1064339). The eastern most portion of the site comprised public open space areas of the current fish market (Lot 1 DP 835794) along the Blackwattle Bay foreshore area.

The ESA noted that the Hanson Cement concrete batching plant comprised several large bulk material silos, loading infrastructure, several washdown bays, and vehicle movement areas, vessel unloading facilities and a site office building. The northern portion of the premises was situated on a concrete deck

wharf structure overlying hardwood girders, whilst the southeast portion appeared to have been constructed on retained fill behind a sea wall. A number of conveyors connected the batch plant, four silos, and truck filling point infrastructure in addition to the adjoining weighbridge. Two designated bunded areas for chemical storage were located in the batch plant and central portion of the site. A two-storey site office building and Ausgrid substation (S1608) were situated in the east of the premises.

The commercial hire boat operations included facilities such as a wharf portion and associated finger jetty berths in the north, with vehicle parking areas, a demountable office building and shipping containers used for storage of supplies and audio-visual equipment. The wharf deck comprised a combination of concrete and asphalt pavement supported on timber beams and turpentine piles. The southern portion of the premises was established on fill material retained by a sea wall. Beyond the sea wall, services supporting the boats at dock were attached to the underside of the wharves (including sewer, water and power). A sewer pump-out facility was situated adjacent to the entry from Bridge Road, connected to the facilities beneath the wharves. One small building of unknown former use was located at the eastern most extent of the premises. Inspection of the site pavements during the ESA was limited by the presence of shipping containers, other equipment and vehicles. Areas able to be visually inspected did not identify indications of above ground storage tanks (AST) or underground storage tanks (UST).

The remnants of the former Jones Brothers coal loader facility included a rendered wall and timber framework adjacent to the street boundary and a paved yard area where structural steel infrastructure was stockpiled. The structure included an Ausgrid substation (S405) that was not inspected. Several temporary building structures were also located in this area. A sandstone block wall retained the land portion of the premises above the water line. Weed vegetation and several mid-sized trees were located in this portion of the site.

The area located directly west of the current fish markets building, which is part of the site, comprised public open space along the Blackwattle Bay foreshore area in the easternmost portion of the site. The area was primarily used as an outdoor dining area for patrons at the current fish markets. The eastern portion of the site was predominantly covered in hardstand, with the exception of a small grassed area in the southern portion of the property and rocks/boulders lining the foreshore area. The ESA noted that the hardstand ground surface of this portion of the site comprised a deck that overlies a mixture of soils (above the high-water level mark) and the surface waters of Blackwattle Bay.

The site is situated on predominantly flat terrain. The ESA noted that a review of topographic information available on the NearMap spatial information database indicated that the southern portion of the site had been subject to land reclamation and had an elevation of approximately 2 m Australian Height Datum (AHD). The northern portion of the site was situated on piers overlying the surface waters of Blackwattle Bay. Site surface water was anticipated to drain directly into Blackwattle Bay.

My observations during the site visit on 5 March 2019 generally confirmed the above consultant's observations, although the following additional observations were made:

- The premises in the central portion of the site were no longer operational, with the commercial hire boat operations having ceased. The premises were largely vacant, however the buildings remained and the sewer pump-out facility was reportedly still in use. No indications of ASTs or USTs were observed.
- Fill material was observed on the ground surface in the former coal loader facility and beneath the deck of the open space area adjacent to the current fish markets. A fragment of suspected asbestos containing material (ACM) was observed on the ground surface at the former coal loader facility.
- The concrete batching plant (Hanson Cement) was in operation at the time of the site visit and was therefore not inspected. The HMRMP reported that the plant was in the process of being demolished in April 2020.

2.4 Proposed Development

It is understood that the site is to be redeveloped by Infrastructure NSW as a new Fish Market. The most recent development plans for the proposed Fish Market are dated 18 September 2019 (those attached to the DGA were dated 31 August 2018). It is understood that statutory approval for the proposed development scheme was sought in two stages, comprising the initial concept development application, being for the demolition of existing structures and approval for the proposed development envelope for use of the site as a fish market. The second development application (Main Works) will seek approval for the construction of the new fish market and associated works.

Specifically, the concept development application was approved for:

- Building envelope for a 3-storey building
- use of the site for the fish market, including waterfront commercial and tourist facilities and ancillary uses
- waterfront structures, including wharves
- Public domain, including landscaping and foreshore promenade
- pedestrian, cycle, footpath and Bridge Road works
- demolition of existing wharves, structure, utilities and services.

The Main Works development application seeks approval for construction of a new fish market including land and water-based structures. The building will include three above ground levels and one basement level. The basement will comprise a car park, plant and storage, waste management facilities and bathrooms. The building will include wholesale services (storage, processing and sales), retail premises, waste management facilities, office space, amenities, plant and storage.

For the purposes of this audit, the 'commercial industrial' land use scenario will be assumed.

3. SITE HISTORY

The DGA provided a summary of the key aspects of the site history based on a review of previous investigations of the site, which was in line with the site history described in the ESA and RAP and as summarised in the RAP SAR. No additional site history information was reviewed in the DGA other than confirming that the central portion of the site was most recently used as a service/docking area for commercial hire vessels, but at the time of the DGA was vacant and that the northeast portion of the site, comprising the remains of the former coal loader, was also vacant.

The site history indicates that the site has been used, and continues to be used, for a range of commercial/industrial uses, including timber merchants, abattoirs and garbage collectors, coal depots, cement works and commercial boat hire.

3.1 Auditor's Opinion

The ESA reports the removal of five USTs from the site in 1995, with post-removal validation indicating residual contamination of soils with heavy metals:

> *"The site formerly had five underground storage tanks (USTs) which were removed from the site in 1995. The USTs had previously stored gasoline, distillate, racing fuel, mineral spirit and mineral oil. During the UST removal, impacted soils were reportedly excavated and removed from the site. The resulting excavations were reportedly validated for total petroleum hydrocarbon (TPH) constituent impacts, however it was further reported […] that heavy metal impacts remained in-situ in fill material at the site. The metals impacts were reported to be relatively immobile (via TCLP testing) and not readily prone to leaching to groundwater/harbour waters."*

The RAP SAR identified that the location of the former USTs and potential residual contamination at these locations requires further assessment during the DGA. There was also uncertainty about the presence of additional USTs on the site due to the absence of a recent SafeWork NSW Dangerous Goods Records search, in particular in the current cement works operations in the south-western portion of the site.

The site history provided in the DGA, and as established in the RAP SAR, provides a general indication of past site uses. Details of activities and operations at the site were not available and the source of material used for reclamation of the bay is unknown, although may comprise potentially contaminated dredged material from deep-water berths formerly located in Blackwattle Bay. Sources of site history information, such as historical aerial photographs, NSW EPA records, SafeWork NSW dangerous goods records, Council records and Certificates of Title, were not previously reviewed in the reports provided or in the DGA.

4. CONTAMINANTS OF CONCERN

The RAP SAR provided a list of the contaminants of potential concern (COPC) and potentially contaminating activities, based on the ESA. These have been tabulated in Table 4.1.

Table 4.1: Contaminants of Concern

Area	Activity	Potential Contaminants
Approximately 20 m wide area along Bridge Road and approximately 10 m along the eastern portion of the site adjacent to the existing fish markets (Attachment 2)	Reclaimed land with fill material	Heavy metals, total petroleum hydrocarbons (TPH), volatile organic compounds (VOCs), polycyclic aromatic hydrocarbons (PAHs), organochlorine pesticides (OCPs), herbicides, polychlorinated biphenyls (PCBs), asbestos, acid sulphate soils (ASS) and ground gases (methane, hydrogen sulfide, carbon dioxide, carbon monoxide and oxygen)
Former coal wharf	Not discussed in the ESA	Heavy metals, TPH/VOCs, PAHs, asbestos and tributyltin (TBT)
Current and former concrete batch plant	Not discussed in the ESA	Heavy metals, TPH/VOCs, PAHs, solvents, asbestos and TBT
Current and former industrial areas	Fuel storage and dispensing, building material	Heavy metals, TPH/VOCs, PAHs, VOCs, OCPs, herbicides, PCBs and asbestos
Marina areas	Maintenance and storage activities	Heavy metals, TPH/VOCs, PAHs, asbestos and TBT

4.1 Auditor's Opinion

The RAP SAR concluded that the COPC adequately reflect the site history and condition, however noted that the sampling density was low for some analytes.

Soil samples collected during the DGA were analysed for metals, TRH, BTEX, PAHs, TBT, asbestos, suspension peroxide oxidation combined acidity and sulfur (SPOCAS) and ASS potential, however were not analysed for OCPs, OPPs, PCBs, VOCs and herbicides. Groundwater samples collected during the DGA were analysed for metals, TRH, BTEX, and PAHs, however were not analysed for VOCs.

While VOCs were previously identified as a COPC, I note that the RAP states that previous soil and groundwater investigations undertaken on the site "*have not identified the occurrence of significant*

volatile compound impacts in soil and/or groundwater at the site". It is also noted that soil vapour sampling and analysis undertaken during the DGA and previous limited groundwater testing for VOCs did not identify concentrations of VOCs that would pose a concern, with all sub-slab vapour results below PQLs and therefore below the adopted site assessment criteria. The omission of VOCs from the analytical suite in soil and groundwater testing undertaken in the DGA is therefore considered acceptable.

Previous soil sampling and testing included analysis for OCPs at a low density (11 samples), however the results were below the laboratory PQL. Testing of sediment samples in the water-based portion of the site reported concentrations below the PQL. Pesticides (OCPs and OPPs) and herbicides are unlikely to have been used at the site and I am satisfied that they are unlikely to be COPC at the site.

Limited sampling for PCBs was previously undertaken (3 samples) and results were less than the PQL. However, PCBs are a contaminant of concern associated with the electrical substations located onsite. Assessment of the substation areas for PCBs following decommissioning would be required.

ASS are considered likely to be present across all areas of the site, including alluvial soil and fill material used in land reclamation. On this basis, the disturbance of materials during site redevelopment works will be required to be conducted in accordance with the ASSMP.

There has been no assessment by the consultants for the presence of per- and poly-fluoroalkyl substances but in my opinion there are no indications in the site history that they would be potential contaminants of concern.

5. STRATIGRAPHY AND HYDROGEOLOGY

5.1 Stratigraphy

JK Geotechnics (2017) reported that the 1:100,000 Geological Map of Sydney indicated the site to be underlain by man-made fill and estuarine soils overlying Hawkesbury Sandstone of the Wianamatta Group. The Hawkesbury Sandstone comprises medium to coarse grained quartz sandstone with very minor shale and laminite lenses. It was further noted that at least two dykes were believed to extend through the site in an approximate northwest to southeast alignment.

Boreholes in Blackwattle Bay identified a subsurface profile generally comprising natural clay and sandy clay soils overlying sandstone bedrock. In the bay, the boreholes typically encountered no fill from the seabed level, except the boreholes close to the existing shoreline where fill extending up to 4.7 m depth was encountered. There generally appeared to be a fill layer close to the southern shoreline. The fill was reported to comprise a clayey sand and silty clay with trace amounts of fine to medium grained sand and coal and plastic fragments.

Boreholes within the site identified between 2.5 and 5.5 m of orange to yellow-brown gravelly sandy clay fill material, with inclusions of sandstone, wood/timber, ash, slag and brick. Boreholes in adjoining Wentworth Park identified fill comprising silty sand or sandy clay containing varying amounts of inclusions such as sandstone and igneous gravel, timber, tile, ceramic, glass, shell, concrete and brick fragments, slag and ash. Underlying natural material within land-based portions of the site comprised grey-brown silty marine sediments, containing abundant shell material.

Sandstone bedrock was encountered underlying natural soils at depths ranging from approximately 5.5 to 13.4 m below ground level (bgl), which is equivalent to -9.1 to -18.5 mAHD, although yellow-brown medium-grained sandstone bedrock was present at a depth of 3.20 mbgl in the central eastern portion of the site.

5.2 Potential for Acid Sulfate Soils

Review of the ASS Risk Map for Prospect/Parramatta (Acid Sulfate Soil Risk Map – Prospect/Parramatta, Edition 2, 1997, NSW Department of Land and Water Conservation) indicated that the site is located within an area of 'high probability' of ASS within bottom sediments.

PB (2009) noted potential indicators of ASS comprising odorous marine sediments with seashells in boreholes located in the southern portion of the site (overlying the land portion of the site) and within marine sediments in Blackwattle Bay. Similar observations were reported by JBS&G (2015) and EIS (2017), however no samples were analysed at a laboratory to confirm if the soils comprised actual ASS.

The DGA included assessment of fill material and natural marine sediments within the land-based portion of the site for ASS. Results are discussed in Section 9.3 of this IAA.

Management of the potential ASS (PASS) is proposed as discussed in the ASSMP.

5.3 Hydrogeology

The ESA stated that a review of the registered bore information maintained by the NSW Department of Primary Industries identified 14 registered bores within a 500 m radius of the site. The closest wells (approximately 250 m southwest of site) were constructed for monitoring purposes and were reported to contain a standing water level (SWL) of approximately 0.6 m within shallow fill materials.

During the DGA, boreholes undertaken in the land portion of the site identified saturated conditions at depths of between 1.8 and 3 mbgl.

Groundwater monitoring was undertaken by PB (2009) (one monitoring round at three monitoring wells - PBMW02, PBMW03 and PBMW04), JBS&G (2015) (one monitoring round at one monitoring well - MW1) and the DGA (one monitoring round at ten locations, including the four existing locations and six new locations – SBMW01 to SBMW06). The investigations identified the following:

- Site groundwater reported total dissolved solid (TDS) concentrations consistent with saline waters
- Groundwater had a relatively neutral pH and was low in oxygen
- Depth to groundwater was approximately 1.3-2.27 mbgl
- SWLs correspond with tidal surface water levels of Blackwattle Bay into which site groundwater is anticipated to discharge
- No odours or sheens were observed.

5.4 Auditor's Opinion

Potential ASS materials were identified within saturated marine sediments within the bay and land portions of the site. The lateral and vertical identification and assessment for ASS has not been undertaken in accordance with the guidance provided in ASSMAC (1998). Consequently, the acid generating potential of the PASS material as well as the extent/volumes of PASS material are currently unknown. It is noted that the ASSMP considers these uncertainties and assumes that sediment is PASS until confirmed otherwise. I consider this appropriate.

I consider that the site stratigraphy and hydrogeology are sufficiently well known for the purpose of remedial planning.

6. DATA GAP ASSESSMENT

6.1 Data Gaps Identified Following Previous Site Investigation

The RAP identified the following data gaps following previous investigation of the site:

1. The sampling density within the land-based portion of the site (eight locations in approximate 0.76 ha) was less than the minimum (19 locations) recommended by NSW EPA (1995) *Sampling Design Guidelines*.
2. Characterisation of fill materials for the presence of asbestos via quantification in accordance with NEPM (2013) and Western Australia Depart of Health (WA DOH, 2009) to determine asbestos management requirements (if any) during the site development works.
3. There was uncertainty as to the historical location of fuel infrastructure known to have previously been located at the site. Whilst there was indirect evidence that such facilities were removed, the original documentation associated with the remediation and validation works was not available. As such, there remains uncertainty as to the nature and extent of any residual impacts that may remain in the vicinity of these former features.
4. Characterisation of fill material and natural soils for ASS has not been completed to date and is required to verify the extent of material requiring management in future development works and assist with refinement of the ASSMP required to be implemented during development activities. Whilst all sediments are expected to be ASS, specific characterisation of the conditions has not been completed to date, which may assist with refining lime (or other material) addition requirements.
5. Additional leachate data will be required to confirm waste classifications for the potential off-site disposal of surplus materials as part of the development works.

The RAP proposed the following further assessments to address the data gaps:

- Soil vapour (20 locations)
- Groundwater (6 locations)
- Ground gas (6 locations)
- ASS (soil)
- TCLP leachates (waste soils)
- Soils (11 locations).

Additional data gaps identified in the RAP SAR included the following:

1. Sources of site history information, such as historical aerial photographs, NSW EPA records, SafeWork NSW dangerous goods records, Council records and Certificates of Title, were not previously reviewed in the reports provided.
2. There was uncertainty about the presence of additional USTs on the site due to the absence of a recent SafeWork NSW Dangerous Goods Records search, in particular in the current cement works operations in the south western portion of the site.
3. Previous assessment of sediments did not adequately address comparisons against ANZAST (2018) default guideline values (DGVs) for PCBs and OCPs (practical quantitation limits (PQLs) were too high) and normalisation with total organic carbon (TOC) (not analysed in EIS (2017)) on a sample-by-sample basis for all sediment samples obtained.

4. The density of sediment samples was not uniform across all areas of the site. Sediments in the western portion of the site were sampled at a lower density.

6.2 Scope of the DGA

The objective of the DGA was to *"address data gaps identified in JBS&G (2018a)* [the ESA] *to inform the final remedial/management requirements during the early works construction phase that when implemented, will ensure the site is suitable for the proposed development".*

Table 6.1 summarises the scope of the DGA field investigations.

Table 6.1: Summary of Field Investigations Undertaken during the DGA

Investigation	Field Investigations	Analytical Data Obtained
The DGA (JBS&G, 2019)	Soil (13 sample locations – SB01 to SB10 and SB05A to SB05C) Groundwater (six new wells SBMW01 to SBMW06, sampling of new and existing wells (total 10), including MW1, MW2A to MW4A). Ground Gas (10 borehole locations – MW 1, MW2A to MW4A, SBMW01 to SBMW06) Soil Vapour (20 sample locations – SS01 to SS20) Acid Sulphate Soils (10 sample locations - SB01 to SB10) TCLP leachability (1 borehole location – SB05)	Soils: Metals, TRH/BTEX, PAHs, Tributyltin (TBT), asbestos Groundwater: Metals, TRH/BTEX, PAHs Ground Gas: Methane (CH_4), Carbon Dioxide (CO_2), Oxygen (O_2), Hydrogen Sulfide (H_2S), Carbon Monoxide (CO) Soil Vapour: VOCs ASS: SPOCAS, ASS testing TCLP leachability: Metals, PAHs

6.3 Auditor's Opinion

The DGA included the testing of soils at 13 locations, which, along with the previous investigation locations, exceeds the minimum number of sampling locations required for site characterisation (19). The spatial distribution of the DGA sampling locations excluded the land-based area in the eastern portion of the site.

The number of groundwater, soil vapour, and ground gas sampling locations met or exceeded the data gap requirements identified in the RAP. Testing of soils for ASS (SPOCAS and acidity) and leachability testing (TCLP) was also undertaken during the DGA at a low density.

Data gaps identified in the RAP SAR were not addressed, including review of site history information, potential for additional USTs and sediment characterisation.

7. EVALUATION OF QUALITY ASSURANCE AND QUALITY CONTROL

I have assessed the overall quality of the data presented in the DGA. Assessment of data from previous investigations was undertaken in the RAP SAR and is not repeated here. My assessment follows in Tables 7.1 and 7.2.

Table 7.1: QA/QC – Sampling and Analysis Methodology Assessment

Sampling and Analysis Plan and Sampling Methodology	Auditor's Opinion
Data Quality Objectives (DQO) The DGA defined specific DQOs in accordance with the seven-step process outlined in Schedule B2 of NEPM (2013).	These were considered appropriate for the investigation conducted.

Sampling and Analysis Plan and Sampling Methodology	Auditor's Opinion
Sampling pattern and locations *Soil:* Thirteen boreholes (SB01 to SB10 and SB05A to SB05C) were undertaken. The sampling locations were located in the southern area of the land-based portion of the site to target specific areas of environmental concern including the area of potential hydrocarbon impacts around historical sample locations PBHA01 and PBHA02. *Groundwater:* Six boreholes were converted into groundwater monitoring wells (SBMW01 to SBMW06). Four existing groundwater monitoring wells (MW1 and PBMW02 to PBMW04) and the six new groundwater monitoring wells were subsequently sampled. The ten groundwater locations were situated along the southern land-based portion of the site. *Ground Gas:* Ground gas sampling was undertaken during the DGA at the ten groundwater monitoring well locations that are situated in the southern land-based portion of the site. *Soil Vapour*: A grid based sub-slab vapour assessment was completed at 20 locations within the proposed Sydney Fish Market building envelope within the southern land-based portion of the site at locations SS01 to SS20.	In my opinion, the DGA investigation of various environmental media within the site, including sampling and analysis of soils, groundwater, ground gas and soil vapour, provides adequate coverage within the southern land-based portion of the site. No further sampling and assessment of soils, groundwater, ground gases and soil vapour was undertaken within the eastern land-based portion of the site in the area along the existing Sydney Fish Market which is marked out to form part of the "Civic Plaza" which connects the new fish market to the wider precinct. The locations of former USTS was unknown and therefore investigation locations were not able to target these areas of the site. The investigation undertaken was considered sufficient to identify significant contamination associated with former USTs and unidentified additional USTs. No further assessment of sediment was undertaken during the DGA. Issues were noted in the RAP SAR with the existing dataset. Further characterisation activities are recommended to ensure sediment conditions are suitably understood from a contamination and ASS viewpoint. The RAP proposed further sampling following further design of the proposed development and evaluation of construction methods.
Sampling density *Soil:* The sampling density of 13 locations sampled during the DGA and eight locations sampled during previous investigations of the site over the land-based area of approximately 0.76 ha exceeds the minimum sampling frequency recommended by the NSW EPA (1995) *Sampling Design Guidelines* (19 locations). Between 1 and 4 samples were analysed from each borehole (total 25 samples). *Groundwater*: The 10 groundwater wells were sampled on one occasion during the DGA. *Ground gas:* The 10 groundwater wells were sampled for ground gas on one occasion. *Soil vapour:* The 20 grid locations were sampled on one occasion.	The soil sampling undertaken gives a reasonable indication of site conditions, in particular within the southern land-based portion of the site. The eastern land-based portion of the site adjacent to the existing fish market was not assessed during the DGA. ASS and PASS material in soils have been assessed in the DGA and the management of soils is addressed in the ASSMP. However, ASS and PASS have not been assessed in sediments, with the management of sediment dewatering activities requiring the development of a Dewatering Plan to demonstrate that dewatering of sediments will not result in the discharge of contaminants to the environment. The density and sampling frequency of groundwater wells, soil vapour sampling locations and ground gas sampling locations across the site following completion of the DGA is adequate. The RAP SAR noted that the density of sediment samples in the western portion of the site was low. The DGA did not include further assessment of sediments. Further assessment of sediment is proposed in the RAP.
Sample depths Soil samples were collected directly underneath the hardstand (concrete) then generally at 0.5-1.0 m intervals to a maximum depth of 7 m or at least 0.5 m into natural materials (or prior refusal), whichever was shallower. Soil locations terminated in fill material in 9 of 13 locations.	Characterisation of soils undertaken during the DGA is adequate, noting that the depth of fill is not critical for remediation planning purposes.

Sampling and Analysis Plan and Sampling Methodology	Auditor's Opinion
Well construction *Groundwater:* Six new groundwater monitoring wells (SBMW01 to SBMW06) were installed during the DGA. The wells were constructed with 50 mm, class 18 unplasticised polyvinyl chloride (UPVC) screen (typically 3 m) and casing and were extended to at least 3 m into groundwater, or to a maximum depth of 6 mbgl. Monitoring wells were constructed using sand to pack the screen to a nominal depth of 0.5 m above the top of screen. Bentonite was then added to a nominal depth of 0.5 m above the sand level to seal the well. More soil cuttings were then added above the bentonite to the surface. The wells were finished with a lockable cap and flush-mounted gatic cover. *Ground gas:* Ground gas was sampled from the new and existing groundwater monitoring wells. No ground gas specific wells were installed. *Soil Vapour Pin:* A 16 mm diameter hole was drilled through the concrete slab at each location, with the slab thickness ranging between 0.1-0.25 m thickness. A VaporPin metallic probe was installed at each location, hammering the probe with a silicone sleeve into the drilled hole to a depth of the encountered slab thickness.	Well construction was generally acceptable. It is noted that groundwater typically intersected the screened interval of the wells, with the exception of SBMW02 and SBMW03. These wells may not be suitable for ground gas monitoring. Groundwater levels are likely to fluctuate with tides in the adjacent Blackwattle Bay, so standing water levels may periodically be above the screen interval.
Sample collection method *Soils:* The boreholes were drilled with solid flight auger, push tube and hand auger. Soil samples were collected by grab sample directly from the auger. *Groundwater*: Well development was undertaken using a decontaminated submersible pump or inertia pump to remove a volume of water until field-measured water quality parameters (EC, pH, DO, redox potential and temperature) had stabilised. Monitoring wells were sampled a minimum of 3 days after well development. The SWL was gauged and an assessment of the presence of light non-aqueous phase liquids/dense non-aqueous phase liquids (LNAPL/DNAPL) was made using an interface probe. Wells were purged and sampled using a low-flow methodology with peristaltic pump and dedicated tubing. *Ground Gas:* Subsurface gases were measured using a landfill gas meter to record levels of CH_4, CO_2, CO, H_2S and O_2, in accordance with Benchmark Technique 15 '*Subsurface Gas Monitoring Devices'* and Benchmark Technique 16 '*Subsurface Gas Monitoring Program*' provided in *Environmental Guidelines: Solid Waste Landfills, Environment Protection Authority* (NSW EPA, 2016). Each monitoring well was monitored for gas flow rates and concentrations and the following testing procedure was undertaken at each well: – Sampling ports on gas analyser (GFM435 or similar) were connected to well cap via gas sampling port using disposable tubing – Initial gas flow rates were reported and then flow rates were monitored for approximately 5 minutes with variation in flow rates documented – Analyser unit was disconnected from gas sampling port and meter connection changed to concentration sampling port prior to reconnection to gas well. Initial gas concentration readings were collected from	Soil sample collection from the auger flights is not ideal as it can result in loss of volatiles and sample cross contamination, although cross contamination was minimised by removing external material. Volatiles are not considered to be present at significant concentrations given that VOC concentrations in soil vapour and groundwater were typically less than the detection limit, therefore the sampling method is considered acceptable. Collection of soil samples using augers is not ideal for assessing the subsurface and quantifying asbestos in fill materials. Test pitting is the preferred methodology to obtain more reliable information on fill material composition. Sampling ground gas from groundwater monitoring wells is not ideal. Samples may represent off-gassing from groundwater within the well, rather than ground gas within soil. This is likely to be the case in SBMW02 and SBMW03 where the SWL was above the screen interval (however may be tide dependent). The data is likely to over-estimate potential ground gas concentrations at the site and is therefore considered conservative when adopted. The soil vapour sampling methodology was acceptable. Overall the sample collection methodologies for the sampling of soils, groundwater, ground gas and soil vapour were found to be acceptable.

Sampling and Analysis Plan and Sampling Methodology	Auditor's Opinion
monitoring wells after 10 second and then again once the gas concentrations had stabilised, noting that methane concentrations should be stable for longer than 10 seconds. *Soil Vapour:* Sampling of the sub-slab vapour probes involved the following: – GFM435 gas detector used to purge each probe for approximately 30 seconds. Gas readings were monitored until oxygen and photo-ionisation detector (PID) readings had stabilised – Leak detection evaluation via placement of isopropyl alcohol-soaked rag within an airtight box containing the sample train located on top of the probe. – Following confirmation of the absence of leaks, the sub-slab vapour samples were collected onto SKC-anasorb carbon tubes.	
Decontamination procedures *Soil:* The DGA states that decontamination of all non-disposable sampling equipment, including augers, was undertaken with a high-pressure water/detergent spray, rinsed with water and then air dried. The equipment was then inspected to ensure that no soil, oil, debris or other contaminants were apparent on the equipment prior to the commencement of works. Sampling equipment was subsequently decontaminated using the above process between each sample location. *Groundwater:* The DGA states that the pump used for well development was decontaminated.	Acceptable
Sample handling and containers *Soil:* Soil samples were transferred to laboratory supplied sample jars or 500 mL plastic bags for asbestos fines/fibrous asbestos (AF/FA) analysis. Samples were not mixed prior to placement into the jars to minimise the potential for loss of volatiles. The sample jars/bags were then transferred to a chilled ice box for sample preservation and transfer to the analytical laboratory under chain of custody protocols. Soil samples for field ASS and laboratory SPOCAS analysis were placed in small zip lock plastic bags and placed directly on ice during sampling activities. Field testing of samples were completed in the field following the collection of all samples in accordance with the field-testing procedure presented in ASSMAC (1998) with field pH_f and pH_{fox} tests recorded. *Groundwater:* Groundwater samples were immediately transferred to laboratory-supplied sample bottles, sampling the most-volatile contaminants first. Field filtering of groundwater samples was undertaken using 0.45 µm filters for samples designated for metals analysis. Sample containers were then transferred in an esky on ice to the analytical laboratory under chain-of-custody protocols. *Soil vapour:* A 6 L volume was collected through a carbon tube using a calibrated pump with a flow rate of 200 mL per minute and a 30 minute sampling period. Following sample collection, the carbon tubes were removed and capped and stored in a cool, dry, and dark container for delivery to the analytical laboratory under chain-of-custody protocols and prior to analysis.	Overall the handling of samples of soil, soil vapour and groundwater was acceptable. The DGA reported that field quantification for asbestos (10 L samples) was undertaken on samples representing 1 m increments collected by 150 mm diameter augers. Samples were sieved (7 mm) or inspected on a plastic sheet. Field records and results were not provided in the DGA.

Sampling and Analysis Plan and Sampling Methodology	Auditor's Opinion
Chain of Custody (COC) Completed COC documentation was provided for the DGA.	Acceptable.
Detailed description of field screening protocols *Soil:* Soil samples were screened using a PID to assess the presence of VOCs. Details of the methodology adopted were not provided. During advancement of the soil bore, PID screening of drill cuttings was undertaken at regular intervals, in particular at the base of fill and within different soil strata where there was potential for localised contamination. Representative soil samples were collected for field screening of potential ASS and laboratory SPOCAS analysis. *Groundwater:* Field parameters including pH, EC, redox potential and temperature were measured using a flow cell and samples were obtained after these parameters had stabilised (i.e. consecutive EC, Eh, DO, and pH readings within 3%, 10 mV, 10% and 0.5, respectively). *Ground Gas:* The following parameters were monitored using a landfill gas meter for CH_4, CO_2, O_2, H_2S, CO, atmospheric pressure, differential pressure and gas flow.	Acceptable.
Calibration of field equipment The DGA report indicates that calibration of the water quality meter was undertaken. No mention is made whether calibration of the PID field equipment had been undertaken prior to use and whether calibration checks were performed during use.	It is noted that calibration records for the water quality meter and the PID were not included in the DGA report. The PID results indicate generally low concentrations consistent with laboratory results, indicating that the field screening assessment was acceptable. The field records of the water quality meter indicate stable measurements with small fluctuations confirming the precision of these measurements, although the accuracy of these field measurements may be less reliable without the confirmed calibration records. However, the groundwater field parameters that were reported in the DGA are similar compared to data reported in previous investigations, confirming the overall reliability of these data.
Sampling logs Logs of soil boreholes and groundwater wells are provided in the DGA report. The borehole logs indicate sampling depth, sampling interval, lithology, observations and well construction details. Field logs of groundwater gauging data, sample observations (including colour, odour, presence of LNAPL, DNAPL, sheens) and sampling method details were recorded. Field sheets of ground gas sampling were provided in the DGA report for three wells sampled on 3 November (SB08, SB07 and MW1).	Acceptable.

Table 7.2: QA/QC – Field and Lab Quality Assurance and Quality Control

Field and Lab QA/QC	Auditor's Opinion
Field quality control samples *Soil:* Field QA samples were analysed as follows: • Intra-laboratory duplicate samples at a rate of 1 in 8 primary samples. Two duplicate samples and 16 primary samples were obtained for asbestos analysis. • Inter-laboratory duplicate samples at a rate of 1 in 8 primary samples. • Rinsate blanks (non-dedicated equipment only) with each sample batch. • Trip blanks (at a rate of one per sampling event). • Trip spike (BTEX only) was obtained with each sample batch. *Groundwater:* • Intra-laboratory duplicate samples at a rate of 1 in 10 primary samples. • Inter-laboratory duplicate samples at a rate of 1 in 10 primary samples. • Trip blanks (at a rate of one per sampling event). • Trip spike (BTEX only) was obtained with each sample batch. *Vapour:* • Intra-laboratory duplicate samples at a rate of 1 in 10 primary samples (comparison against analysis of tube front). • Inter-laboratory duplicate samples at a rate of 1 in 10 primary samples (comparison against analysis of tube front). • Field blank (carbon tubes).	The overall field QA/QC from the DGA investigation is acceptable.
Field quality control results Soil quality control results were generally reported to be within the acceptance limits. Copper, lead, TRH and PAH compounds were reported to have elevated RPDs, which was considered by JBS&G to be a result of the relatively low concentrations of these analytes in the samples and the difficulty in obtaining homogenous soil samples in undisturbed sample matrices. As a conservative measure, the highest reported concentration of each constituent at each location was considered in the interpretation of the results of the investigation. Groundwater quality control sample results were generally within acceptable limits. The RPDs for primary and duplicate pairs were within the RPD acceptance limits. JBS&G concluded that the elevated RPD for copper in the two duplicate samples was due to the concentration of the analyte being close to the PQL, and that this exceedance of the RPD DQI criterion is not considered to affect the reliability of the dataset. Blind and split duplicate vapour sample RPDs were within the acceptance limit.	Overall, in the context of the dataset reported, the reported elevated RPD results are not considered significant and the field quality control results are acceptable.
NATA registered laboratory and NATA endorsed methods Samples were analysed at the following laboratories: Eurofins MGT (primary laboratory) and Envirolab Services (secondary laboratory). Both laboratories are accredited by the National Association of Testing Authorities (NATA) for the laboratory analysis undertaken.	Acceptable.

Field and Lab QA/QC	Auditor's Opinion
Analytical methods Analytical methods were included in the laboratory test certificates provided in the DGA report.	Acceptable
Holding times The extraction and analysis of soil and sub-slab vapour samples were completed within the recommended holding times. Groundwater samples MW1, SBMW05 and SBMW06 were extracted and analysed for semi-volatile compounds outside of the recommended holding times.	Groundwater samples which exceeded analytical holding times prior to analysis were immediately placed on ice following sample collection and submitted to the laboratory, where these samples were kept refrigerated prior to sample extraction and analysis. The sample preservation was appropriate, as indicated by trip spike recoveries discussed above. Therefore, it is unlikely that the slight exceedance in extraction time for semi-volatile compounds significantly affects the reported concentrations. I consider that these minor exceedances do not significantly affect the outcomes of the assessment.
Practical Quantitation Limits (PQLs) PQLs were less than the threshold criteria for the contaminants of concern.	Overall the PQLs are acceptable.
Laboratory quality control samples and results Laboratory quality control samples including laboratory control samples, matrix spikes, surrogate spikes, blanks and duplicates were undertaken by the laboratory. Laboratory control samples were analysed for all media types (soil, soil vapour, groundwater) with all recoveries within the acceptance limit (70-130%). Matrix spike sample analyses exceeded the required frequency of 1 in 20 samples for both soil and groundwater analyses. The reported matrix spike recoveries were within the JBS&G DQI acceptance limit (70-130%) and JBS&G concluded that matrix interference in soil and groundwater samples is not considered to be significant with respect to the accuracy of the dataset. Matrix spike analyses were not undertaken for laboratory analyses of carbon tubes (vapour samples). Soil, groundwater and soil vapour surrogate spike analyses showed that generally recoveries for organic constituent analysis were within the DQI acceptance criterion (range: 70-130%). A small number of surrogate samples (in soil and water) showed ranges outside the JBS&G DQI acceptance criterion, however these were within the NATA accredited laboratory's acceptance limits (50-150% recovery). Laboratory blanks reported results less than PQLs for all analytes.	The laboratory quality control results are generally acceptable.
Data Quality Indicators (DQI) and Data Evaluation (completeness, comparability, representativeness, precision, accuracy) DQIs were identified by JBS&G in the DGA. JBS&G concluded that "*the field sampling and handling procedures produced QA/QC results which indicate that the soil, soil vapour and groundwater data are of an acceptable quality and suitable for use in site characterisation*. […] *On the basis of the results of the field and laboratory QA/QC program, the soil, groundwater and soil vapour data is of an acceptable quality in order to achieve the objectives of the assessment*."	An assessment of the data quality with respect to the five category areas has been undertaken by me and is summarised below.

7.1 Auditor's Opinion

I am of the opinion that the completeness, comparability, representativeness, precision and accuracy of the available data are acceptable for the purposes of assessing data gaps. Some data gaps remain, which are discussed in Section 13.

8. ASSESSMENT CRITERIA

Assessment criteria are the concentrations of a contaminant above which further appropriate investigation and evaluation will be required, and provide the basis of a Tier 1 risk assessment. As defined in National Environmental Protection Council (2013) *National Environmental Protection (Assessment of Site Contamination) Measure* (NEPM (2013)), a Tier 1 risk assessment is a risk-based analysis comparing site data against generic assessment criteria for various land uses to determine the need for further assessment or development of an appropriate management strategy. Assessment criteria are presented herein for the protection of human health and ecological receptors, for a range of media including soil, groundwater and ground gas. Soil vapour assessment criteria are not discussed as no VOC detections were made.

8.1 Site Land Use and Assessment Criteria

When choosing the most appropriate human health assessment criteria for the site, I have considered the form of the proposed development (Section 2.4). The human health assessment criteria adopted for this Audit are therefore considered to be protective of 'commercial/industrial' land use.

Although the protection of human health often drives the first stages of a site assessment, NEPM (2013) requires that all site assessments considers the protection of the environment (terrestrial and aquatic receptors). Ecological assessment criteria appropriate for 'commercial/industrial' land use were adopted.

The assessment criteria adopted for the protection of human health and ecological receptors are outlined below.

8.2 Soil Assessment Criteria

Human Health Assessment Criteria

I have adopted soil assessment criteria protective of human health from the following Australian sources:

- NEPM (2013) Health Investigation Levels (HILs) for non-volatile soil compounds for 'Commercial/Industrial' (HIL-D) land use.
- NEPM (2013) Health Screening Levels (HSLs) for TRH, BTEX and naphthalene compounds for 'Commercial/Industrial' (HSL-D) land use (0-1 m depth), for the vapour inhalation pathway. The HSLs assumed a sand soil type.
- NEPM (2013) Management Limits for Petroleum Hydrocarbons for Commercial/Industrial land use and assuming coarse soil texture. Criteria are relevant for operating sites where significant sub-surface leakage of petroleum hydrocarbons has occurred and when decommissioning industrial and commercial sites. These are therefore conservative when applied to the site.
- NEPM (2013) HSLs for Asbestos Contamination in Soil. Criteria applicable for 'Commercial/Industrial' (HSL-D) land use were adopted for AF/FA. ACM criteria were not applicable since 10 L samples were not field screened.
- Friebel & Nadebaum (2011) HSLs for direct contact for Commercial/Industrial (HSL-D), and vapour inhalation/direct contact pathways for intrusive maintenance workers.
- US EPA Region 9 screening levels (soil) for commercial/industrial land use for dibutyltin (DBT) and TBT (and oxide) have been used in the absence of established Australian soil criteria for organotin compounds.

Ecological Assessment Criteria

I have adopted ecological soil assessment criteria from the following sources:

- NEPM (2013) Ecological Screening Levels (ESLs) for 'Commercial/Industrial' land use, assuming coarse soil.
- NEPM (2013) Ecological Investigation Levels (EILs) for 'Commercial/Industrial' land use. In the absence of site-specific soil data on pH, clay content, cation exchange capacity and background concentrations, the lowest added contaminant limits have been applied as an initial screen.
- Canadian Council of Ministers of the Environment (CCME) (2010) *Canadian soil quality guidelines: carcinogenic and other polycyclic aromatic hydrocarbons (PAHs)* soil quality guideline (SQG) for benzo(a)pyrene for 'Commercial/Industrial' land use. The SQG has been adopted in place of the NEPM (2013) ESL as it is based on a larger and more up-to-date toxicity database than the low reliability NEPM (2013) ESL.

Soil Aesthetic Considerations

I have considered the need for soil remediation based on 'aesthetic' contamination as outlined in *Section 3.6 Aesthetic Considerations* of NEPM (2013) Schedule B1, which acknowledges that there are no chemical-specific numerical aesthetic guidelines. Instead, site assessment requires a balanced consideration of the quantity, type and distribution of foreign material or odours in relation to the specific land use and its sensitivity.

8.3 Groundwater Assessment Criteria

Human Health Assessment Criteria

I note that at this site there is no risk of human groundwater consumption due to its saline nature and the presence of a drinking water supply. There is also a low risk of the saline groundwater being extracted for beneficial use (e.g. watering, recreation). Assessment criteria protective of drinking water were therefore not adopted.

Criteria protective of recreational users were adopted from NHMRC (2011) *National Water Quality Management Strategy, Australian Drinking-Water Guidelines 6, Version 3.4 Updated October 2017*. The guidelines were derived assuming a human will ingest 2 L of water per day. Therefore, application of these drinking-water guidelines is overly conservative when exposure is assumed to occur incidentally during activities such as irrigation, swimming and/or maintenance of sumps/pipelines. A factor of 10 was therefore applied to the criteria to account for incidental ingestion in accordance with recommendations provided in Section 9.3.2 of the NHMRC (2008) *Guidelines for Managing Risks in Recreational Water*.

Ecological Assessment Criteria

I have adopted ecological groundwater assessment criteria from Australian and New Zealand Governments and Australian state and territory governments (ANZAST) (2018) *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZG) (available at www.waterquality.gov.au/anz-guidelines).

Vapour Inhalation

When considering the vapour inhalation pathway for TRH, BTEX and naphthalene compounds in groundwater, I adopted the groundwater HSLs recommended by NEPM (2013) for 'Commercial/Industrial' land use (HSL-D) and assuming coarse soil texture and depth to groundwater of 2 to <4m. Groundwater was shallower than 2 mbgl in some locations and therefore the HSLs are not strictly applicable in those locations, however, were adopted as an initial screen.

8.4 Ground Gas Considerations

I have assessed the ground gas data provided by the consultant with reference to the NSW EPA (2019) *Assessment and Management of Hazardous Ground Gases, Contaminated Land Guidelines*.

8.5 Acid Sulfate Soil Criteria

The assessment of ASS conditions was undertaken by laboratory SPOCAS analysis, and the results were compared to the ASS action criteria in the *Acid Sulfate Soil Manual* (ASSMAC, 1998).

8.6 Consultant's Assessment Criteria

The human health and environmental quality criteria referenced by me are consistent with those adopted in the DGA.

I note that JBS&G did not consider the use of ecological criteria protective of ecological communities within soil to be relevant for the site because the site will be covered in hardstand under the proposed development, and as such, there will be only limited ecological receptors within the land-based portion of the site. I have assessed the analytical data against ecological criteria, as the proposed development plans included in the DGA were not final plans, with future plans potentially including small areas of landscaping within the land-based portion of the site for which ecological criteria may be applicable.

9. EVALUATION OF SOIL RESULTS

The DGA investigation included the collection of soil samples from 13 locations (Attachment 3).

9.1 Field Results

Fill material was encountered at all sampling locations, with the depth of fill confirmed as between 2.8 mbgl and 5.7 mbgl in four locations. Remaining locations were terminated in fill therefore the depth of fill was not confirmed. Fill material typically comprised gravelly sand and sandy clay with sandstone and varying levels of ash and slag. This was underlain by natural fine-grained silt and sandy clay material (marine sediments) to the maximum depth of the investigation (7 mbgl).

No visible fragments of ACM were identified during the soil sampling activities and no significant staining was observed within the soil/fill profile during the fieldwork.

Slight hydrocarbon odours were noted at soil sampling locations SB03, SB04 and SB05, however, PID field screening showed no evidence of hydrocarbon contamination at these locations, which were in proximity to previous sample locations PBHA01 and PBHA02, where localised hydrocarbon impacts were identified.

Field ASS screening was undertaken within boreholes and there were no visual or olfactory indications of potential ASS materials within shallow fill soils. Sulfidic odours and carbonaceous shells were observed within saturated silty sands and sandy clays (marine sediments), which is consistent with potential ASS conditions.

9.2 Analytical Results

Soil samples collected during the DGA were analysed for contaminants listed in Table 6.1. The results have been assessed against the assessment criteria (Section 8) and are summarised in Table 9.1.

Table 9.1: Evaluation of Soil Analytical Results – Summary Table (mg/kg)

Analyte	n	Detections	Maximum	n > Human Health Screening Criteria	n > Terrestrial Ecological Screening Criteria
ACM >7 mm (%) from 500 mL samples	18	0	<PQL	0 above HSL-D 0.05%	-
AF/FA (%)	18	1	0.0001%	0 above HSL 0.001%	-
Asbestos trace analysis	18	0	<PQL	-	-
Benzene	22	0	<0.1	0 above HSL-D 0-1 m, sand 3 mg/kg	0 above ESL (c/i) 75 mg/kg
Toluene	22	0	<0.1	0 above HSL-D 0-1 m, sand NL	0 above ESL (c/i) 135 mg/kg
Ethylbenzene	22	0	<0.1	0 above HSL-D 0-1 m, sand NL	0 above ESL (c/i) 165 mg/kg
Total Xylenes	22	0	<0.3	0 above HSL-D 0-1 m, sand NL	0 above ESL (c/i) 180 mg/kg
F1 (TRH C_6–C_{10} minus BTEX)	22	0	<20	0 above HSL-D 0-1 m, sand 260 mg/kg	0 above ESL (c/i) 215 mg/kg
F2 (TRH >C_{10}–C_{16} minus naphthalene)	22	1	480	0 above HSL-D 0-1 m, sand NL	-
TRH C_6–C_{10}	22	0	<20	0 above ML (commercial/industrial) 700 mg/kg	-
TRH >C_{10}–C_{16}	22	2	**480**	0 above ML (c/i) 1,000 mg/kg	**1 above ESL (c/i) 170 mg/kg**
TRH >C_{16}-C_{34}	22	6	1,500	0 above ML (c/i) 3,500 mg/kg	0 above ESL (c/i) 1,700 mg/kg
TRH >C_{34}-C_{40}	22	1	110	0 above ML (c/i) 10,000 mg/kg	0 above ESL (c/i) 3,300 mg/kg
Naphthalene	25	0	<0.5	0 above HSL-D 0-1 m, sand NL	0 above EIL (c/i) 370 mg/kg
Benzo(a)pyrene	25	10	24	-	0 above SQG (c/i) 72 mg/kg
Benzo(a)pyrene TEQ	25	10	37	0 above HIL-D 40 mg/kg	-
Total PAHs	25	12	254.6	0 above HIL-D 4,000 mg/kg	-
Arsenic	25	24	15	0 above HIL-D 3,000 mg/kg	0 above EIL (c/i) 160 mg/kg
Cadmium	25	0	<0.4	0 above HIL-D 900 mg/kg	-
Chromium	25	25	110	0 above HIL-D 3,600 mg/kg	0 above EIL (c/i) 310 mg/kg
Copper	25	23	**230**	0 above HIL-D 240,000 mg/kg	**4 above EIL (c/i) 85 mg/kg**

Analyte	n	Detections	Maximum	n > Human Health Screening Criteria	n > Terrestrial Ecological Screening Criteria
Lead	25	25	610	0 above HIL-D 1,500 mg/kg	0 above EIL (c/i) 1,800 mg/kg
Mercury (inorganic)	25	16	0.8	0 above HIL-D 730 mg/kg	-
Nickel	25	18	**120**	0 above HIL-D 6,000 mg/kg	**5 above EIL (c/i) 55 mg/kg**
Zinc	25	24	**680**	0 above HIL-D 400,000 mg/kg	**11 above EIL (c/i) 110 mg/kg**
Dibutyltin	8	5	0.018	0 above 250 mg/kg	-
Tributyltin	9	1	0.00062	0 above 250 mg/kg	-

n number of samples
- No criteria available/used
NL Non-limiting
<PQL Less than the practical quantitation limit
c/i commercial/industrial

In assessing the results, I make the following observations:

- Laboratory analytical results for soil samples from the DGA reported that concentrations of inorganic and organic contaminants of concern were below the adopted human health screening criteria.
- Exceedances of ecological screening criteria were reported for the following:
  - TRH (C_{10}-C_{16} fraction) at 1 location (SB03_2.9-3.0; 480 mg/kg), comprising saturated fill material with slight hydrocarbon odour and PID of 3.3-5.3 ppm.
  - copper at four locations (SB03_4.9-5.0; 120 mg/kg, SB05_0.5-0.6; 230 mg/kg, SB07_1.9-2.0; 190 mg/kg and SB10_2.9-3.0; 110 mg/kg)
  - nickel in five samples from three locations (SB07_0.4-0.5; 120 mg/kg, SB08_0.1-0.2; 110 mg/kg, SB09_0.2-0.3; 110 mg/kg and duplicate and triplicate samples of SB09_0.2-0.3; 80 mg/kg and 61 mg/kg, respectively)
  - zinc in eleven samples from locations SB03, SB04, SB05, SB07, SB08 and SB10 (up to 680 mg/kg).
- Fragments of ACM were not observed in sampled materials. Asbestos assessment was undertaken via the advancement of 150 mm solid flight auger boreholes, which is not the preferred method given the reduced volumes of drilling spoil inspected. The DGA reports that field quantification for ACM was undertaken, however results and field records were not provided. Trace chrysotile asbestos was detected as loose fibre bundles in sample SB06 0.2-1.0 at an estimated concentration of 0.00012% w/w, which was below the adopted site assessment criterion for AF/FA (0.001% w/w).
- TRH and BTEX concentrations were below the PQL or less than the human health assessment criteria.
- Total PAH and carcinogenic PAH concentrations were below the adopted site assessment criteria. Elevated concentrations of PAHs were reported in samples from SB03_4.9-5.0 (slight hydrocarbon odour noted) and SB05_0.5-0.6 (ash and slag noted).
- Concentrations of organotins were below the adopted criteria.

9.3 Acid Sulfate Soil Assessment

Seven soil samples were collected from shallow (<2.5 mbgl) gravelly sandy fill materials and assessed for the presence of ASS. Peroxide oxidisable sulfur (SPOCAS) ranged from <0.02% S to 0.04% S and the recorded acid trail was <2 mol H^+/t.

An additional five samples were collected from saturated silty clay and sandy clay materials within the lower portions of the boreholes in marine sediment materials. Samples SB05_4.9-5.0 and SB08_4.9-5.0 exhibited characteristics associated with potential ASS with peroxide oxidisable sulfur contents of 0.5% S and 0.74% S, respectively. The acid trail in these two samples was 220 and 310 mol H^+/t, respectively.

Based on the results and field observations, JBS&G considered that shallow gravelly sandy fill does not comprise ASS or PASS. However, underlying saturated silty-sand and sandy clay materials (sediments) comprise PASS and will require management during future construction activities where works disturb these materials.

9.4 Auditor's Opinion

In my opinion, the soil analytical results obtained during the DGA are consistent with the site history and field observations as well as with the results of previous site investigations assessed in the RAP SAR.

I note that contamination presenting a risk to human health was not identified. While asbestos has been found to be present at one sample location (SB06_0.2-1.0), the investigations undertaken to date have not identified the wide-spread occurrence of asbestos in fill materials. The site is largely sealed with hardstand and the sampling methodology adopted during the DGA limited the ability to visually inspect fill materials. There is therefore considered to remain a reasonable potential for asbestos to be present in fill material at concentrations of concern.

Concentrations of TRH (C_{10}-C_{16} fraction), copper, nickel and zinc exceeded generic ecological criteria in a limited number of samples. A number of the results were detected at a greater depth than EILs/ESLs apply (>2 mbgl), however it is noted that a shallower sample was often not analysed. Development of site specific EILs would likely result in many of the metals detections being less than criteria.

I note that soil sampling in the eastern land-based portion of the site was not undertaken in the DGA and previous investigations included limited locations in this area. The soil conditions in this area of the site are not considered adequately characterised.

Assessment of ASS was undertaken on a low density, however the results are consistent with expectations and field observations. Management will be required to minimise the potential adverse effects of ASS following disturbance and oxygenation of sedimentary material at depth within the land-based portion of the site or within the sediments in the water-based portion of the site in Blackwattle Bay. NSW EPA correspondence in '*The New Sydney Fish Market – Concept and Stage 1 (SSD 8924) and Stage 2 (SSD 8925) EPA comment on Response to Submissions'* (Document Reference: DOC20/229048), dated 20 March 2020 recommended that a Dewatering Plan be prepared for waterlogged materials comprising PASS and ASS.

10. EVALUATION OF GROUNDWATER RESULTS

10.1 Field Results

Groundwater sampling was undertaken on 25 and 26 October and 3 November 2018. Groundwater was clear to light brown with a low turbidity and no sheen. An estuarine swamp odour was observed in purged groundwater from locations PBMW2A and PBMW4A. Depths to groundwater were between 1.46 m (PWMW4A) and 2.50 m (PBMW2A) below top of casing (btoc), which corresponded closely to the

prevailing tide level. No NAPL was identified during the development or the gauging of the monitoring wells.

Physicochemical parameters measured in purged groundwater included pH of 6.6 to 7.73, electrical conductivity of 20,312 to 44,823 µS/cm, redox potential of -325 to 221 mV and dissolved oxygen of 0.08 to 4.32 mg/L. The results indicate that groundwater has a near neutral pH, is saline and slightly anoxic, which is consistent with the results reported in the ESA.

10.2 Analytical Results

In October and November 2018 groundwater samples were collected during one round of sampling from ten wells (MW1, PBMW2A to PBMW4A, and SBMW01 to SBMW06). Well locations are shown in Attachment 3.

The analytical results from the groundwater sampling investigation are summarised below in Table 10.1.

Table 10.1: Evaluation of Groundwater Analytical Results – Summary Table (µg/L)

Analyte	n	Detections	Maximum	Health Screening Levels (NEPM, 2013) n > HSL-D	Recreational Criteria (NHMRC, 2011) n > recreational criteria	Aquatic Ecosystem Criteria (ANZAST, 2018) n >95% species protection, Marine Waters
TRH/TPH	12	0	<PQL	0 above HSL	-	-
BTEX	12	0	<PQL	0 above HSL	0 above criteria	0 above criteria
Naphthalene	12	0	<PQL	NL	-	0 above 50 µg/L
Benzo(a)pyrene	12	0	<PQL	-	0 above 0.1 µg/L	0 above 0.1 µg/L
Anthracene	12	3	0.08	-	-	0 above 0.1 µg/L
Fluoranthene	12	5	0.38	-	-	0 above 1 µg/L
Phenanthrene	12	4	0.14	-	-	0 above 0.6 µg/L
Arsenic (As V)	12	7	4	-	0 above 100 µg/L	0 above 24 µg/L
Cadmium	12	0	<PQL	-	0 above 20 µg/L	0 above 0.7 µg/L
Chromium (Cr VI)	12	0	<PQL	-	0 above 500 µg/L	1 above 4.4 µg/L
Copper	12	9	**6**	-	0 above 20,000 µg/L	**9 above 1.3 µg/L**
Lead	12	3	**11**	-	0 above 100 µg/L	**1 above 4.4 µg/L**
Mercury	12	0	<PQL	-	0 above 10 µg/L	0 above 0.1 µg/L
Nickel	12	7	2	-	0 above 200 µg/L	0 above 7 µg/L
Zinc	12	9	**73**	-	-	**6 above 15 µg/L**

n number of samples
- No criteria available/used
<PQL Less than the practical quantitation limit
NL non limiting

In assessing the analytical results, I make the following observations:

- Concentrations of selected metals (copper, lead and zinc) exceeded ecological screening criteria. The results are consistent with the groundwater investigation results reviewed in the RAP SAR.
- PAH concentrations were recorded below the adopted ecological criteria, although detections of anthracene (up to 0.08 µg/L), phenanthrene (up to 0.14 µg/L) and fluoranthene (up to 0.38 µg/L) were reported in a number of samples. Samples were from wells located along the south-eastern area of the site.
- TRH and BTEX were not detected above the laboratory PQLs.

10.3 Auditor's Opinion

In my opinion, the groundwater monitoring undertaken in the DGA was sufficient to adequately characterise and identify widespread and significantly elevated contaminant concentrations.

Significant petroleum hydrocarbon impact associated with former USTs (as well as potential unidentified USTs) was not identified during groundwater sampling undertaken during the DGA or previously. Elevated PAH concentrations may be associated with USTs, however are more likely to be associated with ash and slag in fill material.

With respect to elevated metals concentrations (copper, lead and zinc), the DGA states that "*Given that there was no significant change of metal concentrations between up gradient and down gradient monitoring wells in addition to no high levels of metals reported in soils at the site, groundwater metal concentrations are likely to be representative of natural background conditions in the urban environment rather than point source impacts associated with site conditions*" and that "*it is considered unlikely that groundwater metal concentrations at the site are elevated because of previous or current activities at the site*".

I do not agree with some of the conclusions stated in the DGA. Fill material contained elevated metals concentrations (Section 9) and was located below the SWL. The elevated metals concentrations in groundwater may therefore be associated with fill material. It is noted however that fill material is more widespread than the immediate site, extending to the southeast into Wentworth Park. Further investigation or remediation of elevated metals concentrations in groundwater would therefore be of limited benefit if limited to the site.

11. EVALUATION OF GROUND GAS RESULTS

During the DGA, hazardous ground gas was sampled at the ten groundwater sampling locations, with sampling undertaken on 2 November and 4 December 2018. The results of the hazardous gas monitoring are summarised below. It is noted that the discussion of results in the DGA (Section 10.2) presented different data than that in Table D of the DGA report. This IAA has reviewed the data presented in the Table D rather than relying on the information presented in Section 10.2 of the DGA.

Stabilised gas flow rate measurements during the monitoring event varied from less than 0.1 L/hr to a maximum flow rate of 2.5 L/hr at SBMW05. JBS&G state that the highest flow rates were potentially associated with elevated atmospheric wind conditions.

Recorded gas concentrations at each well location include the following:

- CH_4 concentrations were generally below the limit of reporting, with one detection at PBMW4A (1.3%). A gas screening value (GSV) of 0.005 was calculated for CH_4 (1.3% x flow rate of 0.4 L/hr).
- CO_2 gas concentrations varied from below the limit of reporting to a maximum concentration of 11.5% at PBMW4A. A GSV of 0.046 was calculated for CO_2 (11.5% x flow rate of 0.4 L/hr).
- H_2S and CO gas concentrations were below the limit of reporting at all locations.

- O_2 concentrations varied between 17.7% to 21.7%.

The results are consistent with previous monitoring reviewed in the RAP SAR.

The calculated GSVs for CH_4 and CO_2 classify the site as very low risk (characteristic situation 1). No gas protection is required based on the results presented in Table D of the DGA.

11.1 Auditor's Opinion

Ground gas monitoring was undertaken from an adequate number of sampling locations and provides an adequately representative (conservative) assessment of the ground gas conditions. Further assessment of ground gas conditions is not considered to be warranted.

12. EVALUATION OF SOIL VAPOUR RESULTS

Soil vapour probes were installed at 20 sample locations during the DGA (SS01 to SS20) (Attachment 3).

No significant odours or indicators of contamination were observed during the placement of the vapour probes. Stabilised O_2 (range: 1.3% to 20.8%), PID (range: 0.1 to 8.3 ppm), CH_4 (0% at all locations), CO_2 (range: 0.0% to 6.6%) and H_2S (0% in all samples) readings were obtained at each sample location prior to collection of the vapour sample.

VOC analyses of the 21 sub-slab vapour samples, including one duplicate sample, reported concentrations below the PQL.

12.1 Auditor's Opinion

Soil vapour monitoring was undertaken from an adequate number of sampling locations and provides a representative assessment of soil vapour conditions. VOC contamination was not identified, which is consistent with field observations and the site history. Further assessment of soil vapour conditions is not considered to be warranted.

13. EVALUATION OF CONCEPTUAL SITE MODEL

A conceptual site model (CSM) is a representation of the contaminant source, pathway and receptor linkages at a site. The ESA and RAP previously presented a CSM based on the results of previous investigations. The CSM was used in the ESA to identify data gaps and inform decisions around further investigation and management requirements. The DGA provided a refined CSM based on the results of the additional investigations of soil, groundwater, soil vapour and hazardous ground gas.

Table 13.1 provides my review of the CSM presented in the DGA.

Table 13.1: Review of the Conceptual Site Model

Element of CSM	Consultant	Auditor Opinion
Contaminant source and mechanism	The previous site investigations identified areas of potential environmental concern (APEC) and corresponding COPCs, including: • Fill used during land reclamation activities (COPCs: heavy metals, TPHs, VOCs, PAHs, OCPs, herbicides, PCBs, asbestos, ASS, ground gases) • Former coal wharf (COPCs: heavy metals, TPH, VOCs, PAHs, asbestos, TBT) • Current and former concrete batch plants (COPCs: heavy metals, TPH, VOCs, PAHs, solvents, asbestos, TBT, OPPs)	The revised CSM in the DGA does not discussion the contaminant sources. The previous site investigations identified and adequately described the known and potential sources of contamination and contaminants of concern including the mechanism(s) of contamination.

Element of CSM	Consultant	Auditor Opinion
	• Current and former industrial areas, including USTs and associated infrastructure, chemical use and building materials (COPCs: heavy metals, TPH, VOCs, PAHs, OCPs, OPPs, herbicides, PCBs, asbestos) • Marina areas where maintenance/storage activities using TBT, creosote and heavy metal containing products/materials have been applied and/or removed, infrastructure, and the wharves themselves as part of site activities (COPCs: heavy metals, TPH, VOCs, PAHs, asbestos, OPPs, TBT, solvents)	
Affected media	Each of the APECs and corresponding COPCs previously identified in the ESA have the potential to impact soils, groundwater, surface water and vapours (indoor and ambient air). The DGA identified the following affected media and corresponding COPCs: • Fill used during land reclamation activities: *"no identified impacts to site soils that require management or remediation…"*. • Natural soils: ASS • Groundwater: copper, lead and zinc exceeding ecological criteria, however these were considered to be natural background conditions of an urban environment • Ground gas was considered very low risk • VOC concentrations in soil vapour were less than the detection limit and was therefore not considered to be affected.	I agree with the affected media identified, with the exception of the characterisation of fill and sediment, as follows. Elevated concentrations of metals and TPHs were identified in fill material exceeding ecological criteria. Elevated concentrations of PAHs were also identified in fill material associated with ash and slag. The site is largely sealed with hardstand, the sampling methodology adopted during the DGA limited the ability to visually inspect fill materials, and quantification of ACM was not undertaken. There is therefore considered to remain a reasonable potential for asbestos to be present in fill material at concentrations of concern. Impact to sediments is not included in the DGA CSM. Previous investigations included only a limited scope for the assessment of sediment, which was to be addressed in future data gap assessments. Previous investigations identified TRHs, PAHs, metals, TBT and PCB as COPCs in sediment. The RAP reported that contaminant concentrations in sediment were generally consistent with sediments across the broader Blackwattle Bay area.
Receptor identification	The DGA summarised potential human receptors and associated exposure pathways for the site based on exposure scenarios that may occur under the proposed redevelopment of the site. The potential primary human receptors are as follows: • Patron (adult or child) and commercial worker (adult). Location: commercial building and land area of the site. • Construction worker or intrusive maintenance worker (short duration). Location: excavations. • The site will be sealed as a result of building and/or accessway construction. Ecological receptors are limited to off-site receptors which have the potential to be	The potential human and ecological receptors have been adequately identified. It is however noted that disturbance of in situ sediment during development or site use may impact ecological receptors. Should the development plans be revised, there may be a requirement to revise the receptors. In particular, if landscaping with site soils is proposed.

Element of CSM	Consultant	Auditor Opinion
	impacted as a result of groundwater or surface water (if present) migrating from the site to the surface waters of Blackwattle Bay.	
Exposure pathways	No current ecological or human health risks have been identified within soils or groundwater under the proposed development. The primary pathway of concern for the site is gas/vapour intrusion. Gases from the subsurface can potentially migrate into buildings and gases can potentially accumulate in buildings due to reduced ventilation. However, concentrations of VOCs in sub-slab vapour were shown to be below laboratory detection limits, indicating an incomplete pathway for these contaminants. Review of the existing ground gas data indicated that the maximum GSV for the site falls within 'characteristic gas situation 1' comprising very low risk conditions. Available soil and sediment data were previously compared to direct contact criteria (where available), and results were below the adopted criteria under a recreational land use scenario.	Direct contact pathways (oral and dermal) will be limited for most site users. The majority of the site will be sealed, and as such direct contact to contaminated soils, groundwater or sediment would be limited for site users. Constructions workers may be exposed to impacted materials during development works. Inhalation of soil vapour or ground gases is an exposure pathway, however is not considered to present a risk based on the results of the DGA. With regard to potentially completed ecological exposure pathways on-site, the majority of the site will be sealed as a result of building and/or accessway construction. Limited vegetation will be present in raised planter beds or similar, rather than within site soils. As such there are no direct exposure pathways for ecological receptors to soil. The proposed development may result in changes in sediment bed levels and in the movement of vessels within the Bay. This may lead to changes in hydrodynamic flow conditions, such that surficial sediments may at times be disturbed/re-suspended in different areas of the Bay, resulting in localised changes in sediment/water chemistry and ecosystem conditions. Further consideration as to the potential environmental impacts of such changes were beyond the scope of the previous assessments and will require further consideration during the broader design of the development.
Presence of preferential pathways for contaminant movement	The DGA did not discuss preferential pathways.	Preferential pathways are typically associated with soil vapour and ground gas. Impact was not identified during the DGA therefore further consideration of preferential pathways is not considered necessary.
Potentially complete source-pathway-receptor (SPR) linkages requiring remediation or management	The DGA concluded that *"No current ecological or human health risks have been identified within site soils or groundwater under the proposed development scheme"*. The SPR linkage for gas/vapour intrusion was considered to be incomplete based on the contaminant concentrations identified during the DGA.	The available investigation data has not identified complete SPR linkages, however there is the potential for some to be present based on the identified data gaps (discussed in Section 13.1 below).
Evaluation of data gaps	The DGA noted that waste classification of material requiring offsite disposal was a data gap, in particular leachability analysis. The DGA noted that this was to be assessed when service plans were available.	The DGA addressed a number of data gaps outlined in the RAP, however some remain. These are listed in Section 13.1 below.

Element of CSM	Consultant	Auditor Opinion
	The RAP notes that additional surface water quality data should be collected to provide a baseline dataset prior to development activities commencing. The dataset can be used to monitor the success of management measures to be implemented during construction activities.	

13.1 Auditor's Opinion

The CSM presented in the DGA is considered an adequate basis for assessing remedial requirements and to inform management requirements during the proposed development works. Additional data gaps considered to remain following the DGA include the following:

- Soil in the eastern land-based portion of the site was not assessed at an adequate density. Further assessment would be required to inform suitability of the material to remain onsite or for waste classification for offsite disposal.
- The footprint of the electrical substations require assessment for PCBs and PAHs following demolition.
- Characterisation of fill materials for the presence of asbestos was limited by the methodology adopted during the DGA. There is considered a reasonable potential for asbestos to be present within fill material. The absence of asbestos in material disposed offsite and any fill material retained onsite should be confirmed by further assessment during redevelopment, ideally following removal of buildings and hardstand.
- The location of historical fuel infrastructure is unknown. Whilst there is indirect evidence that it was removed, the original documentation associated with the remediation and validation works has not been provided. Investigations to date have not identified significant petroleum hydrocarbon contamination in soil, groundwater or soil vapour, therefore this data gap is not considered significant. Further assessment or management may be required if localised impact is identified during excavation of the site, however this could be adequately managed under the UFP.
- There is the potential for additional USTs to be present as records of dangerous goods storage have not been reviewed. Bulk excavation of the site is proposed which would likely identify any unidentified USTs. The RAP includes a general procedure for removal of USTs within the contingency plan. Review of SafeWork NSW dangerous goods records and other sources of historical information (i.e. historical aerial photographs, NSW EPA records, Council records, Certificates of Title) is recommended to identify additional potential sources of contamination.
- Previous assessment of sediments did not adequately address comparisons against relevant ANZAST (2018) DGVs for PCBs and OCPs (PQLs were too high) and normalisation with TOC (not analysed in EIS, 2017) on a sample-by-sample basis. Further sediment assessment was not undertaken in the DGA. The RAP did not indicate specifics of further sediment sampling to be undertaken. It is noted, however, that the RAP states that *"Pending further design of the proposed development work and evaluation of construction methods, it is anticipated that a site sampling program to further characterise sediments in areas of the site to be the subject of disturbance will be undertaken. The scope and nature of the assessment will be sufficient to enable a suitable data set to guide management of potential contaminant and acid release during the construction works"*. This should be addressed when the final development plans are available.
- The RAP SAR noted that the density of sediment samples is not uniform across all areas of the site. In particular, sediments in the western portion of the site have previously been sampled at a lower density. The existing data set is considered sufficient to broadly characterise sediment quality,

although further characterisation of sediments is required to inform management during excavation and construction. Management of sediment dewatering activities requires the development of a Dewatering Plan to demonstrate that dewatering of sediments will not result in the discharge of contaminants to the Blackwattle Bay receiving environment.

The remaining data gaps can be addressed during demolition of existing structures, excavation of the basement area and construction of the Fish Market building. Processes and procedures defined in the RAP were updated in a revised RAP (8 July 2020) to address the remaining data gaps. The revised RAP is to be reviewed by me in a Section B SAS and SAR. The proposed construction environmental management plan (CEMP), REMP and Dewatering Plan will provide further confidence that data gaps can be adequately addressed.

14. HAZARDOUS MATERIALS REMOVAL MANAGEMENT PLAN

JBS&G prepared a HMMP (8 April 2020) which provided details and management procedures for the proposed decommissioning and demolition of the existing structures at the site, including the Hanson concrete batching plant infrastructure, wharf structures, a finger jetty, a concrete jetty, piles supporting the existing wharves and jetty structures, the Jones Brothers Coal Loader remnants and all other associated land and water based infrastructure in addition to works to make good the existing seawall infrastructure.

The HMMP was replaced by the HMRMP (12 August 2020) in response to the findings of a draft version of this IAA and to satisfy the requirements of Condition B28 of SSD 8924. Condition B28 requires the HMRMP to include the following:

a) Ensure the development complies with the *NSW Occupational Health and Safety Regulation 2001* and Part 7 of the *Protection of the Environment Operations (Waste) Regulation 2014;*

b) Be consistent with Safe Work Australia's code of practice *How to Safely Remove Asbestos 2011* and *How to Manage and Control Asbestos in the Workplace 2011;*

c) Identify any known or potential areas of concern on site for hazardous and asbestos containing materials;

d) outline the procedures for identification, handling and disposal of hazardous materials;

e) include an Asbestos Management Plan;

f) ensure that all hazardous materials would be handled and disposed of by suitably qualified and licensed experts in accordance with the relevant guidelines and legislation;

g) ensure an induction process is in place for site workers and visitors regarding the identification of hazardous and asbestos containing material and the formal procedures to be followed if such materials are identified on site;

h) include a suitable airborne asbestos fibre monitoring program for all asbestos removal works areas; and

i) outline procedures for validation and inspection following the completion of asbestos removal works and issuing of asbestos clearance certificates.

The objective of the HMRMP is to provide "*…procedures and standards to be followed in order to remove hazardous materials associated with current infrastructure at the site, whilst ensuring the protection of human health and the surrounding environment"* under appropriate regulatory and legislative guidance.

Hazardous building materials that may be identified in historical buildings include ACM, lead-based paint, PCBs, synthetic mineral fibres (SMFs) and ozone depleting substances (ODS), in addition to asbestos and lead containing dusts from degraded materials. These materials require careful

management during demolition activities undertaken at a site in order to protect sensitive receptors. The HMRMP summarises the findings of a survey of buildings and other structures on Lots 3 to 5 undertaken on 30 April 2020. The survey identified asbestos, lead paint and dust and SMF. Inspection of light fittings could not be undertaken, and it was assumed that PCB containing capacitors were present.

The survey did not access the electrical substations on Lots 3 and 5 and the HMRMP recommended that hazardous material identification and removal be undertaken under separate management/removal plans.

The survey also did not access the portions of Lot 107 and Lot 1 within the site and the HMRMP recommended that a pre-demolition hazardous building materials survey be undertaken to confirm the presence, extent and conditions of materials.

Removal works management procedures and relevant responsible persons are identified in the HMRMP, in addition to asbestos removal contractor licence requirements and site management activities (Hazardous Material Removal Control Plans, site safety inductions, training and certification, site access controls, personal protective equipment (PPE) and decontamination requirements). The removal protocols for asbestos, lead paint and dust, SMF and PCBs are detailed in the HMRMP. ODS were not identified during the survey and therefore removal protocols were not included in the HMRMP.

14.1 Auditor's Opinion

The HMRMP addresses the proposed decommissioning and demolition of the existing structures at the site (excluding the electrical substations). The requirements of Condition B28 are largely met, with the exception that an Asbestos Management Plan (item e) was not included in the HMRMP. JBS&G considered that the requirements of an asbestos management plan were provided in the HMRMP. I note that the contents of an asbestos management plan are defined by the *Work Health and Safety Regulation 2017*, which I have not reviewed as it is not a requirement of the *Contaminated Land Management Act 1997*.

The HMRMP notes that asbestos may be present within fill material, however does not provide procedures for handling asbestos in soil. Asbestos has not been observed during site investigations and laboratory assessment of fill material identified AF/FA in one sample below the criteria. Limitations were identified with the sampling density and methodology, therefore characterisation of fill material for asbestos has been identified as a data gap (Section 13.1) requiring further assessment following removal of buildings and hardstand. There is a reasonable potential for fill material to contain asbestos given the presence of other anthropogenic materials (timber, tile, ceramic, glass, concrete, brick, slag and ash). The HMRMP noted that appropriate asbestos management controls were provided in the revised RAP and could be included in the CEMP. This is considered appropriate.

The HMMP would require revision to include specific procedures for ODS should these be identified on the site.

15. CONCLUSIONS AND RECOMMENDATIONS

JBS&G concluded in the DGA that:

> "*Based on the results and findings of this data gaps assessment, it is considered that the remedial framework outlined in the RAP… is valid, and when implemented will ensure the site is suitable for the proposed development. Notwithstanding, it is recommended that the RAP, ASSMP and HMMP… be revised to include the additional results and findings of this data gap assessment such that the final remedial scope/management requirements can be defined*."

As noted in Section 13.1 of this IAA, there are residual data gaps that were not addressed in the DGA. The data gaps are unlikely to preclude remediation works outlined in the RAP from being undertaken, however I agree that update of the RAP and HMMP was required to incorporate the results of the DGA

and plans for addressing remaining data gaps, as well as the requirements of the development consent. The HMRMP was prepared to address the findings of a draft version of this IAA and satisfy the requirements of Condition B28 of the development consent. A revised RAP (8 July 2020) has also been prepared and is to be reviewed by me in a Section B SAS and SAR.

In response to the NSW EPA comments provided in Section 1.1, I provide the following conclusions:

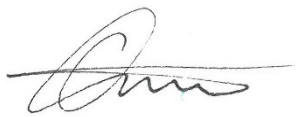
1. *"…the appropriateness of the DGA report and the report's conclusions…":* The scope of the DGA addressed many of the data gaps identified in the RAP and the RAP SAR, however some are noted to remain (Section 13.1 of the IAA). I agree with the DGA conclusion that the remedial framework in the RAP was valid, however update of the RAP was required to include the results of the DGA, as well as processes and procedures to address the remaining data gaps and the findings of this IAA. The revised RAP is to be reviewed in a Section B SAS and SAR.
2. *"…whether the characterisation is sufficient to ensure any asbestos containing materials in soils and at ground surface are managed appropriately…":* Characterisation of asbestos was identified as a data gap following the DGA. Areas of the site were not assessed, the density of field quantification was low and the methodology adopted did not adequately characterise fill materials for asbestos. There is considered a reasonable potential for asbestos to be present within fill material. Further assessment of fill material for asbestos should be undertaken following building demolition and removal of hardstand. The revised RAP summarised the remaining data gaps and included procedures for addressing them.
3. *"…whether the management requirements [of the HMMP] are appropriate…":* The HMMP reviewed by the NSW EPA was revised in the HMRMP. The HMRMP identifies hazardous building materials and includes procedures for their removal. It does not discuss removal of asbestos from the surface or within soil, however the revised RAP provides appropriate procedures for this purpose. It is therefore concluded that the HMRMP and revised RAP provide appropriate processes and procedures for the management of asbestos within structures, on the ground surface and within soil.

* * *

Consistent with the NSW EPA requirement for staged 'signoff' of sites that are the subject of progressive assessment, remediation and validation, I advise that:

- This advice letter does not constitute a Site Audit Report or Site Audit Statement.
- At the completion of the remediation and validation I will provide a Site Audit Statement and supporting documentation.
- This interim advice will be documented in the Site Audit Report.

Yours faithfully
Ramboll Australia Pty Ltd

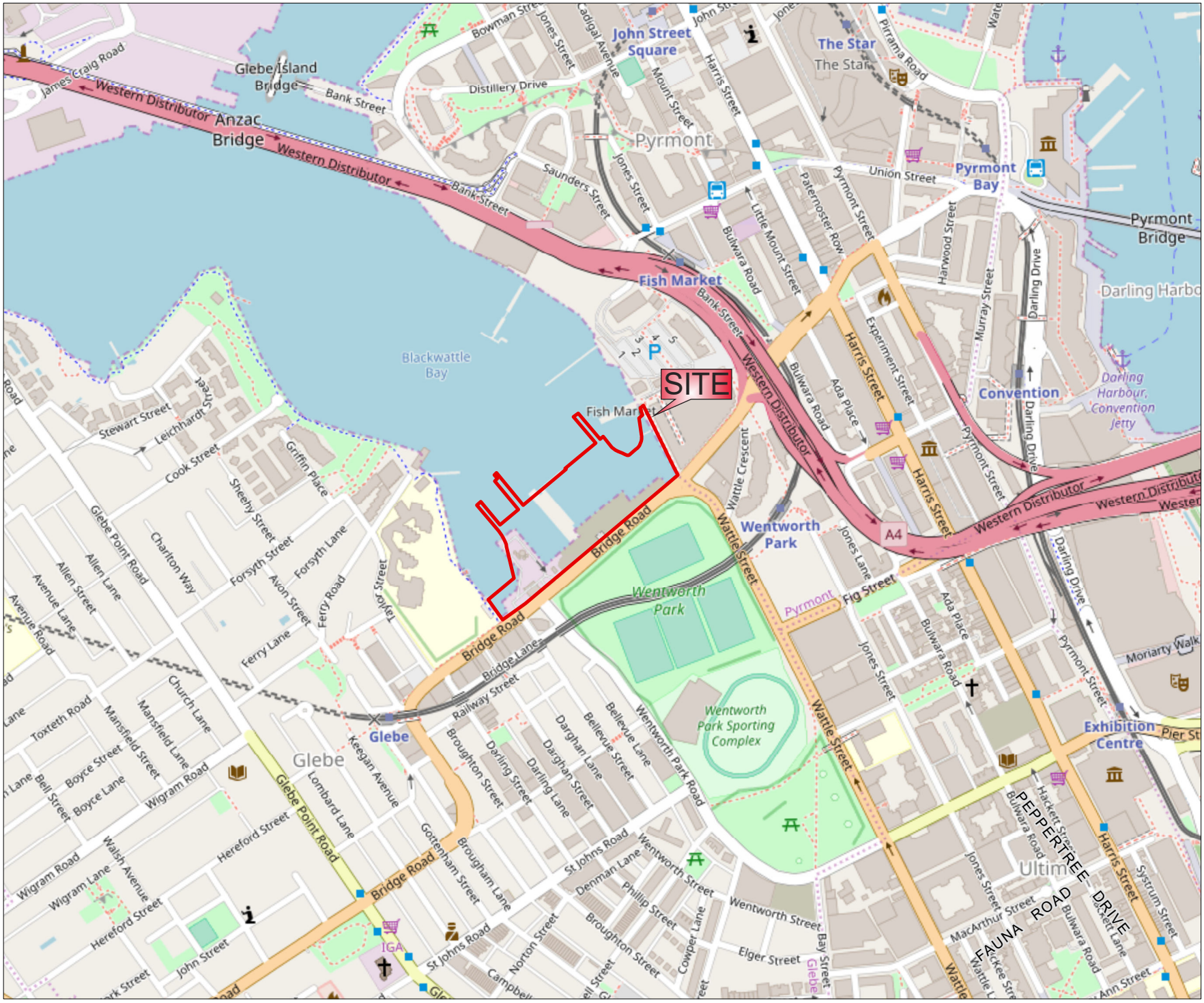


Tom Onus
EPA Accredited Site Auditor 1505

Attachments:

1. Site Location
2. Site Layout
3. DGA Sample Locations

Attachment 1: Site Location



Legend:

Approximate new Sydney Fish Market development boundary

JBS&G

Job No: 54578	
Client: UrbanGrowth NSW	
Version: R05 Rev A	Date: 04-Feb-2019
Drawn By: RF	Checked By: CB
Scale 1:8,000	

0 100 200
metres

Coor. Sys. GDA 1994 MGA Zone 56

1A-C Bridge Road
Pyrmont, NSW

SITE LOCATION

FIGURE 1

File Name: 54578_01
Service Layer Credits: © OpenStreetMap (and) contributors, CC-BY-SA

Legend:

- Approximate new Sydney Fish Market development boundary
- Cadastral Boundary
- Approximate Land Area
- ACM Fragments Observed on Ground Surface

Proposed Landuse

- Fishmarkets Building Envelope
- Public Domain
- Working Wharfs

Attachment 2: Site Layout

JBS&G

Job No: 54578	
Client: UrbanGrowth NSW	
Version: R05 Rev A	Date: 01-Mar-2019
Drawn By: CA	Checked By: CB

Scale 1:2,000

0 25 50
metres

Coor. Sys. GDA 1994 MGA Zone 56

1A-C Bridge Road
Pyrmont, NSW

SITE LAYOUT

FIGURE 2

File Name: 54578_02
Reference: Near Map - http://www.nearmap.com.au/. Imagery - 18-01-2018.

Legend:

- Approximate Site Boundary
- Cadastral Boundary
- New Fishmarket Building Envelope

Sample Locations

- Soil Sample Location
- Soil Sample Location (Hand Auger)
- Groundwater and Ground Gas and Soil
- Groundwater and Ground Gas
- Sub-Slab Vapour Sample Location

JBS&G

Job No: 54578	
Client: UrbanGrowth NSW	
Version: R05 Rev A	Date: 01-Mar-2019
Drawn By: CA	Checked By: CB
Scale 1:1,200	

0 20 40
metres

Coord. Sys. GDA 1994 MGA Zone 56

1A-C Bridge Road
Pyrmont, NSW

SAMPLE LOCATIONS
FOR DATA GAP ASSESSMENT

FIGURE 4

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