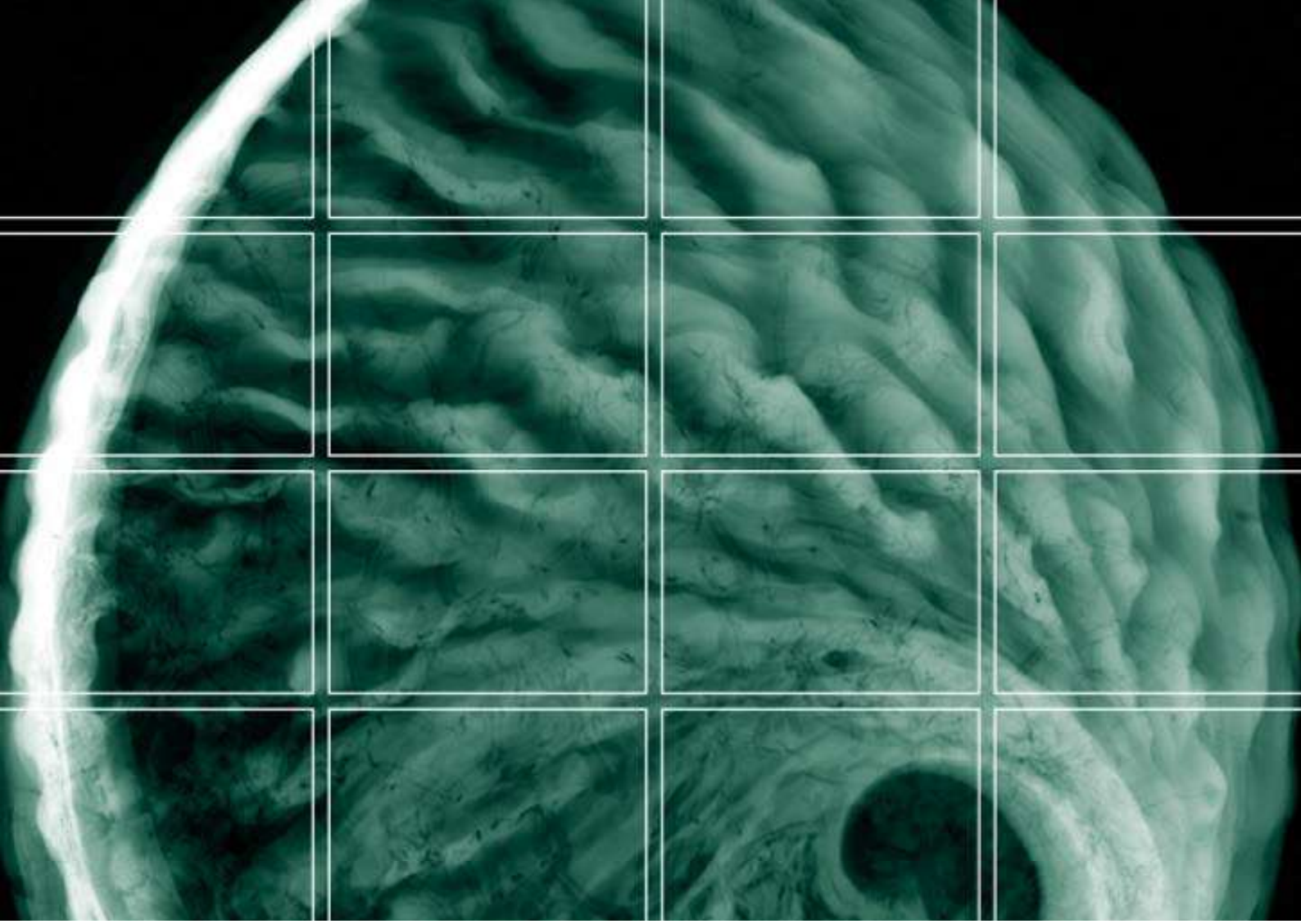
Appendix F

Sampling and Analysis Quality Plan (SAQP)



Kamay Wharf Project

Sampling and Analysis Quality Plan

1 October 2020

Project No.: 0564417

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Kamay Wharf Project

Sampling and Analysis Quality Plan

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CONTENTS

Acronyms and Abbreviations

Name	Description
ACM	Asbestos Containing Material
AHD	Australian Height Datum
AMG	Australian Map Grid
ASC NEPM	National Environment Protection (Assessment of Site Contamination) Measure
ASS	Acid Sulfate Soils
BTEX	Benzene, Toluene, Ethylbenzene and Xylenes
CLM	Contaminated Land Management Act 1997
CoPC	Contaminant of Potential Concern
CSM	Conceptual Site Model
DP	Deposited Plan
DPI	Department of Primary Industries
DSI	Detailed Site Investigation
EPL	Environment Protection License
ESA	Environmental Site Assessment
m	Metre
m AHD	Metres Above Australian Height Datum
m bgl	Metres Below Ground Level
NEPC	National Environment Protection Council
NEPM	National Environment Protection Measure
NSW EPA	New South Wales Environment Protection Authority
OCP	Organochlorine Pesticides
OPP	Organophosphorus Pesticides
PAH	Polycyclic Aromatic Hydrocarbons
PFAS	Per and Polyfluoroalkyl Substances
PFOA	Perfluorooctanoic Acid
PFOS	Perfluorooctane Sulfonate
POEO Act	Protection of the Environment Operations Act 1997
PSI	Preliminary Site Investigation
RAP	Remedial Action Plan
SAQP	Sampling and Analysis Quality Plan
TBT	Tributyltin
TRH	Total Recoverable Hydrocarbons
UXO	Unexploded Ordnance

1. INTRODUCTION

Environmental Resources Management Australia Pty Ltd (ERM) was engaged by Arup Australia Pty Ltd (Arup) to prepare this Sampling and Analysis Quality Plan (SAQP) for a Targeted Detailed Site Investigation (DSI) to be undertaken within the site identified as the Kamay Wharf Project, located in Kurnell and La Perouse, NSW (the Site).

1.1 Background

ERM understands that Transport for NSW is seeking approval to reinstate public ferry wharves and associated infrastructure at La Perouse and Kurnell in Botany Bay. The proposal would allow for the recommencement of operation of the ferry service that ended in 1974 following a heavy storm that caused severe damage to the wharves.

A concept design has been developed for the proposed redevelopment which includes the following key features:

- Two new wharves, one at La Perouse and one at Kurnell that would include:
  - Berth for ferries;
  - Berth for recreational vessels;
  - Facilities for recreational fishing;
  - Sheltered waiting areas;
  - Landside tie-in and landscaping;
- Reconfiguration of existing car parking areas at La Perouse and Kurnell to increase the number of spaces; and
- Installation of utilities to service the wharves.

The Site location is illustrated on **Figure 1** and the current layout is presented on **Figure 2.**

To refine Arup's understanding of potential contamination within the Site, ERM undertook a Preliminary Site Investigation (PSI) within the Site including a review of the NSW EPA contaminated land register, historical aerial photographs, groundwater-bore information; relevant government databases, published soil, geology and topographic maps and a site inspection

Based on the results of the abovementioned PSI, ERM recommended that an intrusive investigation of soil, sediment and groundwater should be undertaken to more accurately assess the contamination status of the site.

1.2 Objectives

This objectives of this SAQP are to summarise the:

- Data Quality Objectives (DQOs) for the proposed targeted DSI; and
- The methodology for the proposed works, including sampling, analytical and reporting requirements.

2. SITE DETAILS AND SETTING

ERM notes that the Kamay Wharf project is located within two sites located in Kurnell and La Perouse, NSW. Site specific information relating to the site information and site setting is presented within the following sections.

2.1 Site Identification

The site identification information is presented within the table below:

Table 2.1 – Site Identification Details

Site	Item	Description
Kurnell	**Legal Description**	■ Part Lot 71 DP 908; and ■ Part Lot 3 DP 1165618
	Local Government Area	■ Sutherland Shire Council
	Current Zoning	■ E1 – National Parks and Nature Reserves ■ E2 – Environmental Conservation ■ W1 – Natural Waterways ■ B1 – neighbourhood Centres
	Geographical Co-Ordinates	■ 34º00'22"S 151º33'00" E (approximate centre of Site)
	Site Location and Site Layout	■ Figure 1a and Figure 2a
La Perouse	**Legal Description**	■ Lot 5113 DP 752015 ■ Lot 1 DP 934156 ■ Lot 1057 DP 752015 ■ Lot 285 DP752015 ■ Part Lot 2 DP 776343 ■ Part Lot 1 DP 776343 ■ Part Lot 5086 DP 752015 ■ Part Lot 1 DP 862586 ■ Lot 5257 DP 824002 ■ Lot 5253 DP 824002 ■ Lot 5254 DP 824002 ■ Lot 5256 DP 824002 ■ Lot 5255 DP 824002 ■ Lot 1081 DP 752015 ■ Lot 7045 DP 1026891 ■ Lot 7043 DP 1026891 ■ Lot 1 DP 915424 **Lot 3 DP 1165618**
	Local Government Area	■ Randwick Council
	Current Zoning	■ E1 – National Parks and Nature Reserves ■ RE1 – Public Recreation ■ SP2 - Infrastructure
	Geographical Co-Ordinates	■ 33º59'19"S 151º13'59" E (approximate centre of Site)
	Site Location and Site Layout	■ Figure 1b and Figure 2b

2.2 Site Setting

The following section summarises information obtained during the site background and history review.

Site Identifier	Item	Description
Kurnell	**Site area**	Approximately 28.5 ha (including land and water portions of the Site)
	Current land-use	The site is currently comprised of undeveloped recreational land (beach, open grass parkland and vegetated bushland), open water (Botany Bay) and public roadways,
	Proposed Future Use	Re-instatement of public ferry wharves and associated infrastructure at La Perouse and Kurnell in Botany Bay
	Surrounding Land use	The land uses surrounding the site include: ■ **North:** Botany Bay; ■ **South:** Low density residential dwellings then the former Kurnell refinery (Caltex Kurnell Terminal); ■ **East:** Undeveloped recreational bushland then Botany Bay / Pacific Ocean; and ■ **West:** Low density residential dwellings (suburb of Kurnell) followed by undeveloped bushland / wetlands and then Quibray Bay.
	Site Elevation	Between 0 – 4 m Australian Height Datum (AHD)
	Topography	■ Regional topography is generally flat with a slight slope to the north / north east. The portion of the site located on land slopes to the north in the direction of Botany Bay.
	Hydrology	■ The portion of the Site located on land was observed to be comprised of a public road way in the south western portion, of the Site, a public beach within the northern portion of the Site and undeveloped recreational land in the eastern portion. ■ During periods of rainfall, it is anticipated that surface waters would either flow into stormwater infrastructure located within Captain Cook Drive, infiltrate the site surface in unsealed portions of the Site or flow offsite to the adjacent Botany Bay.
	Geology, Soils and Acid Sulfate Soils	Geology mapping provided by NSW Planning and Environment – resources and energy indicates the site is underlain by an unnamed Quaternary formation comprising coarse quartz sands, varying amounts of shell fragments and clean to muddy, shelly, mostly marine sand overlying the Triassic Hawksbury Sandstone Formation comprising medium to coarse-grained quartz sandstone with minor shale and laminite lenses. Soils within the site are described as: ■ Deep podzols of dunes within swales and organic peats within swamp areas. Mapping indicated that the western portion of the site was comprised of class 1, class 3 and class 5 Acid Sulfate Soils (ASS). Mapping indicated that there was a high probability of ASS occurring within subtidal marine sediments.
	Hydrogeology	Information from NSW Department of Primary Industries' and the Bureau of Meteorology indicated the following: ■ A search of registered groundwater bores identified 11 bores within the 2 km search radius. Standing water levels were measured between 0 m below ground level (bgl) to 3.0 m bgl. Registered bores were utilised for arrange of purposes including water supply, domestic, household, monitoring and water supply bores.

Site Identifier	Item	Description
		■ Drillers logs indicated that groundwater was identified within unconsolidated sand and clayey sand.
La Perouse	**Site area**	Approximately 11.5 ha (including land and water portions of the Site)
	Current land-use	The site is currently comprised of undeveloped recreational land (open grass parkland), open water (Frenchmans Bay) and public roadways (Anzac Parade).
	Proposed Future Use	Re-instatement of public ferry wharves and associated infrastructure.
	Surrounding Land use	The land uses surrounding the site include: ■ **North:** Frenchmans Bay, low density residential dwellings and recreational parkland; ■ **South:** Botany Bay; ■ **East:** Undeveloped recreational bushland then Botany Bay / Pacific Ocean; and ■ **West:** Botany Bay followed by industrial land comprising fuel / chemical storage located approximately 1.5 km to the west of the Site.
	Site Elevation	Between 0 – 15 m Australian Height Datum (AHD)
	Topography	■ Regional topography is generally flat with a slight slope to the south / south east in the direction of the Pacific Ocean. ■ The central portion of the site is located at an elevation of approximately 15 m AHD and slopes to the south, east and west in the direction of Botany Bay.
	Hydrology	■ The portion of the Site located on land was observed to contain a centralised ring road (Anzac Parade). During periods of rainfall it is anticipated that surface water would either flow into stormwater infrastructure located within Anzac Parade, infiltrate the site surface in unsealed portions of the Site or flow offsite to the adjacent Botany Bay.
	Geology, Soils and Acid Sulfate Soils	Geology mapping provided by NSW Planning and Environment – resources and energy indicates the site is underlain by an unnamed Mesozoic formation comprising medium to coarse grained quartz and sandstone, very minor shale and laminite lenses and an unnamed Quaternary formation comprising coarse quartz sands and varying amounts of shell fragment. Soils within the site are described as: ■ Shallow discontinuous earthy sands and yellow earths on crests and insides of benches. Shallow siliceous sands on leading edges, shallow to deep leached sands, grey sands and gleyed podzolic soils in poorly drained areas ad localised yellow podzolic soils associated with shale lenses. Mapping indicated that the western portion of the site was comprised of class 4 and class 5 Acid Sulfate Soils (ASS). Mapping indicated that there was a potential probability of ASS occurring within subtidal marine sediments.
	Hydrogeology	Information from NSW Department of Primary Industries' and the Bureau of Meteorology indicated the following: ■ A search of registered groundwater bores identified 37 bores within the 2 km search radius. Standing water levels were measured between 0 m below ground level (bgl) to 143.0 m bgl. The majority of bores identified groundwater at depths of between 3 m and 8 m bgl. Registered bores were utilised for arrange of purposes including water supply, domestic, household, monitoring and water supply bores. ■ ERM notes that the Site is located immediately adjacent to the NSW Office of Water Groundwater Extraction Exclusion Area (GEEA) - Area 2. Mapping

Site Identifier	Item	Description
		indicates the exclusion zone extends from the northern boundary of the Site at the intersection of Anzac parade and Endeavour Avenue. ■ Drillers logs indicated that groundwater was identified within unconsolidated sand, clays and sandstone bedrock.

3. PREVIOUS INVESTIGATIONS

In preparing this SAQP, ERM reviewed the following previous reports:

- Environmental Resources Management (2020) Kamay Wharf Project, Preliminary Site Investigation, 25th August 2020 (ERM 2020); and
- Environmental Resources Management (2020) Kamay Wharf Project, Preliminary Site Investigation – La Perouse Site, 25th August 2020 (ERM 2020a).

A summary of the above reports is presented below:

ERM 2020

ERM was engaged by Arup to undertake a PSI at the site identified as the Kamay Ferry Wharf Proposal located in Kurnell, NSW. The results of the PSI indicated the following:

- The site is located in predominantly public open space comprising beach area, parkland and undeveloped bushland associated with Botany Bay National Park with the northern portion of the site extending into Botany Bay;
- The site is underlain by a quaternary formation comprising coarse quartz sands, varying amounts of shell fragments and clean to muddy, shelly, mostly marine sand overlying the Triassic Hawksbury Sandstone Formation comprising medium to coarse-grained quartz sandstone with minor shale and laminate lenses.
- Groundwater within the surrounding area was identified at depths between 0 m bgl to 3.0 m bgl with registered bores utilised for a range of purposes including domestic, household, monitoring and water supply bores.
- Historical records indicate the site has largely been vacant since the 1950s with minor construction works of a small jetty / pier in the 1970s. The surrounding area has comprised low density residential to the west, open space / bushland to the east and the Kurnell refinery to the south since the 1950's to present time.

Based on information reviewed as part of the PSI, ERM considered there to be a potential risk to human health / ecological receptors due to the following potentially complete pollutant linkages identified at the site:

- Potential uncontrolled fill materials associated with construction of the existing roadways or levelling / site filling purposes;
- Historical onsite and surrounding land uses including (but not limited to) the adjacent Caltex Kurnell Refinery which is currently regulated by the NSW EPA; and
- Potential impacted surface materials resulting from illegal dumping of waste materials.

ERM further noted that based on the proposed construction method, the potential release of contamination within subsurface soils and sediments would require consideration during the design of construction environmental controls.

It was the opinion of ERM that based on the results of the PSI, an intrusive investigation of soil, sediment, surface water and groundwater should be undertaken to more accurately assess the contamination status of the site.

ERM 2020a

ERM was engaged by Arup to undertake a PSI at the site identified the Kamay Ferry Wharf Proposal located in la Perouse, NSW. The results of the PSI indicated the following:

- The site is located in predominantly public open space comprising beach area, parkland and undeveloped bushland associated with Botany Bay National Park with the northern portion of the site extending into Botany Bay.
- The site is underlain by an unnamed Mesozoic formation comprising medium to coarse grained quartz and sandstone, very minor shale and laminite lenses and an unnamed Quaternary formation comprising coarse quartz sands and varying amounts of shell fragment.
- Groundwater within the surrounding area was identified at depths between 0 m bgl to 143.0 m bgl. The majority of bores identified groundwater at depths of between 3 m and 8 m bgl. Registered bores were utilised for arrange of purposes including water supply, domestic, household, monitoring and water supply bores. ERM notes that the Site is located immediately adjacent to the NSW Office of Water Groundwater Extraction Exclusion Area (GEEA) - Area 2. Mapping indicates the exclusion zone extends from the northern boundary of the Site at the intersection of Anzac parade and Endeavour Avenue.
- Historical records indicate the site has largely been vacant since the 1930s with limited use of the Site for Defence purposes in the 1940s. Records from this time indicate the potential for Mortar Firing to have been undertaken in an easterly direction towards Congwong Bay. ERM notes that a small pier was observed in aerial photographs from the 1930's and may be associated with the adjacent historical sand mining in Frenchmans bay. Following closure / demotion of Defence buildings the site has been used for recreational parkland and the la Peruse Museum.

Based on information reviewed as part of the PSI, ERM considered there to be a potential risk to human health / ecological receptors due to the following potentially complete pollutant linkages identified at the site:

- Potential uncontrolled fill materials associated with construction of the existing roadways or levelling / site filling for construction of onsite building structures;
- Potential use of hazardous materials within onsite historical and current building structures;
- Historical onsite and surrounding land uses including (but not limited to) former Defence land uses, sand mining etc.; and
- Potential Unexploded Ordnance located within a former Mortar Firing area located to the East of the Site.

ERM further noted that based on the proposed construction method, the potential release of contamination within subsurface soils and sediment would require consideration during the design of construction environmental controls.

It was the opinion of ERM that based on the results of the PSI, an intrusive investigation of soil, sediment, surface water and groundwater should be undertaken to more accurately assess the contamination status of the site.

4. PRELIMINARY CONCEPTUAL SITE MODEL

Based on the results of ERM (2020) and ERM (2020a) PSIs, ERM developed preliminary CSMs for both the Kurnell and La Perouse sites outlining the potential source, pathway and receptors linkages.

- The preliminary CSMs are presented within Section 5 of both ERM (2020) and ERM (2020a).

The CSMs will be updated / refined throughout the course of the project as new information is made available.

5. DATA QUALITY OBJECTIVES

ERM has developed Data Quality Objectives (DQOs) for this investigation. The DQOs for this SAQP have been developed in accordance with the ASC NEPM and the Australian Standard AS4482*Guide to the Sampling and Investigation of Potentially Contaminated Soil*.

5.1 Step 1 – State the Problem

The ERM (2020) and ERM (2020a) PSI identified a range of potentially contaminating historical land uses / activities at the site and surrounding area, as such Arup requires a DSI to be undertaken to assess the potential for contamination to be present at the site that may require consideration during potential redevelopment works of the Site.

5.2 Step 2 – Identify the Decisions

Based upon the objectives of the DSI the decisions required to meet the objectives are discussed below:

- Are there (or will the proposed development create) any potential unacceptable risks to human health and / or ecological receptors from contaminants in fill / soil and / or groundwater?
- Is there any evidence of, or potential for, migration of contaminants from the Site?
- Is there any evidence of, or potential for, off-site migration of contaminants from adjacent sites onto the Site?
- Is there sufficient information on the distribution and characteristics of contaminated media across the site to evaluate risk of harm to human health and/or the environment and whether off-site migration of contamination may have occurred?
- Is management or remediation of contamination, if identified, required?
- Is there sufficient information on the distribution and characteristics of contaminated media across the site to develop a Remediation Action Plan or Site Management Plan to (where necessary) remediate and / or manage site contamination?

5.3 Step 3 – Identify Information Inputs

The inputs to make the above decisions include:

- Information relating to the environmental setting of the site and surrounding area obtained during preparation of the ERM (2020) and ERM (2020a) PSI.
- Field observations made during intrusive investigation works.
- Laboratory analytical data of collected soil and groundwater samples.
- Field measurements collected during intrusive investigation and groundwater monitoring rounds.
- Screening-level assessment criteria from guidelines made or approved by the NSW EPA detailed within Section 7.0.
- Confirmation of acceptable data quality by assessment of data quality assurance / quality control by comparison against Data Quality Indicators (DQI).

5.4 Step 4 – Define the Study Boundaries

The boundaries of the investigation are identified as follows:

- Spatial boundaries – the investigation is limited to the site boundaries as illustrated within Figure 1 and Figure 1a and the maximum depth of investigation at each location detailed within Section 6.0 of this SAQP.
- Temporal boundaries – the temporal boundary is limited to the data collected during these investigation works. As such, seasonality will not be assessed at this stage of the investigation.
- Constraints within the study boundaries – the following are potential limitations that require consideration within the development of the sampling strategy:
  - Restrictions associated with drilling over water.
  - Access restrictions associated with site topography and vegetation.
  - Restrictions associated with existing operational roadways and members of the general public
  - Possible presence of underground and overhead utilities.

Proposed sample locations have been selected taking into consideration the above factors.

5.5 Step 5 – Develop the Decision Rules

The decision rules adopted for this investigation are included in the table below:

Decision Required to be Made	Decision Rule
Are the data sufficient to address the objectives of the investigation?	■ Do the collected data indicate the potential for significant and widespread contamination arising from key AECs identified within ERM (2020) and ERM (2020a) ■ Do field observations (including visual, olfactory, presence of anthropogenic materials in fill) indicate potential significant contamination at the investigation locations? ■ Do analytical data exceed adopted screening-level assessment criteria? ■ Have any additional areas of potential environmental concern been identified within investigations works?
Are the data generated by sampling and analysis of an acceptable quality?	■ Have the data collected been subjected to an assessment of quality assurance/quality control and found to be suitable for use in this assessment?
Does the site contain soil/groundwater and/or soil vapour impacted by contamination resulting from historical land uses?	■ Collected soil and groundwater samples are to be analysed for CoPCs associated with current and historical land uses practices and results compared to relevant NSW EPA endorsed regulatory guideline criteria.
Is there evidence of significant widespread contamination?	■ Collection of representative soil, sediment and groundwater samples during site investigation works.
Is additional information required to determine the potential liabilities/constraints associated with the proposed development?	■ If it is determined that additional information is required to further reduce the uncertainties associated with the distribution and characterisation of soil, sediment and / or groundwater contamination, then appropriate recommendations for further assessment and/or investigation (including for assessment of potential risks) will be provided.
Is there sufficient information to develop a remedial / site management strategy	■ Do the results of the investigation provide sufficient information of the nature, distribution and risk to identified receptors of contamination within soil and groundwater? If no, additional investigation may be required,

5.6 Step 6 – Specify Limits of Decision Error

This step establishes the decision maker's tolerable limits on decision errors, which provide performance goals for limiting uncertainty in the data. Data generated during this project must be appropriate to allow decisions to be made with confidence.

Specific limits for this project have been adopted in accordance with the appropriate guidance from the HEPA (2020) NEMP and the ASC NEPM appropriate data quality indicators (DQIs) used to assess data quality assurance / quality control (QA / QC) and standard ERM procedures for field sampling and sample handling.

To assess the usability of the data prior to making decisions, the data will be assessed against pre-determined DQIs for precision, accuracy, representativeness, comparability and completeness.

The pre-determined DQIs established for the project are discussed below in relation to precision, accuracy, representativeness, comparability, completeness and sensitivity.

- **Precision** – measures the reproducibility of measurements under a given set of conditions. The precision of the laboratory data and sampling techniques is assessed by calculating the Relative Percent Difference (RPD) of duplicate samples.
- **Accuracy** – measures the bias in a measurement system. The accuracy of the laboratory data that are generated during this project is a measure of the closeness of the analytical results obtained by a method to the 'true' value. Accuracy is assessed by reference to the analytical results of laboratory control samples, laboratory spikes and analyses against reference standards.
- **Representativeness** – expresses the degree with which sample data accurately and precisely represent a characteristic of a population or an environmental condition. Representativeness is achieved by collecting samples on a representative basis across the site, and by using an adequate number of sample locations to characterise the site to the required accuracy.
- **Comparability** – expresses the confidence with which one data set can be compared with another. This is achieved through maintaining a level of consistency in sampling techniques, analytical techniques and reporting methods.
- **Completeness** – is defined as the percentage of measurements made which are judged to be valid measurements. The completeness goal is set at there being sufficient valid data generated during the study.
- **Sensitivity** – expresses the appropriateness of the chosen laboratory methods, including the limits of reporting, in producing reliable data in relation to the adopted assessment criteria.

If any of the DQIs are not met, further assessment will be necessary to assess whether the non-conformance will significantly affect the usefulness of the data. Corrective actions may include requesting further information from samplers and/or analytical laboratories, downgrading of the quality of the data or alternatively, re-collection of the data. DQIs are provided the table below.

Data Quality Objectives	Frequency	Data Quality Indicator
Precision		
Blind duplicates (intra laboratory)	■ 1/20 samples (or 1/10 for PFAS)	■ <30% RPD where result is >10 times LOR
Blind duplicates (inter laboratory)	■ 1/20 samples (or 1/10 for PFAS)	■ <30% RPD where result is >10 times LOR
Accuracy		
Surrogate spikes	■ All organic samples	■ 70-130%

Laboratory control samples	■ 1 per lab batch	■ 70-130%
Matrix spikes	■ 1 per lab batch	■ 70-130% ■ Lower recoveries may be acceptable for OCPs, OPPs, PCBs and phenols and will be assessed according to USEPA protocols.
Representativeness		
Sampling appropriate for media and analytes	■ NA	■ NA
Samples extracted and analysed within holding times.	■ NA	■ organics (14 days), inorganics (6 months)
Rinsate blank	■ 1 per day where non-dedicated equipment is used. ■ Samples are to be analysed for all CoPCs other than asbestos.	■ <LOR
Trip spike	■ 1 per lab batch (BTEX only)	■ 70-130%
Method blank / field blank	■ 1 per lab batch	■ <LOR
Comparability		
ERM standard operating procedures for sample collection & handling	■ All samples	■ All samples
NATA* accredited analytical methods used for all analyses	■ All samples	■ All samples
Consistent field conditions, sampling staff and laboratory analysis	■ All samples	■ All samples
Completeness		
Sample description and Chain of Custodies completed and appropriate	■ All samples	■ All samples
Appropriate documentation	■ All samples	■ All samples
Satisfactory frequency and result for QC samples	■ All QA / QC samples	■ -
Data from critical samples is considered valid	■ NA	■ Critical samples valid
Sensitivity		
Limits of reporting appropriate and consistent	■ All samples	■ All samples

5.7 Step 7 – Optimise the Design for Obtaining Data

Historic uses of the sites indicate the potential for contamination to be present that may pose a risk to human health or the environment. The potentially contaminating sources and activities undertaken at the sites are detailed above and within ERM (2020) and ERM (2020a).

Based on the nature of identified potential contamination and the information required to inform potential design constraints, a targeted assessment of soil, sediment and groundwater will be undertaken within the Site.

Proposed sampling locations are presented on **Figure 3**.

6. INVESTIGATION METHODOLOGY

6.1 Fieldwork Methodology

The following table summarises the scope of works and methodology to be adopted for the investigation. Proposed sampling locations are illustrated on Figure 3.

- ERM notes that the investigation will be undertaken concurrently with Arup geotechnical investigation works. ERM notes that all site management, contractor management, waste disposal etc. will be undertaken by Arup,

Task	Proposed Scope
1 – Project Preliminaries	Prior to the commencement of investigation works, ERM will complete the following: ■ Preparation of a site specific Health and Safety Plan (HASP) and associated Safe Work Method Statements (SWMS). preparation and submission of required permits for the investigation works; and ■ ERM notes that Arup will be responsible for engagement and subsequent management of subcontractors including underground utility locator, drillers and surveyors.
2 – Service Location	■ ERM notes that Arup will undertake all service clearance activities during concurrent geotechnical investigations.
3 – Equipment Calibration	All equipment used in the field will be operated under the appropriate technical procedures and calibrated prior to use in accordance with the manufacturer's specifications. ■ The PID will be calibrated to an isobutylene standard at the beginning of each working day in accordance with manufacturer requirements and ERM's SOPs. ■ Water quality meters will be calibrated by the hire company prior to use and relevant calibration certificates retained by ERM. ■ Water quality meters will also be calibrated at the beginning of each day (where used over multiple days) in accordance with the manufacturer specifications. ■ All of the relevant calibration records will be provided as an annex in the investigation reports.
4 – Soil / Sediment Sampling	Contamination investigation works will be undertaken concurrently with geotechnical investigations and will involve a range of test pitting and soil bores. The specific sampling locations / methodology are detailed within **Appendix B**. ■ During investigation works soil / sediment will be logged by an appropriately trained and experienced scientist / engineer to record the following information: soil type, colour, grain size, sorting, angularity, inclusions, moisture condition, structure, visual signs of contamination (including staining and fragments of fibre cement sheeting) and odour in general accordance with AS 1726. ■ Two primary samples will be analysed from each sampling location. Field quality control/quality assurance (QA/QC) samples will be collected including field duplicates, inter-laboratory duplicates, rinsate blanks, trip blanks and trip spikes (as per the requirements detailed below within Section 6.2); ■ During the advancement of all soil bores (including those to be converted to monitoring wells) all locations will be field screened with a calibrated photoionisation detector (PID) for the presence of ionisable volatile compounds. ■ All collected samples will be placed within laboratory-supplied containers, stored in a chilled esky and transported to a NATA accredited laboratory analysis under chain of custody conditions for the required analysis. ■ All soil bore locations will be GPS recorded for incorporation into subsequent reporting.
5 - Groundwater Well Installation	A total of 2 groundwater monitoring wells will be installed as illustrated in appendix B to assess potential impact to underlying aquifers. The specific sampling locations / methodology are detailed within Appendix B. ■ Groundwater monitoring wells will be advanced using various drilling methods based on depth of well to be installed, access and type of samples to be collected. Specific ground surface penetration techniques (concrete core, hand auger) will be used

Task	Proposed Scope
	based on the ground surface cover (concrete, bitumen, grass) and actual / suspected presence of underground services in proximity to the sample location ■ During the drilling of groundwater bores, all locations will be field screened with a calibrated photoionisation detector (PID) for the presence of ionisable volatile compounds. ■ Once groundwater is intercepted, groundwater monitoring wells will be constructed using 50 mm machine slotted uPVC casing, washed filter sand and a bentonite clay seal. The screened interval will be approximately 3.0 m in length. Wells will be finished with a monument ("stick-up") style cover. ■ Upon completion of drilling works, waste materials generated during drilling works will be temporarily stored in sealed drums disposed offsite by a licensed waste contractor. ■ After the installation, each groundwater monitoring well will be developed. During development, wells will be purged using inertia pumps, high flow pumps or disposable bailers. Water quality field parameters will be assessed for stabilisation during development. Where yield is low, the wells will be purged dry. ■ All existing wells included within the assessment and newly installed wells will be surveyed to aid in the assessment of ground water flow direction / velocity.
6 - Groundwater Sampling	ERM will undertake a groundwater-monitoring event of the newly installed groundwater wells located within the Site. ■ The standing water levels in each groundwater monitoring well will be gauged using an oil/water interface meter from the top of well casing. ■ The total depth of the groundwater monitoring well will also be measured. ■ Groundwater within the wells will be purged and sampled using low flow methods. ■ Three groundwater samples (two primary and one duplicate) will be collected and placed into laboratory provided sample containers and stored with a cooler box for transport to the laboratory under Chain-of -Custody procedures. ■ The samples will be submitted to NATA accredited analytical laboratory for analysis in accordance with the proposed analytical schedule detailed below. Duplicate and Triplicate spilt samples will be collected as per the requirements outlined within the NEPM
7 - Equipment Decontamination	All sampling equipment will be decontaminated between sampling locations where designated disposable materials are not used. All non-dedicated equipment will be decontaminated as follows: ■ all loose soil removed with a wire brush; ■ washed in potable (tap) water and brush scrubbing using tap water and a non-phosphate / PFAS free detergent (Decon 90 / Liquinox respectively) and deionised water; ■ rinsed with water; and ■ air dried. Rinsate samples are to be collected as per the requirements of this SAQP to confirm the appropriateness of equipment decontamination.

6.2 Field QAQC

The field quality assurance procedures to be adopted and the field quality control samples to be collected during the investigation are presented in table below. The field QA / QC plan to be adopted for the investigation has been designed to achieve pre-determined DQIs that will demonstrate that the precision, accuracy, representativeness, completeness, comparability and sensitivity of the dataset and that the dataset is of acceptable quality to meet the objectives of the site investigation.

Data Type	Comments and Acceptable Control Limits
Field personnel	■ Field personnel; appropriately trained in the collection of environmental samples and inducted into all site specific client requirements.
Field data collection	■ Site conditions and sample locations properly described. ■ Information to be recorded in field notes. Field notes are appropriately completed and summarised in the report on the investigation.
Sample handling (storage and transport)	■ Soil and water samples will be collected into the sample jars and bags supplied by the selected analytical laboratories and appropriate for the required analysis. ■ All containers will be filled so that minimal headspace is present within the jar. ■ The filled jars will be stored on ice in a chilled, insulated container until received by the analysing laboratory to retard potential sample degradation. ■ Sample numbers, dates, preservation and analytical requirements will be recorded on Chain of Custody documentation, which will also be delivered to the analytical laboratory. ■ All samples are required to be documented as received by the laboratory chilled and intact.
Calibration of Field Equipment	■ The PID will be calibrated at the commencement of each day of sampling, and if necessary, during the day in accordance with the procedure provided by the supplier. ■ Supplier calibration records will be obtained for all equipment sourced for the investigation. ■ Calibration records will be kept for inclusion in the report on the investigation.
Decontamination Procedures	Decontamination of non-dedicated sampling equipment will be undertaken in accordance with ERMs standard procedures and will generally involve: ■ Using clean, disposable nitrile gloves for each sample collection event. ■ Rinsing all non-disposable equipment with deionised water; then a detergent such as Decon 90; then again with deionised water after each sample collection event. When sampling for PFAS, decontamination of non-dedicated sampling equipment will involve: ■ Rinsing all non-disposable equipment with deionised water; then a detergent such as Liquinox; then again with deionised water after each sample collection event.
Field Duplicates (intra-laboratory and inter-laboratory)	■ Intra-laboratory duplicates will be collected and analysed at a rate of 1 in every 20 primary samples, with a minimum of 1 sample. ■ Inter-laboratory duplicates will be collected and analysed at a rate of 1 in every 20 primary samples, with a minimum of 1 sample. ■ The duplicate samples will be obtained from locations suspected of being contaminated and analysed for the key CoPCs as collected primary samples. ■ Duplicate / Triplicate samples will be collected (i.e splitting technique) as per the requires of the NEPM When sampling for PFAS: ■ Intra-laboratory duplicates will be collected and analysed at a rate of 1 in every 10 primary samples, with a minimum of 1 sample. ■ Inter-laboratory duplicates will be collected and analysed at a rate of 1 in every 10 primary samples, with a minimum of 1 sample.
Rinsate Blanks	■ Rinsate blank samples will be collected at a rate of one per day where non-dedicated equipment is used.

Method Blank/Field Blank	■ Laboratory prepared trip blanks will be used and analysed at a rate of one per batch for the soil investigation and one per batch for the groundwater investigation.
Trip Spikes	■ Laboratory prepared trip spikes will be used and analysed at a rate of one per batch for the soil investigation and one per batch for the groundwater investigation.

6.3 Sample Nomenclature

Sample nomenclature will be as outlined in the below table:

Sample Media	Sample Location Type	Location	Sample Convention (Example Field Identification)
Soil	Test Pit	TP01	■ TP01_Sampled Depth
	Soil Bore	SB01	■ SB01_Sampled Depth
Groundwater	Groundwater monitoring Wells	MW01	■ MW01
Sediment	Sediment Sample	SED01	■ SED01_Sampled Depth
QA/QC Samples	All samples	Quality Control Samples	■ QC101_date of sample collection for duplicates; ■ QC201_date of sample collection for triplicates; ■ QC301_date of sample collection for trip blanks; ■ QC401_date of sample collection for trip spikes; and ■ QC501_date of sample collection for rinsates.

6.4 Laboratory Methods

At the time of this SAQP, the primary and secondary laboratories had not yet been finalised. ERM notes that all samples will be submitted to nominated primary and secondary laboratory that have NATA certified methods for all required analysis and that LORs are appropriate for the adopted screening criteria. .

6.5 Anticipated Analytical Schedule

The below outlines the analytical requirements. It is noted that laboratory analysis may be modified where observed site-specific conditions indicate a variation in expected CoPC.

Sample media	Analytical Analysis
Soil Suite A	■ Asbestos, total recoverable hydrocarbons (TRH); benzene, toluene, ethylbenzene and xylenes (BTEX); semi-volatile organic compounds (SVOCs), Volatile Organic Compounds (VOCs), heavy metals, polycyclic aromatic hydrocarbons (PAHs), phenols, OCP / OPP, ASS
Soil Suite B	■ Per- and Polyfluoroalkyl Substances (PFAS), Chlorinated Hydrocarbons (CHCs), Tributyltin (TBT), ASS, TRH, BTEX, SVOCs, VOCs, Heavy Metals, Nutrients / Inorganics
Groundwater	■ Per- and Polyfluoroalkyl Substances (PFAS), Chlorinated Hydrocarbons (CHCs), Tributyltin (TBT),TRH, BTEX, SVOCs, VOCs, Heavy Metals, Nutrients / Inorganics
Sediment	■ Tri-butyl Tin (TBT), PFAS, TRH, BTEX, PAH, SVOCs, VOCs, heavy metals, triazine, atrazine and OCP/ OPP.

6.6 Laboratory QAQC

The laboratory quality assurance procedures to be adopted and the internal laboratory quality control samples to be analysed and the corresponding acceptable control limits are presented in the table below.

Item	Comments and Acceptable Control Limits
Sample Analysis	All sample analyses to be conducted using NATA certified laboratories which will implement a quality control plan in accordance with NEPC (2013).
Holding Times	All samples are to be submitted to the laboratory within the required laboratory holding times. Maximum acceptable sample holding times include: ■ Soil: 7 days for pH and some chlorinated hydrocarbon such as vinyl chloride, 14 days for organic analyses, 6 months for inorganic analyses and indefinite for asbestos. ■ Water: 6 hours for pH; 7 days for VOCs and SVOCs, 14 days for organic analyses and 6 months for inorganic analyses. ▪ ERM notes that due to the proximity of the Site to laboratories, pH will be based on field measurements collected during groundwater sampling.
Laboratory Detection Limits	■ All laboratory detection limits to be less than the adopted assessment criteria.
Laboratory Blanks	■ Laboratory blanks to be analysed at a rate of 1 in 20, with a minimum of one analysed per batch.
Laboratory Duplicates	■ Laboratory duplicates to be analysed at a rate of 1 in 20, with a minimum of one analysed per batch.
Laboratory Control Samples (LCS)	■ LCSs to be analysed at a rate of 1 in 20, with a minimum of one analysed per analytical batch.
Surrogates	■ Surrogate compound concentrations will be required to be spiked at similar concentration to sample results, at a rate of 1 in 20.
Matrix spikes	■ Matrix spikes matrix spike duplicate prepared by dividing a field sample into two aliquots, then spiking each with identical concentrations of the analytes at a rate of 1 in 20.

7. ASSESSMENT CRITERIA

Individual soil and groundwater data, along with the maximum, minimum, mean, standard deviation and 95% Upper Confidence Limit (UCL) of the mean concentration (if required) will be compared to the relevant assessment criteria.

The adopted assessment criteria have generally been sourced from guidelines made or approved by the NSW EPA which includes the National Environmental Protection Council (NEPC) (1999) National Environment Protection (Assessment of Site Contamination) as amended by Amendment Measure 2013 (No. 1) and where alternative sources have been utilised appropriate justification has been provided.

Media	Assessment Criteria
Soil	Human Health Soil contaminant concentrations will be compared against published values consistent with requirements in NEPM, 2013 sourced from the following: ■ **Health Investigation Levels** (HILs): ▪ HIL C (recreational) ▪ HIL D (commercial / industrial). ■ **Health Screening Levels (**HSLs) for vapour intrusion: ▪ HSL A (low density residential) ▪ HSL B (high density residential) ▪ HSL C (recreational) ▪ HSL D (commercial / industrial). ■ **Ecological Investigation Limits** ▪ Commercial and industrial land use (Ecological – Direct Contact) Coarse ▪ Urban residential and open space – coarse Management Limits ■ Management Limits for assessment of risks to human health in residential, parkland and public open space as well as commercial and industrial settings will be applied subsequent to the above screening criteria. Aesthetic ■ Consideration with also be given to the aesthetics of the soil encountered.
Groundwater	For the purpose of this assessment, groundwater concentrations of contaminants will be compared against published values consistent with requirements in NEPM, 2013 sourced from the following in the specified order of preference: ■ Health Screening Levels (HSLs) for vapour intrusion, asper the NEPM, 2013: o HSL A (low density residential) o HSL B (high density residential) o HSL C (recreational) o HSL D (commercial / industrial). ■ National Health and Medical Research Council (2011) Australian Drinking Water Guidelines (updated August 2018). While groundwater is considered unlikely to be used for drinking purposes in the vicinity of the site, screening against drinking water guideline values will be conducted on a conservative basis under the scenario that groundwater is extracted and used for other purposes. Screening against drinking water guideline values has also been conducted on a conservative basis under the scenario that groundwater has the potential to discharge to a surface water body which could be used for recreational purposes. ■ Australian and New Zealand Environment Conservation Council (ANZECC) & Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ), Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC & ARMCANZ, 2000). On the basis that the most likely nearest potential surface water receptor is a fresh water body, Trigger Values for fresh water and 99% (PFAS) and 95% protection levels (unless otherwise noted) have been adopted. Comparison against these criteria is considered conservative as some attenuation of chemical constituents would be expected prior to groundwater at the site reaching the nearest potential surface water receptors. Ecological ■ Australian and New Zealand Environment Conservation Council (ANZECC) & Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ), Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZAST, August 2018).

	■ On the basis that the most likely nearest potential surface water receptor (Botany Bay) is a marinewater body, trigger Values for marine water and 95% protection levels (unless otherwise noted) have been adopted.
Sediment	■ *Revision of the ANZECC/ARMCANZ Sediment Quality Guidelines,* CSIRO Land and Water Science Report 08/07 (Simpson, Batley & Chariton 2013).

7.1 PFAS Specific Assessment Criteria

The following sections describe the assessment criteria to be used based on the identified land use scenarios.

7.1.1 Soil Criteria

The adopted assessment screening criteria relevant to the different potential exposure scenarios are detailed in the following table.

Land use Scenario	Source and Rationale		
	PFOS and/or PFHxS	PFOA	Comment
Health Based Guidance Values			
Public open space	1 mg/kg	10 mg/kg	■ For site areas where recreational use may be undertaken the public open space guidance will be utilised. ■ Based on 20% of FSANZ TDI, i.e. up to 80% of exposure is assumed to come from other pathways. National Environment Protection (Assessment of Site Contamination) Measure Health Investigation Level C assumptions for public open space such as parks, playgrounds, playing fields (e.g. ovals), secondary schools (except where soil used for agriculture studies) and footpaths. ■ It does not include undeveloped public open space (such as urban bushland and reserves) which should be subject to a site-specific assessment where appropriate.
Residential with garden / accessible soil	0.009 mg/kg	0.1 mg/kg	■ As the site does not include plans for any residential development, ERM will not screen collected samples against residential screening criteria. . ■ However, where site land use / masterplans are provided that detail the potential for low density dwellings, ERM will adopt this screening criteria. ■ Based on 20% of FSANZ TDI, i.e. up to 80% of exposure is assumed to come from other pathways. ASC NEPM Level -A assumptions with home-grown produce providing up to 10% of fruit and vegetable intake (no poultry), also includes children's day care centres, pre-schools and primary schools. Does not include home-grown poultry/egg
Ecological Guideline Values			
Interim Soil – ecological direct exposure. Public open space	1 mg/kg	10 mg/kg	■ Soil results collected from the sites will be assessed against the public open space criteria presented in NEMP (2018). ■ The NEPM states that 'future work is recommended to review available soil – ecological direct exposure criteria proposed by Australian research and industry organisations. As an interim, it is proposed that the human health screening value for Public open space be used.'
Interim Soil – ecological indirect exposure	0.01 mg/kg	NA	■ Soil results collected from all sites will be assessed against the interim soil – ecological indirect exposure Residential presented in NEMP (2020)

Land use Scenario	Source and Rationale		
	PFOS and/or PFHxS	PFOA	Comment
			■ ERM notes that the indirect guidelines are likely to be overly conservative for the sites and will be considered in a site-specific context in subsequent project phases.

7.1.2 Sediment Criteria

There are no published health or ecological screening criteria for PFAS in sediment. The primary issues of concern associated with PFAS in sediment are as follows.

- Potential human health impacts due to direct contact exposure to sediment.
- The potential for sediment to act as a source of PFAS that may remobilise into the water column and/or aquatic food chains.
- The potential for sediment and / or sediment pore water concentrations to pose direct eco-toxicological effects.

In consideration of the primary risks / exposure scenarios, the following tier 1 screening criteria have been adopted.

- Health-based screening criteria for open space (NEMP 2020 have been adopted to assess potential health risks due to direct contact with sediment by human receptors.
  - ERM notes that while soil criteria are not derived with specific consideration of sediment exposure, the frequency and duration of exposure to sediments during recreational use of water bodies are much lower than those assumed for soil exposure in a residential setting. Use of residential soil criteria is therefore considered protective of potential risk due to sediment exposure.
- Interim Soil – ecological direct exposure for public open space (NEMP 2020) have been used to assess the sediments.
  - ERM notes that while the soil criteria have not been derived with specific consideration of sediment exposure the use of the guideline for screening purposes in conjunction with the surface water sampling is considered appropriate for the investigation
- Potential impacts on surface water and/or the aquatic food chain have been assessed by comparison of surface water concentrations to relevant screening levels.
- There is currently insufficient data regarding direct sediment toxicity to sediment dwelling organisms, thus no screening criteria are available for this pathway.
  - As an interim measure the NEMP recommends the human health value of 1 mg/kg be used to evaluate soil and this has been used to evaluate provide an indication the exposure of organisms to concentrations in sediment.

7.1.3 Groundwater

- While ERM notes that an initial assessment of potential beneficial re-uses of groundwater within the area **(Section 3.0)** indicates that the beneficial use of groundwater within the vicinity of the site is unlikely, as a conservative measure, to assess the risk to human health, drinking water guidelines will be used as the primary screening criteria for this assessment. Details on screening criteria for groundwater will be adopted as per the below table.

Land use Scenario	Rationale and adopted Groundwater Criteria		
	PFOS / PFHxS	**PFOA**	
Inerim Marine Water and Ecological – Fresh Water	0.00023 µg/L (99% protection); 0.13 µg/L (95% protection); (PFOS only)	19 µg/L (99% protection); 220 µg/L (95% protection;	■ Groundwater and Surface water screening criteria are sourced from Table 1 Draft Commonwealth Environmental Management Guidance (2016) which summarises the draft (as yet unpublished) guideline values developed for inclusion in the future revision of the ANZECC&ARMCANZ (2000) document "*Australian and New Zealand Guidelines for Fresh and Marine Water Quality*". ■ These guidelines are derived for a range of species protection levels, depending on the nature of the aquatic ecosystem, with 99% species protection values applicable to high conservation value / largely unmodified systems, 95% protection values applicable to slightly to moderately disturbed systems, and lower protection levels (90% and/or 80%) applicable to highly disturbed systems. ■ In addition, ANZECC&ARMCANZ (2000) recommend that for bio accumulative compounds, the 99% level be used for slightly to moderately disturbed ecosystems, unless site-specific assessment of risks due to bioaccumulation through the food chain is undertaken.
Human Health – Drinking Water	0.07 µg/L (PFOS + PFHxS)	0.56 µg/L	■ Values adopted from FSANZ (2017) Health Based Guidance Values for PFAS: For use in site investigations in Australia. Also referenced in the NEPM (2018) ■ Recreational criteria has been sourced from the NHMRC 2019 guidance utilising refined estimates of water ingestion while swimming etc. ■ ERM notes that the degree of conservatism in the drinking water and recreational water guidance values (90% attributed to other exposure pathways) means that exceeding these values does not constitute a risk if other pathways are controlled.
Human health – Recreation	2 µg/L (PFOS + PFHxS)	10 µg/L	

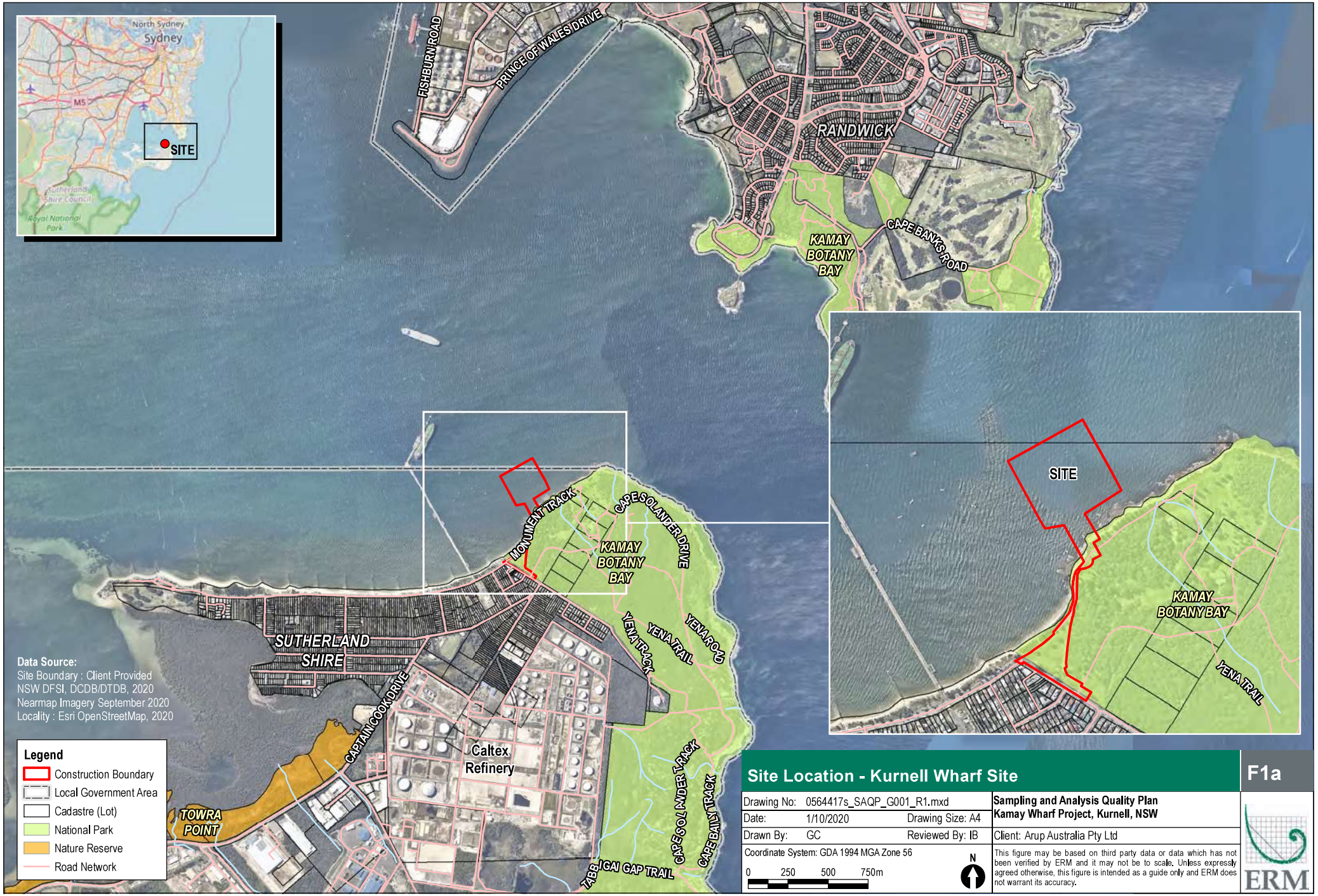
ERM notes that at the time of this SAQP the specific laboratory to be utilised for sample analysis had not been finalised. Due to the low concentrations associated with the NEMP freshwater screening criteria, where the LOR exceeds the adopted criteria for HEPA NEPM (2018) Ecological – Fresh Water 99% criteria, the LOR will be used as an interim screening level.

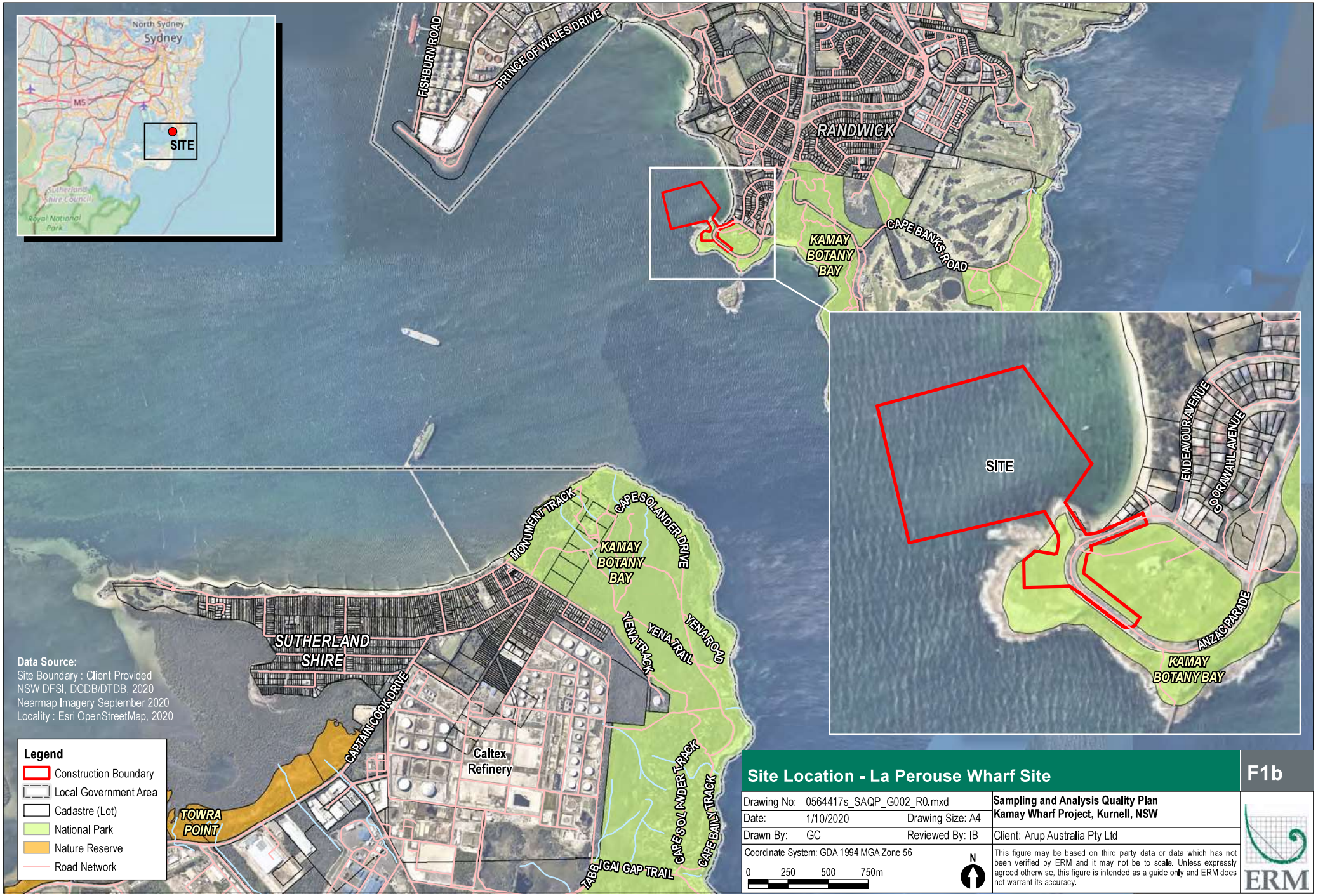
8. REPORTING

On completion of investigative works, ERM will summarise the findings of the investigation in a report consistent with NSW EPA made or approved guideline reporting requirements. The following will be included as a minimum:

- Executive summary.
- Scope of works.
- Site identification information.
- A summary of the site history site conditions and the surrounding environment.
- A summary of geology and hydrogeology.
- A discussion of the nature and extent of identified contamination surrounding the Site.
- Sampling and Analysis Plan and Sampling Methodology.
- Field and laboratory QA / QC information and an evaluation of the appropriateness and usability of the data obtained.
- Field and laboratory results compared to the assessment criteria.
- A refined Conceptual Site Model including an updated source – pathway – receptor linkage assessment based on information collected during investigation works.
- Conclusions and Recommendations.
- Appendices including results tables, figures, survey figures, borehole logs, site photographs, calibration records and laboratory certificates.

APPENDIX A FIGURES


North Sydney
Sydney
M5
SITE
Sutherland Shire Council
Royal National Park
FISHBURN ROAD
PRINCE OF WALES DRIVE
RANDWICK
KAMAY BOTANY BAY
CAPE BANKS ROAD
SITE
KAMAY BOTANY BAY
YENA TRAIL
MONUMENT TRACK
CAPE SOLANDER DRIVE
KAMAY BOTANY BAY
YENA TRACK
YENA TRAIL
YENA ROAD
SUTHERLAND SHIRE
CAPTAIN COOK DRIVE
Caltex Refinery
TOWRA POINT
CAPE SOLANDER TRACK
CAPE BAILY TRACK
TABBIGAI GAP TRAIL
Data Source:
Site Boundary : Client Provided
NSW DFSI, DCDB/DTDB, 2020
Nearmap Imagery September 2020
Locality : Esri OpenStreetMap, 2020
Legend
Construction Boundary
Local Government Area
Cadastre (Lot)
National Park
Nature Reserve
Road Network
Site Location - Kurnell Wharf Site
F1a
Drawing No: 0564417s_SAQP_G001_R1.mxd
Date: 1/10/2020
Drawing Size: A4
Drawn By: GC
Reviewed By: IB
Coordinate System: GDA 1994 MGA Zone 56
0 250 500 750m
N
Sampling and Analysis Quality Plan
Kamay Wharf Project, Kurnell, NSW
Client: Arup Australia Pty Ltd
This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.
ERM



Site Location - La Perouse Wharf Site

F1b

Drawing No:	0564417s_SAQP_G002_R0.mxd		
Date:	1/10/2020	Drawing Size: A4	
Drawn By:	GC	Reviewed By: IB	

Coordinate System: GDA 1994 MGA Zone 56

0 250 500 750m

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Sampling and Analysis Quality Plan
Kamay Wharf Project, Kurnell, NSW

Client: Arup Australia Pty Ltd

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ERM


KAMAY
BOTANY BAY
Legend
Construction Boundary
National Park
Ferry Design (Concept)
1/10/2020
Data Source:
Site Layout : Client Provided
NSW DFSI, DCDB/DTDB, 2020
Nearmap Imagery September 2020
Site Layout - Kurnell Wharf Site
F2a
Drawing No: 0564417s_SAQP_G003_R1.mxd
Date: 1/10/2020
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Drawn By: GC
Reviewed By: IB
Coordinate System: GDA 1994 MGA Zone 56
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Sampling and Analysis Quality Plan
Kamay Wharf Project, Kurnell, NSW
Client: Arup Australia Pty Ltd
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ERM


KAMAY
BOTANY BAY
Legend
Construction Boundary
Cadastre (Lot)
National Park
Ferry Design (Concept)
Data Source:
Site Layout : Client Provided
NSW DFSI, DCDB/DTDB, 2020
Nearmap Imagery September 2020
Site Layout - La Perouse Wharf Site
F2b
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Reviewed By: IB
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Sampling and Analysis Quality Plan
Kamay Wharf Project, Kurnell, NSW
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ERM


KU-BH02
KU-BH03
KU-BH01
KU-TP21
KU-TP20
KAMAY
BOTANY BAY
KU-TP14
KU-TP10
KU-TP06
KU-TP05
KU-TP04
KU-TP03
KU-TP02
Legend
Construction Boundary
National Park
Ferry Design (Concept)
Soil Bore
Test Pit
Data Source:
Site Layout : Client Provided
NSW DFSI, DCDB/DTDB, 2020
Nearmap Imagery September 2020
Sampling Locations - Kurnell Wharf Site
F3a
Drawing No: 0564417s_SAQP_G005_R1.mxd
Date: 1/10/2020
Drawing Size: A3
Drawn By: GC
Reviewed By: IB
Coordinate System: GDA 1994 MGA Zone 56
0 25 50 75m
N
Sampling and Analysis Quality Plan
Kamay Wharf Project, Kurnell, NSW
Client: Arup Australia Pty Ltd
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LP-BH02
LP-BH03
LP-BH01
LP-TP07
LP-TP06
LP-TP05
LP-TP10
LP-TP04
LP-TP03
LP-TP02
LP-TP01
KAMAY
BOTANY BAY
Legend
Construction Boundary
Cadastre (Lot)
National Park
Ferry Design (Concept)
Soil Bore
Test Pit
Data Source:
Site Layout : Client Provided
NSW DFSI, DCDB/DTDB, 2020
Nearmap Imagery September 2020
Sampling Locations - La Perouse Wharf Site
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Sampling and Analysis Quality Plan
Kamay Wharf Project, Kurnell, NSW
Client: Arup Australia Pty Ltd
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APPENDIX B ARUP GEOTECHNICAL INVESTIGATION METHODOLOGY

ERM has over 160 offices across the following countries and territories worldwide

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Ireland
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Kenya
Malaysia
Mexico
Mozambique
Myanmar
The Netherlands
New Zealand
Norway
Panama
Peru
Poland
Portugal
Puerto Rico
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