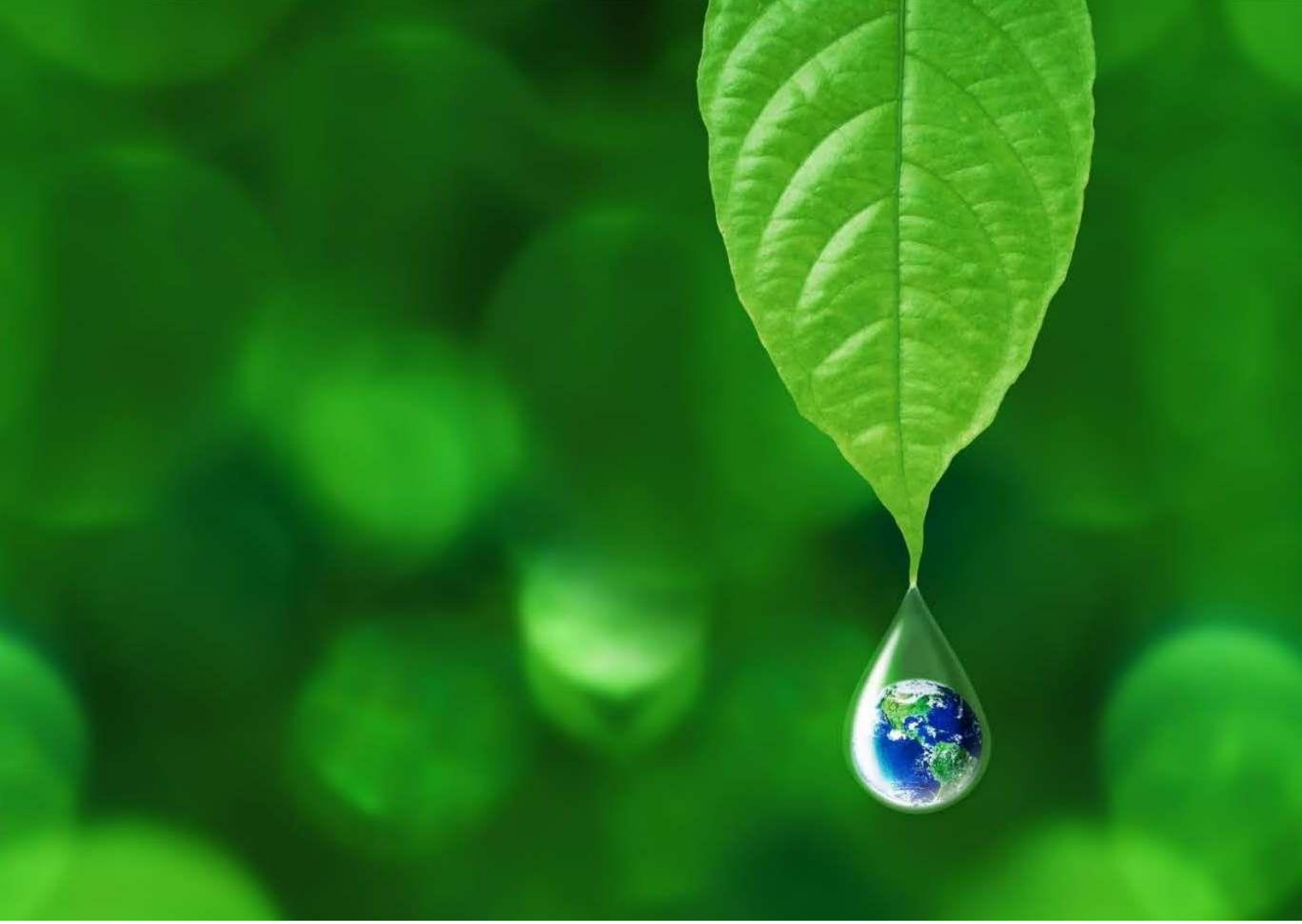

JOHN HOLLAND

Remediation Action Plan – Pipelines

Upper South Creek Advanced Water Recycling Centre

6 March 2024

Project No.: 0677828

The business of sustainability

ERM

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6 March 2024

Remediation Action Plan – Pipelines

Upper South Creek Advanced Water Recycling Centre

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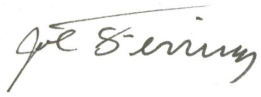

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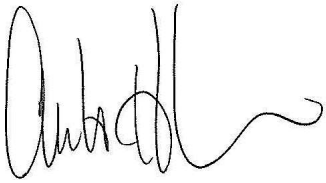

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CONTENTS

List of Tables

Acronyms and Abbreviations

Acronym	Definition
AAJV	AECOM Aurecon Joint Venture
ACM	Asbestos Containing Materials
AEC	Area of Environmental Concern
AF / FA	Asbestos Fines / Fibrous Asbestos
AHD	Australian Height Datum
AMG	Australian Map Grid
AMP	Asbestos Management Plan
AS	Australian Standard
ASS	Acid Sulfate Soils
BTEX	Benzene, Toluene, Ethylbenzene and Xylene
CEMP	Construction Environmental Management Plan
CLM Act	Contaminated Land Management Act
COC	Chain of Custody
CoPC	Contaminant of Potential Concern
CSM	Conceptual Site Model
DP	Deposited Plan
DQI	Data Quality Indicator
DQO	Data Quality Objectives
DSI	Detailed Site Investigation
EIL	Ecological Investigation Level
EIS	Environmental Impact Statement
ENM	Excavated Natural Material
EPA	Environment Protection Authority (NSW)
EPRM	Excavated Public Road Material
ERM	Environmental Resources Management Australia Pty Ltd
ESL	Ecological Screening Level

Acronym	Definition
GPS	Global Positioning System
ha	Hectare
HASP	Health and Safety Plan
HDD	Horizontal Directional Drilling
HDPE	High-Density Polyethylene
HIL	Health Investigation Level
HSL	Health Screening Level
IAA	Interim Audit Advice
LOR	Limit of Reporting
m	Metre
m AHD	Metres relative to Australian Height Datum
m bgl	Metres Below Ground Level
M BTOC	Metres Below Top of Case
MGA	Map Grid of Australia
NATA	National Association of Testing Authorities
NEPC	National Environment Protection Council
NEPM	National Environment Protection Measure
NOHSC	National Occupational Health and Safety Commission
NSW	New South Wales
OC	Organochlorine (pesticide)
OP	Organophosphorus (pesticide)
PAH	Polycyclic Aromatic Hydrocarbons
PASS	Potential Acid Sulfate Soils
PCBs	Polychlorinated Biphenyls
PFAS	Per- and Poly-Fluoroalkyl Substances
PID	Photoionsiation Detector
POEO Act	Protection of the Environment Operations Act 1997 (NSW)
PPE	Personal Protective Equipment
QA / QC	Quality Assurance / Quality Control
RAP	Remediation Action Plan
RMS	Roads and Maritime Services (NSW)
ROA	Remedial Options Assessment
SAQP	Sampling and Analysis Quality Plan
SCLI	Soil and Contaminated Land Impact
SVR	Site Validation Report
SWMS	Safe Work Method Statement
TCLP	Toxicity Characteristic Leaching Procedure
TP	Test Pit
TRH	Total Recoverable Hydrocarbons
UCL	Upper Confidence Limit
USC AWRC	Upper South Creek Advanced Water Recycling Centre
VENM	Virgin Excavated Natural Material
VSAQP	Validation Sampling and Analysis Quality Plan

EXECUTIVE SUMMARY

Environmental Resources Management Australia Pty Ltd (ERM) was engaged by John Holland Group (John Holland) to prepare a Remedial Action Plan (RAP) for the construction alignment where treated water and brine pipelines will be constructed as part of the development of the future Upper South Creek Advanced Water Recycling Centre (USC AWRC). The land within the pipelines construction alignment is referred to herein as 'the Pipelines Alignment' and the USC AWRC and associated Pipelines Alignment are collectively referred to as 'the Project'. The USC AWRC is located in Kemps Creek, New South Wales (NSW) and the Pipelines Alignment comprises the following key areas and features:

- A treated water pipeline: approximately 17 kilometres (km) in length, from the USC AWRC to the Nepean River at Wallacia Weir, for the release of treated water; and
- A brine pipeline: approximately 24 km in length, which will transfer brine from the USC AWRC to Lansdowne, NSW, where it connects to Sydney Water's existing Malabar wastewater network.

John Holland has been engaged as the principal contractor to deliver the construction of the Project.

Due to the identified potential for contamination within the Pipelines Alignment, the project Conditions of Approval (Conditions E77, E78 and E80) required Areas of Environmental Concern (AECs) identified as moderate and high risk to be investigated to assess the suitability of the Pipelines Alignment for the planned future commercial / industrial land use.

A Sampling and Analysis Quality Plan (SAQP) was developed by ERM to investigate these AECs and was documented in *Sampling and Analysis Quality Plan, Upper South Creek Advanced Water Recycling Centre Pipeline Alignment* (ERM, 2023 – 'the Pipelines AECs SAQP'), which was approved by the Site Auditor. This RAP has been developed prior to the completion of investigation works under the Pipelines AECs SAQP due to the logistical requirements of the Project. Any remediation works resulting from the investigation undertaken as part of the Pipelines AECs SAQP will be undertaken in accordance with this RAP.

This RAP also includes detailed procedures for classifying materials to be excavated for construction within the Pipelines Alignment, regardless of whether these materials were generated as a result of remediation work or through construction work related to pipeline construction. These procedures include:

- a soil investigation scope which is intended to allow for classification of the excavated materials in situ; and
- procedures for classification of materials ex situ from stockpiles following excavation.

The objectives of this RAP are to:

- In the event that contamination requiring remediation is identified: detail the required remediation processes and procedures to be implemented within the Pipelines Alignment to enable the Pipelines Alignment to be made suitable for the proposed commercial / industrial USC AWRC development; and
- Regardless of whether contamination which requires remediation is identified: detail the procedures for classifying materials to be excavated within the Pipelines Alignment.

To achieve the specific objectives of this RAP, ERM completed the following scope of work:

- Reviewed previous investigations undertaken within the Pipelines Alignment, which detailed site-specific environmental conditions and the nature and extent of contamination within the Pipelines Alignment;
- Defined the procedures for classifying materials to be excavated within the Pipelines Alignment, including a scope of additional investigative works required to enable in situ classification of materials to be excavated as well as procedures for ex situ classification of excavated materials;

- Defined remediation goals based on the Conceptual Site Model (CSM) and proposed future land use scenarios;
- Undertook an assessment of potential remediation options against the criteria of effectiveness, timeframes, health and safety, sustainability and cost and in consideration of relevant regulatory guidance relating to remedial hierarchy;
- Outlined the preferred remediation strategy based upon information presented within the assessment of options; and
- Prepared this RAP, which outlines the specific requirements of the recommended remediation approach.

Based on a review of information presented within previous investigations, consideration of the benefits and disadvantages of the available options, and consideration of the fact that the Pipelines Alignment will undergo extensive excavation due to the nature of the construction program, excavation of impacted soils and off-site disposal or encapsulation has been selected as the preferred remediation option.

It is also noted that a separate RAP was developed by ERM in August 2023 to guide the remediation of asbestos-contaminated soil at the USC AWRC site in Kemps Creek and reported as *Remediation Action Plan, Upper South Creek Advanced Water Recycling Centre* (ERM, 2023b).

1. INTRODUCTION

Environmental Resources Management Australia Pty Ltd (ERM) was engaged by John Holland Group (John Holland) to prepare a Remedial Action Plan (RAP) for the construction alignment where treated water and brine pipelines will be constructed as part of the development of the future Upper South Creek Advanced Water Recycling Centre (USC AWRC). The land within the pipelines construction alignment is referred to herein as 'the Pipelines Alignment' and the USC AWRC and associated Pipelines Alignment are collectively referred to as 'the Project'. The USC AWRC is located in Kemps Creek, New South Wales (NSW) and the Pipelines Alignment comprises the following key areas and features:

- A treated water pipeline: approximately 17 kilometres (km) in length, from the USC AWRC to the Nepean River at Wallacia Weir, for the release of treated water; and
- A brine pipeline: approximately 24 km in length, which will transfer brine from the USC AWRC to Lansdowne, NSW, where it connects to Sydney Water's existing Malabar wastewater network.

The Pipelines Alignment location is presented in **Appendix A – Figure 1** and the proposed construction footprint is presented in **Appendix A – Figure 2**.

1.1 Background

Sydney Water is constructing a new water recycling plant known as the USC AWRC in Kemps Creek, NSW. The USC AWRC is being built to service the South West and Western Aerotropolis Growth Areas of Sydney. John Holland has been engaged as the principal contractor to deliver the construction of the USC AWRC.

Previous investigations (summarised in **Section 4**) undertaken during preparation of the Environmental Impact Statement (EIS) identified several Areas of Environmental Concern (AEC) associated with historical land use practices undertaken within and surrounding the Pipelines Alignment.

Due to the identified potential contamination associated with the Pipelines Alignment, the project Conditions of Approval (Conditions E77, E78 and E80) required AECs identified as moderate and high risk to be investigated to assess the suitability of the Pipelines Alignment for the planned future commercial / industrial land use.

As required under the project Conditions of Approval (Conditions E74, E75, E76, E81 and E84), a NSW EPA accredited Site Auditor (Mr. Andrew Lau) (the Site Auditor) has been engaged by Sydney Water to review contamination assessment, remediation and site management works completed within the Project (inclusive of the Pipelines Alignment as well as the USC AWRC). This RAP has been provided to the Site Auditor in accordance with Condition E75 and corresponding Interim Audit Advice (IAA) will be provided to the NSW Department of Planning and Environment.

A Sampling and Analysis Quality Plan was developed by ERM to investigate these AECs and was documented in *Sampling and Analysis Quality Plan, Upper South Creek Advanced Water Recycling Centre Pipeline Alignment* (ERM, 2023a – 'the Pipelines AECs SAQP'), which was approved by the Site Auditor. This RAP has been developed prior to the completion of investigation works under the Pipelines AECs SAQP due to the logistical requirements of the Project. Any remediation works resulting from the investigation undertaken as part of the Pipelines AECs SAQP will be undertaken in accordance with this RAP.

This RAP also includes detailed procedures for classifying materials to be excavated for construction within the Pipelines Alignment, regardless of whether these materials were generated as a result of remediation work or through construction work related to pipeline construction. These procedures include:

- a soil investigation scope which is intended to allow for in situ classification of the materials to be excavated; and

- procedures for classification of materials ex situ from stockpiles following excavation.

1.2 Objectives

The objectives of this RAP are to:

- In the event that contamination requiring remediation is identified: detail the required remediation processes and procedures to be implemented within the Pipelines Alignment to enable the Pipelines Alignment to be made suitable for the proposed commercial / industrial USC AWRC development; and
- Regardless of whether contamination which requires remediation is identified: detail the procedures for classifying materials to be excavated within the Pipelines Alignment.

1.3 Scope of Work

To achieve the specific objectives of the RAP, ERM completed the following scope of work:

- Reviewed previous investigations undertaken within the Pipelines Alignment, which detailed site-specific environmental conditions and the nature and extent of contamination within the Pipelines Alignment;
- Defined the procedures for classifying materials to be excavated within the Pipelines Alignment, including a scope of additional investigative works required to enable in situ classification of materials to be excavated as well as procedures for ex situ classification of excavated materials;
- Defined remediation goals based on the conceptual site model (CSM) and proposed future land use scenarios;
- Undertook an assessment of potential remediation options against the criteria of effectiveness, timeframes, health and safety, sustainability and cost and in consideration of relevant regulatory guidance relating to remedial hierarchy;
- Outlined the preferred remediation strategy based upon information presented within the assessment of options; and
- Prepared this RAP, which outlines the specific requirements of the recommended remediation approach.

1.4 Interface with the USC AWRC Remediation Action Plan

A RAP was developed by ERM in August 2023 to guide the remediation of asbestos-contaminated soil at the USC AWRC site in Kemps Creek and reported as *Remediation Action Plan, Upper South Creek Advanced Water Recycling Centre* (ERM, 2023b). This USC AWRC RAP included procedures for placement of asbestos-contaminated soils within a purpose-designed encapsulation area located in the northern portion of the USC AWRC site. If remediation of asbestos-contaminated soils from the Pipelines Alignment is required, it is expected that these soils will also be placed within the USC AWRC site's encapsulation area if considered suitable by John Holland, Sydney Water, the Site Auditor and the Environmental Consultant. This process is further described in **Section 9** herein.

2. KEY PROJECT STAKEHOLDERS

The key stakeholders involved with the remediation project are as follows:

Table 2-1 Key Project Stakeholders

Role	Organisation	Contact Name	Contact Phone Number
Client	John Holland	■ Alyce Harrington	■ +61 409 633 908
Site Auditor	Andrew Lau (JBS&G)	■ Andrew Lau	■ +61 412 512 614
A**sset** Owner	Sydney Water	■ Cheryl Cahill ■ Emma Bradbeer	■ +61 456 666 573 ■ +61 428 516 258
Principal Contractor and Remediation Contractor	John Holland	■ Aidan O'Driscoll	■ +61 414 945 464
Environmental Consultant	ERM	■ Ian Batterley ■ Joe Ferring	■ +61 466 649 294 ■ +61 424 970 468

3. SITE SETTING

The information provided in the following sections is a summary of the site background and history information obtained from previous investigations undertaken. Several of the below details have been summarised from the findings of the Soil and Contaminated Land Impact (SCLI) Assessment (Aurecon Arup, 2021)[1].

3.1 Site Identification

The identification information for the Pipelines Alignment is presented within **Table 3-1** below.

Table 3-1 Site Identification

Item	Description
Site Address	■ Traversing Western Sydney, NSW – Nepean River in the west to Cabramatta in the east
Site Boundary	■ Illustrated on **Appendix A, Figure 1** and **Figure 2**
Site Ownership	■ Multiple landowners throughout, with Sydney Water holding easements for the pipelines throughout the Project.
Councils	■ Wollondilly Shire Council ■ Penrith City Council ■ Liverpool City Council ■ Fairfield City Council ■ Canterbury-Bankstown Council
Site Area	■ Approximately 1,684,306 m^2 (Impact Assessment Area surrounding the USC Pipeline)
Pipeline Extent	■ 17 kilometres (km) of treated water pipeline from USC AWRC (to the west) to the Nepean River at Wallacia Weir; and ■ 24 km of brine pipeline from USC AWRC (to the east) to South Creek.
Current Zoning	The Pipelines Alignment is currently comprised of the following zoning, which will remain unchanged following the construction of the pipelines: ■ AGB – Agribusiness ■ C2 – Environmental Conservation ■ ENT – Enterprise ■ ENZ – Environment and Recreation ■ R1 – General Residential ■ R2 – Low Density Residential ■ R3 – Medium Density Residential ■ R4 – High Density Residential ■ RE1 – Public Recreation ■ RU1 – Primary Production ■ RU2 – Rural Landscape ■ RU4 – Primary Production Small Lots ■ RU5 - Village ■ RE1 – Public Recreation ■ SP2 – Infrastructure
Site Location and Site Layout	Illustrated on **Appendix A, Figure 1** and **Figure 2**

[1] Aurecon Arup (2021). *Upper South Creek Advanced Water Recycling Centre, Soils and Contaminated Land Impact Assessment*. File reference: 20036007. Final. Dated 27 July 2021.

3.2 Surrounding Land Use

The land uses surrounding / within the Pipelines Alignment include:

- **Treated water pipelines:** Primarily rural lots with some agricultural, residential, commercial areas, primary production sheds, storage of excess resource recovery materials, a petrol station and SUEZ Kemps Creek Resource Recovery Park; and
- **Brine pipeline:** Residential, rural living, industrial buildings, commercial areas, Brandown quarries / landfill and petrol stations.

3.3 Environmental Setting

Site environmental setting information is provided within **Table 3-2** below.

Table 3-2 Site Environmental Summary

Item	Description
Topography and Site Elevation	■ The treated water pipeline follows gently sloping topographies, with elevations generally ranging from 30 metres (m) to 90 m above Australian Height Datum (m AHD), from the low-lying areas around the South Creek / Kemps Creek area (35 – 40 m AHD) through to the Nepean River valley (35 m AHD), traversing a small ridge in the vicinity of The Northern Road, Luddenham (90 m AHD). ■ The brine pipeline alignment, heading east from the AWRC Site at 40 m AHD elevation, follows gently sloping topographies, rising to a high point at Cecil Hills (80 m AHD) before sloping down again towards Prospect Creek in Fairfield at 10 m AHD.
Hydrology	■ The treated water pipelines and the western portion of the brine pipeline are located within the Hawkesbury-Nepean catchment. The eastern portion of the brine pipelines is within the highly urbanised Georges River catchment. ■ Several rivers and streams intersect the proposed pipeline alignments: from west to east the pipelines are intersected by the Nepean River, Jerrys Creek, Mulgoa Creek, Cosgroves Creek, Oaky Creek, Badgerys Creek, South Creek, Kemps Creek, Hinchinbrook Creek, Clear Paddock Creek, Green Valley Creek and Prospect Creek. ■ During periods of rainfall, it is anticipated that surface waters would largely infiltrate the ground surface (within unsealed areas) or flow towards constructed stormwater infrastructure (within sealed portions of the Pipelines Alignment and surrounding areas). ■ The Hawkesbury River is the ultimate downstream receiving environment and is located approximately 29 km from the closest point of the Project.
Geology	The NSW Seamless Geology dataset (Department of Regional NSW, 2020) indicated the Pipelines Alignment is underlain by the below stratigraphic units: ■ Anthropogenic Fill – Highly variable fill materials (includes topsoil, embankments, road pavements, landscaped areas etc.) ■ Alluvial Sediments / Deposits – Loose, unconsolidated fine to medium grained sand, silt and clay. ■ Bringelly Shale – Variable sedimentary rock types. Black and grey shales and sandstones with small scale bedding. ■ Minchinbury Sandstone – Fine to medium grained quartz sandstone with calcite and volcanic lenses. ■ Ashfield Shale – Black mudstones and grey shales with small scale bedding. ■ Hawkesbury Sandstone – Medium to coarse-grained quartz sandstone with minor shale and laminite lenses. Sandstones are either massive or cross-bedded sheet facies with vertical or sub-vertical joint sets. The combination of bedding planes and widely spaced joints gives sandstone outcrops a distinctive blocky appearance.
Soils	Soil landscapes throughout the Pipelines Alignment include the following: ■ Berkshire Park – Alluvial landscape. ■ Blacktown – Residual landscape. ■ Disturbed Terrain – Disturbed landscape. ■ Falconbridge – Residual landscape. ■ Gymea – Erosional landscape.

Item	Description
	■ Hawkesbury – Colluvial landscape. ■ Hazelwood – Colluvial landscape. ■ Luddenham – Erosional landscape. ■ Picton – Colluvial landscape. ■ Richmond – Alluvial landscape. ■ South Creek – Alluvial landscape
Acid Sulfate Soils	The majority of the Pipelines Alignment is not located within an area of known potential Acid Sulfate Soils (ASS) occurrence. Some potential ASS risk areas are present around Prospect Creek in the eastern portion of the Pipelines Alignment, including: ■ A high potential for occurrence of ASS along the brine pipeline for bottom sediments and surrounding embankments where the Hume Highway intersects Prospect Creek. ■ A high potential for occurrence of ASS for bottom sediments in the George Rivers near Moorebank, and a low probability for occurrence of ASS along the sides of the Georges River. ■ Areas surrounding the Georges River in Chipping Norton and Millperra, where a mixture of ASS probability zones are present, including disturbed terrain, high probability ASS, high probability bottom sediments, and low probability for ASS. ■ The risk of disturbing ASS is highest within the eastern portion of the brine pipeline. The main disturbance mechanisms will be ground disturbance by excavation, Horizontal Directional Drilling (HDD) and localised dewatering / ground water management for the pipelines, if required. ASS were assessed during the SCLI Assessment (Aurecon Arup, 2021). The assessment found that for the treated water pipeline, ASS was considered unlikely to be encountered during construction based on the results of previous investigations (laboratory testing and lithology). For the brine pipeline, the only area where ASS were considered to potentially be encountered was around Prospect Creek. Two boreholes (BDNO5_BH23 and BDNO5_BH24) drilled on either side of Prospect Creek did not indicate ASS presence based on laboratory results. Therefore, no ASS management plans were considered to be required for construction.
Hydrogeology	Information from NSW DPIE Soil and Land Information (eSPADE) online mapping indicated the soils within the Pipelines Alignment as having the below infiltration rates: ■ The western extent of the treated water pipeline, along the vegetated slopes of the Warragamba River, and a nearby tributary – soils with high infiltration rates, even when thoroughly wetted and consisting chiefly of deep, well to excessively drained sands or gravels. These soils have a high rate of water transmission. ■ A small section in the western extent of the treated water pipeline along the Nepean River – soils having moderate infiltration rates when thoroughly wetted and consisting chiefly of moderately deep to deep, moderately fine to moderately coarse textures. These soils have a moderate rate of water transmission. ■ Across the majority of the Pipelines Alignment in locations with higher elevation, typically areas further that are 500m from a waterway – soils having slow infiltration rates when thoroughly wetted and consisting chiefly of soils with a layer that impedes downward movement of water, or soils with moderately fine to fine texture. These soils have a slow rate of water transmission. ■ Across the Pipelines Alignment within and adjacent to waterways – soils having very slow infiltration rates when thoroughly wetted and consisting chiefly of clay soils with a high swelling potential, soils with a permanent high water table, soils with a claypan or clay layer at or near the surface, and shallow soils over nearly impervious material. These soils have a very slow rate of water transmission. ■ Groundwater standing water levels were noted within the brine pipeline at generally 1.2 meters below ground level (m bgl) to 2.0 m bgl. This information was obtained from the groundwater monitoring wells located within the closest petrol stations surrounding the Pipelines Alignment.

3.4 Council and Regulatory Records

A summary of council and regulatory records is provided within **Table 3-3** below.

Table 3-3 Council and Regulatory Records

Item	Description
Contaminated Sites	A review of contaminated sites notified to the NSW EPA under Section 60 of the Contaminated Land Management Act 1997 (CLM Act) within 200m from the Pipeline Alignment was undertaken within the SCLI Assessment (Aurecon Arup, 2021), and identified the following: ■ 11 service station sites notified to the NSW EPA were identified within a distance of 200m from the Pipeline alignment; ■ Most notified sites were listed as not requiring regulation under the CLM Act. However, the Caltex service station on 141 Hume Highway was formerly regulated for contamination under the CLM Act; ■ The risks of the EPA notified sites impacting the pipeline alignments were considered to be low due to management class and/or distance (Aurecon Arup, 2021). Metro Service Station Bonnyrigg was considered to be moderate risk due to known contamination and distance from the pipeline. The areas of concern identified by the SCLI Assessment are manged under separate investigative works to this RAP.
NSW Government PFAS Program	Two sites listed under the NSW EPA PFAS National Environmental Management Plan were identified within a 5km radius of the pipeline alignment: ■ Kemps Creek NSW rural fire service at 245 Devonshire Road, Kemps Creek: the site is located 3.1km from the brine pipeline and 4.5km from the treated water pipeline, and is being investigated for historical use of fire-fighting foams. ■ Bankstown Airport at 3 Avro St, Bankstown: the site is located 2.6km from the brine pipeline. The overall PFAS groundwater contamination risk was considered to be low by the SCLI Assessment (Aurecon Arup, 2021) based on the distance to the pipeline alignments and due to shallow depths of proposed construction works.
National Waste Management Sites	Three sites on the National Waste Management Sites Database were identified within 500m of the Pipelines Alignment: ■ Elizabeth Drive Landfill, Sita Australia Pty Ltd located 450 m southwest of the AWRC. ■ Kemps Creek Landfill, NSW Investments Pty Ltd located 200m east of the brine pipeline. ■ Brandown Landfill, Brandown Pty Ltd located adjacent the brine pipeline.
Licensed Activities Under the POEO Act 1997	Four licensed activities under the Protection of the Environment Operations Act 1997 (POEO Act 1997) were identified within 1km of the Pipelines Alignment: ■ Luddenham broiler farm located adjacent the treated water pipeline. ■ Brandown recycling yard located adjacent the brine pipeline. ■ Hi Quality Kemps Creek quarry located 540m north of the treated water pipeline. ■ SUEZ advanced waste treatment facility located 500m south west of the AWRC site. The SCLI Assessment (Aurecon Arup, 2021) stated that the risk of the licenced activities impacting the project was generally considered to be low due to the distance to the Pipelines Alignment and/or activity. Brandown Pty Ltd was considered moderate risk due to licensed waste activities and distance from the project and is managed under separate investigative works to this RAP.

3.5 Site History Summary

The SCLI Assessment (Aurecon Arup, 2021) included a review of historical aerial photographs and the review which indicated that the Pipelines Alignment has largely remained as agricultural and rural/residential land use since the 1940s, particularly in the western extent between Wallacia and Cecil Hills. Rural residential building density was noted to have increased within suburban pockets, particularly in the eastern extent of the alignment. Industrial activities were noted to be located at numerous locations along the alignment zoned for this land use.

The key items noted were:

- Historical and existing landfill activities at the SUEZ Resource Recovery Park;
- Historical and existing quarrying at the Hi Quality Group Quarry;
- Stockpiles on an adjacent lot originating from the quarry; and
- Historical and existing quarrying and landfilling activities at the Brandon Quarries / Landfill.

4. PREVIOUS INVESTIGATIONS AND OTHER RELEVANT REPORTS

In developing this RAP, ERM undertook a review of the following previous investigations relevant to the Pipelines Alignment:

- Aurecon ARUP (2021), *Upper South Creek Advanced Water Recycling Centre – Soils and Contaminated Land Impact Assessment*, 27 July 2021 ("the SCLI Assessment"); and
- JBS&G (2023), *L05 Interim Audit Advice (0503-2307-05) – Sydney Water Corporation – Upper South Creek Advanced Water Recycling Centre – Review of the Upper South Creek Advanced Water Recycling Centre - Soils and Contaminated Land Impact Assessment – Pipelines,* ("IAA05").

The following additional reports have recently been prepared for the Pipelines Alignment and the USC AWRC site and are relevant to the scope of this RAP:

- ERM (2023a), *Sampling and Analysis Quality Plan, Upper South Creek Advanced Water Recycling Centre Pipeline Alignment*; and
- ERM (2023b), *Remediation Action Plan, Upper South Creek Advanced Water Recycling Centre*.

Several other investigations have previously been undertaken within the Pipelines Alignment or in close proximity to the Pipelines Alignment which were not available for ERM's review at the time of preparation of this RAP. These relevant additional investigation documents are:

- Roads and Maritime Services (RMS) (2018), *MR535 Elizabeth Drive Upgrade – The Northern Rd to M7, Strategic Geotechnical Factual Report*;
- RMS (2019), *M12 Motorway Environmental Impact Assessment – Appendix O Soils and contamination assessment report*;
- AECOM Aurecon Joint Venture (AAJV) (2019), *WSAGA Reticulation Amplifications Options Assessment and Detailed Design, Preliminary Site Investigation (Contamination)*;
- AAJV (2019a), *WSAGA Reticulation Amplifications Options Assessment and Detailed Design, Contamination Site Investigation Report*;
- AAJV (2019b), *WSAGA Reticulation Amplifications Detailed Design – Geotechnical Investigation Report;*
- Aurecon Arup (2019), *Resilience Planning: Prospect South to Macarthur Distribution System, Detailed Site Investigation*;
- Aurecon Arup (2020), *Upper South Creek Advanced Water Recycling Centre Reference Design, Geotechnical Desk Study – Treated Water, Environmental Flows and Brine Pipelines;*
- Aurecon Arup (2020a), *Upper South Creek Advanced Water Recycling Centre Reference Design, Geotechnical Interpretive Note – Brine Pipeline;* and
- Aurecon ARUP (2021a), *Upper South Creek Advanced Water Recycling Centre and Pipelines Detailed Site Investigation*, 12 March 2021.

A summary of the relevant previous investigations available to ERM are discussed below.

4.1 The SCLI Assessment (Aurecon Arup, 2021)

Aurecon and ARUP were engaged by Sydney Water to undertake a contamination assessment of the Pipelines Alignment (the SCLI Assessment) to aid in development of the EIS.

The scope of works relevant to this report included a desktop review of existing information, review and assessment of existing asbestos related reports, a site walkover and site inspection. The site walkover informed the DSI (Aurecon ARUP, 2021a) and additional soil testing requirements.

The scope of works also included assessment of soil laboratory results from the associated DSI (Aurecon ARUP, 2021a) and development of a CSM for the Pipelines Alignment.

Information provided by Aurecon / ARUP identified the following:

- The pipelines construction methodology (trenching and under boring principally) follows roads, easements and previously developed lands where soils have either been disturbed or have limited environmental value with impacts limited to shallow soils, weathered rock and rock;
- Contamination AECs identified along the pipelines would be managed during construction and impacted soils and fill (where considered suitable) could be reused beneficially as engineering fill on the AWRC Site or nearby projects where resource recovery exemptions and orders are adhered too for beneficial reuse. Existing contamination risks and AECs are not considered to be a significant constraint to the pipeline's alignments during construction and operation;
- Construction and operation of the pipelines have the potential to impact the soils and contamination in the following key ways:
    - Removal of topsoils, subsoils and changes in infiltration where earthworks remove natural soil cover;
    - Disturbance of ASS near Prospect Creek which is the only area of the project with ASS risk;
    - Disturbance of contaminated soils during construction via excavations of trenches for pipelines;
    - Mobilisation of contaminants via excavation and disturbance such as leachable contaminants via water and asbestos fibres via airborne deposition;
    - Leaks / spills of chemicals, partially untreated sewage or brine release into the soil and groundwater;
    - Soil erosion, leading to the release of sediment-laden stormwater into receiving waterways;
    - Increased soil erosion where sodic subsoils are excavated and reused on the surface or exposed in situ for extended periods of time during wet weather events; and
    - Reuse of saline soils excavated near drainage lines and low-lying areas along the pipelines and reused as engineering fill increasing salinity release risk to surface waters and groundwater.
- Overall, with the implementation of the proposed mitigation measures, the Project is expected to have a low impact to soils and contamination risks. With the implementation of the prescribed mitigation and management measures, construction management plans, recommended intrusive investigations and compliance monitoring the project would have a low impact on soils and contamination.

The AECs identified in relevance to the Pipelines Alignment included:

- AEC 6: SUEZ Kemps Creek Resource Recovery Park (now Cleanaway) for the treated water pipeline alignment;
- AEC 8: Corner of Elizabeth Drive and Range Road, Kemps Creek for the brine pipeline alignment; and
- AEC 16 – petrol stations – in particular the petrol station on Cabramatta Road, Bonnyrigg.

4.2 IAA05 (JBS&G, 2023)

Andrew Lau of JBS&G Australia Pty Ltd (JBS&G) was engaged by Sydney Water as the EPA accredited site auditor for the Project to ensure that any Works required in relation to contamination and remediation are appropriately managed and the land is suitable for the final intended land use. Based on a review of the information provided, the Site Auditor provided the following advice:

- The auditor agreed with the risk ratings (Aurecon Arup, 2021) that have been determined for the pipeline alignment sites;
- The site history did not include a title search nor commentary on the potential for ASTs/USTs for the storage of agricultural chemicals/hydrocarbons as fuel nor is there consideration given to the potential for mass burial of livestock and the potential for hazardous ground gases that might arise. The auditor considered the risks to be low and the auditor noted that these will be managed by an unexpected finds procedure that the auditor has already reviewed;
- The auditor noted that material from the pipeline alignments will be imported to the AWRC site for site levelling purposes and requested that the protocol for sampling and analysis and material tracking be approved by the auditor prior to the export of materials from the pipeline alignments; and
- It was proposed that impacted material from the pipeline alignments excavations be imported to the AWRC site if the materials are considered suitable. These must be subjected to the importation protocol.

4.3 The Pipelines AECs SAQP (ERM, 2023a)

The Pipelines AECs SAQP was prepared to guide the investigation of the potential distribution / extent of contamination within the following AECs identified within the SCLI Assessment as moderate risk and (where required) the potential contamination management / remediation requirements to enable subsequent redevelopment works at the Site:

- AEC 6: SUEZ Kemps Creek Resource Recovery Park (now Cleanaway) for the treated water pipeline alignment;
- AEC 8: Corner of Elizabeth Drive and Range Road, Kemps Creek for the brine pipeline alignment; and
- AEC 16 – petrol stations.

This RAP was developed prior to the completion of investigation works under the Pipelines AECs SAQP due to the logistical requirements of the Project. Any remediation works resulting from the investigation undertaken as part of the Pipelines AECs SAQP will be undertaken in accordance with this RAP.

The Pipelines AECs SAQP stated that *"where material excavated from the pipeline alignment is proposed to be imported to the plant site, additional sampling and analysis requirements will be presented as an addendum to this SAQP".* This RAP, in particular Section 6, was subsequently prepared for this purpose and a separate addendum to the Pipelines AECs SAQP is therefore no longer required.

4.4 The USC AWRC RAP (ERM, 2023b)

The USC AWRC RAP was prepared to detail the required remedial processes and procedures to be implemented at the USC AWRC site to enable the site to be made suitable for the proposed USC AWRC development. The USC AWRC site was identified within the SCLI Assessment as a moderate-rated AEC which required further investigation. A DSI was undertaken to assess the nature and extent of contamination at the USC AWRC site and was reported in *Detailed Site Investigation, Upper South Creek Advanced Water Recycling Centre* (ERM, 2023c).

Based on a review of information presented within previous investigations and in consideration of the benefits and disadvantages of the presented options, ERM considered that excavation and onsite containment of asbestos-containing fill materials with encapsulation under a constructed soil capping layer to be the most pragmatic, sustainable and cost-effective approach to mitigating potential environmental and human health risks. No other contamination at the USC AWRC site was identified as requiring remediation.

A Long-Term Environmental Management Plan (LTEMP) will be required to document residual impacts and control future works that have the potential to disturb managed material.

The USC AWRC RAP is relevant to this Pipelines RAP in that asbestos-contaminated soils from the Pipelines Alignment, where identified, are expected to be placed within the USC AWRC site's encapsulation area if considered suitable by John Holland, Sydney Water, the Site Auditor and the Environmental Consultant.

4.5 Summary of Potential Contamination

Based on information provided within the previous reports detailed above, it was concluded that there was a moderate potential for contamination to be associated with the following potential sources described in **Table 4-1** below.

Table 4-1 Areas of Environmental Concern

AEC	Description	Risk Ranking	Comment
AEC-6	■ SUEZ Kemps Creek Resource Recovery Park (now Cleanaway): Environment Protection Licences (EPLs) refer to premises as the 'SUEZ Advanced Waste Treatment Facility' and 'Elizabeth Drive Landfill Facility'.	Moderate	■ Groundwater containing elevated copper, zinc, ammonia, nitrogen and nickel levels, and gas containing methane and carbon dioxide exceedances above adopted guidelines (ASC NEPM and NSW EPA *Assessment and Management of Hazardous Ground Gases*, 2020b) have previously been detected adjacent to the premises (Aurecon Arup, 2021). ■ The premises operates under an EPL, and the migration of landfill gas is likely limited within the upper soil (unsaturated) zone and the migration of leachate is likely limited within shallow groundwater. ■ Groundwater is not anticipated to be used by human health or ecological receptors at the Pipelines Alignment as indicated in the CSM of the SCLI Assessment (Aurecon Arup, 2021). ■ Further, it is noted that the EPL for the landfill includes the generation of electrical power from gas, so there is a landfill gas collection system at the landfill premises which would be anticipated to mitigate the migration of landfill gas.
AEC-8	■ Corner of Elizabeth Drive and Range Road, Kemps Creek	Moderate	■ ACM present within the soil to the north of Range Road and parts of AEC-8 are within the impact area, which are anticipated to be disturbed during trenching construction activities.
AEC-16	■ Petrol Stations	Moderate	■ Total Recoverable Hydrocarbons (TRH) exceedance in soil samples previously detected, associated with the service station at 709 Cabramatta Road, West Bonnyrigg, which may be disturbed during pipeline construction. ■ Several other petrol stations within the Pipelines Alignment footprint / within proximity to potentially impact the Pipelines Alignment, are also considered a moderate risk to the contamination status of the land / potential receptors (as outlined in **Section 4**). ■ Subject to HDD and trenching construction activities.

Note: AEC-12 and AEC-13 were identified in the EIS as moderate contaminated sites, but are part of the Environmental Flows pipeline program, which is outside the scope of the Project. These AECs are not considered further herein.

5. PRELIMINARY CONCEPTUAL SITE MODEL

The preliminary Conceptual Site Model (CSM) for the Pipelines Alignment is presented in **Table 5-1** below. This CSM is consistent with the AECs identified within the Pipelines AECs SAQP.

Table 5-1 Preliminary Conceptual Site Model

Potential Sources	CoPCs	Pathways	Potential Receptors	Risk of Potentially Complete Pollutant Linkage	Comment
Landfill leachate within soils / groundwater (AEC-6)	■ Heavy metals (8), ammonia and nitrogen	■ Dermal contact, inhalation, and / or incidental ingestion with contaminated surface waters / groundwater / soils	■ Current and future Pipelines Alignment users; and ■ Workers carrying out development, installation or maintenance works within the Pipelines Alignment.	■ Moderate	■ Groundwater containing elevated copper, zinc, ammonia, nitrogen and nickel exceedances above adopted guidelines (ASC NEPM) have previously been detected adjacent to the premises (Aurecon Arup, 2021). ■ Groundwater is not expected to be encountered during trenching activities; however, if groundwater is encountered, the requirement for further investigation will be considered on a case-by-case basis (e.g., in relation to confirmed/suspected contaminated sites, etc.).
	■ Heavy metals (8), ammonia and nitrogen	■ Transport of contamination through surface water / groundwater flows	■ Adjacent sensitive receptors; ■ Current and future Pipelines Alignment users; and ■ Workers carrying out development, installation or maintenance works within the Pipelines Alignment.	■ Moderate	
	■ Heavy metals (8), ammonia and nitrogen	■ Transport of contamination to underlying groundwater aquifers	■ Adjacent sensitive receptors; and ■ Future potential users of groundwater within the Pipelines Alignment.	■ Moderate	
Landfill gas within soils (AEC-6)	■ Methane and carbon dioxide	■ Inhalation of landfill gases during soil disturbance works	■ Current and future Site users; and ■ Workers carrying out development, installation or maintenance works within the Pipelines Alignment	■ Low	■ The EPL for the landfill includes the generation of electrical power from gas, so there is a landfill gas collection system at the landfill premises which would be anticipated to mitigate the migration of landfill gas. ■ Soils are to be sampled and assessed due to above moderate risk identified, which will include screening soils with a Photo-Ionisation Detector (PID) and a Landfill Gas Analyser. Considering the low risk of landfill gas migration into the pipeline installation area due to the above point, the PID screening results during soil sampling are considered sufficient to assess the risk from ground gases in this area. The resulting DSI can therefore assess the risk to future construction workers and the need for installing and assessing landfill gases through soil vapour wells (if required).
Uncontrolled Fill Materials (AEC-8)	■ Asbestos, TRH, BTEX, heavy metals, PAHs, PCBs and OCP / OPP	■ Dermal contact, inhalation, and / or incidental ingestion with contaminated surface waters / soils.	■ Current and future Pipelines Alignment users; and ■ Workers carrying out development, installation or maintenance works within the Pipelines Alignment.	■ Moderate	■ No records of the origin or nature of fill material imported to the Pipelines Alignment was available. ■ Surface fill materials within various portions of the Pipelines Alignment were observed to contain ACM. ■ Groundwater is not expected to be encountered during trenching activities; however, if groundwater is encountered, the requirement for further investigation will be considered on a case-by-case basis (e.g., in relation to confirmed/suspected contaminated sites, etc.).
	■ Asbestos, TRH, BTEX, heavy metals, PAHs, PCBs and OCP / OPP	■ Transport of contamination through surface water flows.	■ Adjacent sensitive receptors; ■ Current and future Pipelines Alignment users; and ■ Workers carrying out development, installation or maintenance works within the Pipelines Alignment.	■ Low – Moderate	
	■ Asbestos, TRH, BTEX, heavy metals, PAHs, PCBs and OCP / OPP	■ Transport of contamination to underlying groundwater aquifers	■ Adjacent sensitive receptors; and ■ Future potential users of groundwater within the Pipelines Alignment.	■ Low – Moderate	
	■ Asbestos, TRH, BTEX, heavy metals, PAHs, PCBs and OCP / OPP	■ Transport of contamination through mechanical means	■ Workers carrying out development, installation or maintenance works within the Pipelines Alignment.	■ Moderate	

Potential Sources	CoPCs	Pathways	Potential Receptors	Risk of Potentially Complete Pollutant Linkage	Comment
Petroleum releases from petrol stations (AEC-16)	■ TRH, BTEX and PAHs	■ Dermal contact, inhalation, and / or incidental ingestion with contaminated surface waters / groundwater / soils	■ Current and future Pipelines Alignment users; and ■ Workers carrying out development, installation or maintenance works within the Pipelines Alignment.	■ Moderate	■ Total Recoverable Hydrocarbon (TRH) exceedance in soil samples previously detected, associated with the service station near Cabramatta Road, West Bonnyrigg, which may be disturbed during pipeline construction. ■ Several other petrol stations within the Pipelines Alignment footprint / within proximity to potentially impact the Pipelines Alignment, are also considered a moderate risk to the contamination status of the land / potential receptors. ■ Groundwater is not expected to be encountered during trenching activities; however, if groundwater is encountered, the requirement for further investigation will be considered on a case-by-case basis (e.g., in relation to confirmed/suspected contaminated sites, etc.).
	■ TRH, BTEX and PAHs	■ Transport of contamination through surface water / groundwater flows	■ Adjacent sensitive receptors; ■ Current and future Pipelines Alignment users; and ■ Workers carrying out development, installation or maintenance works within the Pipelines Alignment.	■ Moderate	
	■ TRH, BTEX and PAHs	■ Transport of contamination to underlying groundwater aquifers	■ Adjacent sensitive receptors; and ■ Future potential users of groundwater within the Pipelines Alignment.	■ Moderate	
	■ TRH, BTEX and PAHs	■ Transport of contamination through mechanical means	■ Workers carrying out development, installation or maintenance works within the Pipelines Alignment	■ Moderate	

6. EXCAVATED MATERIAL CLASSIFICATION AND MANAGEMENT

The onsite materials proposed to be excavated during the USC Pipeline development are required to be assessed to enable classification of the material. Classification of the material will be undertaken to assess whether the material is suitable for:

- beneficial reuse within the Project boundaries (i.e., within the pipelines alignment or at the USC AWRC plant site); or
- placement within the asbestos containment area at the USC AWRC plant site (asbestos-contaminated soils only), shown in **Appendix A – Figure 3**; or
- transportation off-site for beneficial re-use in accordance with the NSW EPA VENM classification requirements or Resource Recovery Orders; or
- transportation off-site for disposal as waste (in the event that onsite beneficial reuse/containment or off-site reuse is not appropriate).

Based on the information provided to ERM by John Holland, the estimated volumes of excavated material are:

- Trench excavation: approximately 83,100 m^3 (unbulked), across a pipeline length of approximately 34.5 km; and
- Trenchless excavation: Approximately 4,600 m^3 (unbulked) across a pipeline length of approximately 5.2 km.

The following sections detail the classification methodology required to be undertaken for excavated material classification during pipeline construction. Excavated material classification will be undertaken with reference to the Data Quality Objectives presented in **Appendix B**.

The excavated material classification program set out within this RAP is in addition to the investigation scope and methodology described within the Pipelines AECs SAQP. The Pipelines AECs SAQP was prepared to guide investigation of the moderate to high AECs that were identified by the EIS; however the data collected during the AECs DSI will also be utilised for excavated material classification purposes. In accordance with the *Waste Classification Guidelines, Part 1: Classifying Waste* (NSW EPA, 2014), all data relevant to a particular material (inclusive of data collected in situ and ex situ) will be reviewed as part of the material's classification. In the event that suspected contamination is identified outside of the investigation locations during pipeline construction, the Unexpected Finds Procedure described in **Section 12.3** and **Appendix C** will be implemented.

6.1 Excavated Material Classification Sampling and Analysis Quality Plan

6.1.1 Sampling Density

6.1.1.1 Classification of Materials In Situ

Material to be excavated for pipeline construction via open trenches (approximately 83,100 m^3, unbulked) will be sampled in situ prior to excavation at a rate of one sample per 500 m^3 to allow for excavated material classification. Based on the anticipated volume of excavated materials provided by John Holland, a minimum number of 166 samples will be collected and analysed from the material. Based on the depth of the proposed trench excavations, and given the likelihood of a minimum of two soil types to be present within the vertical profile, it was considered two samples per investigation location would be adequate to characterise the material. Therefore, a minimum of 83 investigation locations are required to satisfy the selected sampling density.

Recent investigation has been undertaken by ERM along the pipeline alignment during subsurface utility potholing works completed by John Holland during July and August 2023. Due to the timing and logistics of this work, a separate SAQP was not developed. ERM environmental scientists collected soil samples from 48 boreholes advanced by John Holland via vacuum excavation, with samples being collected from within the boreholes via hand auger. Where possible, at least two samples were collected from each borehole, with a total of 72 samples being collected. Samples were analysed for the following COPCs:

- TRH C_6-C_{40};
- BTEX;
- heavy metals (As, Cd, Cr, Cu, Ni, Pb, Zn, Hg);
- PAHs;
- PCBs;
- OCP / OPP; and
- asbestos (presence / absence).

The data collected during the above soil sampling program will be included within the in-situ material classification dataset, along with the data collected during the Pipelines AECs SAQP investigation and the additional investigation scope described below.

The proposed investigation program for in situ material classification was developed per the above requirements and with consideration of the recently completed investigation locations and the Pipelines AECs SAQP proposed sampling locations. The proposed investigation program includes progression of 71 boreholes and collection of 142 soil samples for laboratory analysis.

Proposed investigation locations for in situ classification are shown on **Appendix A – Figures 4a to 4h**, along with John Holland's proposed potholing locations, recently completed sampling locations via potholing and the investigation locations proposed in the Pipelines AECs SAQP for context. It is expected that individual proposed in situ classification investigation locations may be adjusted slightly to align with John Holland's potholing locations.

6.1.1.2 Classification of Materials Ex Situ

Material to be excavated via trenchless excavation (approximately 4,600 m^3, unbulked) will be sampled ex situ from stockpiles following excavation and dewatering at a rate of one sample per 250 m^3 in accordance with *Sampling design part 1 – application, Contaminated Land Guidelines* (NSW EPA, 2022). Due to the excavation methodology associated with this material, it is not practicable to classify this material in situ prior to excavation. It is expected that this material will be stockpiled temporarily within construction compounds prior to classification. In the event that dewatering of this material is not practicable (due to available space, time constraints or other construction limitations), this material will be assessed and classified as liquid waste in accordance with the requirements of NSW EPA (2014).

If ex situ classification is required for other excavated materials, samples should be collected from stockpiled materials at frequencies in accordance with the requirements of NSW EPA (2022) as summarised in **Table 6-1** and **Table 6-2** below.

Table 6-1 Stockpile Sampling Frequencies (Material Not Potentially Impacted by Asbestos)

Stockpile Volume (m^3)	Minimum Number of Samples	Comments
<75	3	
75 to <100	4	
100 to <125	5	
125 to <150	6	
150 to <175	7	
175 to <200	8	
200 to <2500	10	Appropriate when calculating 95% Upper Confidence Level (UCL)
>2500	One sample per 250 m^3	Appropriate when calculating 95% Upper Confidence Level (UCL)

Notes:
This table pertains to stockpiled material which is not suspected of containing asbestos. If there is any evidence to suggest that asbestos could be present, the procedures in Table 6-2 should be undertaken.

Table 6-2 Stockpile Sampling Frequencies (Material Potentially Impacted by Asbestos)

Purpose of Stockpile Characterisation	No. of Samples Required	Comments
Placement within USC AWRC containment area (already confirmed to be asbestos-containing)	Refer to Table 6-1	Applicable to stockpiles which have already been confirmed to contain asbestos. Additional chemical characterisation is required to assess suitability for placement within the USC AWRC containment area. If not suitable, then classification for off-site disposal will be required.
On-site reuse	Refer to Table 6-1	Asbestos fines (AF) / fibrous asbestos (FA) quantification (500 mL sample)
Off-site reuse	Refer to the requirements of the Resource Recovery Order/Exemption specific to the proposed classification of this material.	
Disposal to landfill	Refer to Table 6-1	Classification must be undertaken per Waste Classification Guidelines (NSW, EPA, 2014).
Transport to recycling facility	Refer to Table 6-1	Each sample must be tested for: ■ non-friable asbestos using the NEPM gravimetric procedure where the sample volume must be a minimum of 10 L per sample; and ■ asbestos fines/ fibrous asbestos ('AF/FA') where the sample collected must be a minimum of 500 mL. Classification must be undertaken per Waste Classification Guidelines (NSW, EPA, 2014). If a stockpile contains asbestos, it must not be recycled.

Notes:
This table pertains to stockpiled material which is suspected of containing asbestos, but which has not yet been confirmed (via visual evidence and/or laboratory analysis).

6.1.2 Sampling Methodology

The selected method of sampling for in situ classification is progression of boreholes via vacuum excavation and subsequent sampling via a hand auger to collect soil samples. It is noted that test pits are the preferred methodology for the assessment of fill / ACM; however due to site access constraints within the Pipelines Alignment, a combination of vacuum excavation and sampling via hand auger will be undertaken. In the event that vacuum excavation is not practicable for specific locations, sampling via hand auger only will be undertaken.

Table 6-3 below summarises the scope of works and methodology to be adopted for the investigation.

Table 6-3 Classification Methodology Summary

Task	Proposed Scope
1 – Project Preliminaries	Prior to the commencement of sampling works, ERM will complete the following: ■ Preparation of a Site-specific Health and Safety Plan (HASP) and associated Safe Work Method Statements (SWMS). In addition to ERM / regulatory requirements, the HASP and SWMS will consider the most recent NSW Government advice relating to precautions regarding COVID-19. ■ Review of required John Holland permits for the investigation works, as required. ■ All project plans will be developed in consideration of John Holland requirements relating to off-site residents and other relevant stakeholders.
2 – Service Location	■ Soil sampling works (for in situ classification) will be undertaken concurrently with potholing activities led by John Holland. Prior to the commencement of intrusive works, John Holland will undertake a review of available service plans, including Before You Dig Australia and other available plans specific to the Pipelines Alignment. ■ The proposed investigation locations will be cleared by John Holland via an experienced underground utility locator with radio detection and Ground Penetrating Radar (GPR) equipment.
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 Photo-Ionisation Detector (PID) will be calibrated to an isobutylene standard at the beginning of each working day in accordance with manufacturer requirements and ERM's standard operating procedures. ■ All of the relevant calibration records will be provided as an annex in the investigation reports.
4 – Boreholes	■ Boreholes will be advanced via a combination of vacuum excavation and hand auger to assess potential soil contamination within the Pipelines Alignment. ■ Soil will be logged by an appropriately trained and experienced scientist / engineer to record the following information: soil / rock 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[2]. ■ During investigation works, all collected soil samples will be field screened with a calibrated PID for the presence of ionisable volatile organic compounds. ■ Field QA/QC samples will be collected including field duplicates and inter-laboratory duplicates (as per the requirements outlined within **Section 6.1.4** below). ■ All investigation locations will be Global Positioning System (GPS) recorded for incorporation into subsequent decision-making and reporting.
5 - Stockpiles	■ Samples of stockpiled material will be collected by hand from at least 0.5 m below the surface of the stockpile in accordance with the sampling frequencies outlined in **Table 6-1** and **Table 6-2** in this RAP. An excavator may be used to assist with sampling, if required.

[2] Standards Australia (2017). *AS 1726-2017, Australian Standard, Geotechnical Site Investigations.*

Task	Proposed Scope
	■ Materials will be logged by an appropriately trained and experienced scientist / engineer to record the following information: soil / rock 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[3]. ■ Each stockpile sample will be field screened with a calibrated PID for the presence of ionisable volatile organic compounds. ■ Field QA/QC samples will be collected including field duplicates and inter-laboratory duplicates (as per the requirements outlined within **Section 6.1.4** below).
5 – Sample Handling	■ All collected samples will be placed within laboratory-supplied containers and transported to NATA accredited laboratories for analysis under chain of custody conditions for the required analyses. Duplicate and triplicate spilt samples will be collected as per the requirements outlined within the ASC NEPM. ■ Samples will be analysed per **Section 6.1.3** below.
6 – 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 (soil sampling equipment only) or a cloth (water sampling equipment); - washed in potable (tap) water and brush scrubbing using tap water and a non-phosphate detergent (Decon 90) and deionised water; - rinsed with water; and - air dried. ■ Rinsate samples are to be collected and analysed as per the requirements of this RAP to confirm the appropriateness of equipment decontamination.

6.1.3 Laboratory Analysis

Soil samples, including samples collected from materials both in situ and ex situ, will be submitted to laboratories accredited by the National Association of Testing Authorities (NATA) for the following analyses as a minimum:

- TRH C_6-C_{40};
- BTEX;
- heavy metals (As, Cd, Cr, Cu, Ni, Pb, Zn, Hg);
- PAHs;
- PCBs;
- OCP / OPP;
- AF / FA quantification (500 mL sample); and
- Toxicity Characteristic Leaching Procedure (TCLP) leachate for metals (Pb and Ni) – for waste classification only.

Additional analyses may be required to enable off-site beneficial reuse in accordance with applicable Resource Recovery Orders. These requirements are presented within **Section 6.2**.

6.1.4 Field Quality Assurance and Quality Control

The field quality assurance procedures to be adopted and the field quality control samples to be collected during the investigation are presented in **Table 6-4** below.

[3] Standards Australia (2017). *AS 1726-2017, Australian Standard, Geotechnical Site Investigations.*

Table 6-4 Field QA/QC Requirements

Data Type	Comments and Acceptable Control Limits
Field personnel	■ Appropriately trained in the collection of environmental samples and inducted into all Site-specific John Holland requirements.
Field data collection	■ Site conditions and sample locations appropriately described. ■ Information to be recorded in field notes. Field notes are appropriately completed and summarised in the Soil Validation Report (SVR).
Sample handling (storage and transport)	■ Soil 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. ■ The filled containers will be stored on ice in a chilled, insulated cooler box 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. ■ The interface probe and water quality meter will be calibrated in accordance with the manufacturer's requirements, prior to field works, 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 ERM's 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.
Field Duplicates (intra-laboratory and inter-laboratory)	■ Intra-laboratory duplicates will be collected and analysed at a rate of one in every 10 primary samples, with a minimum of one sample. ■ Inter-laboratory duplicates will be collected and analysed at a rate of one in every 20 primary samples, with a minimum of one sample. ■ The duplicate samples will be obtained from locations suspected of being contaminated and analysed for the same CoPCs as collected primary samples. ■ Duplicate / triplicate samples will be collected (i.e., splitting technique) as per the requirements of the ASC NEPM.
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 of soil samples.
Trip Spikes	■ Laboratory prepared trip spikes will be used and analysed at a rate of one per batch of soil samples.

6.2 Material Classification

The material is expected to be classified as one or more of the following material types:

- Beneficial reuse within the Project boundaries under commercial/industrial land use;
- Virgin excavated natural material (VENM);
- Excavated natural material (ENM);
- Excavated public road material (EPRM);

- Waste to be disposed at a suitably licensed landfill facility.

Table 6-5 below presents a summary of the specific methodology associated with the expected classification of the various material types, additional analysis required, regulatory framework (if applicable) and assessment criteria.

Table 6-5 Summary of Material Classification Scope and Methodology

Material Classification	Overview	Sampling Density	Laboratory Analysis	Classification Methodology	Assessment Criteria	Reporting
Beneficial reuse within the Project boundaries under commercial / industrial land use	Results of the in-situ sampling program, and ex situ sampling if required, across the Pipeline Alignment will be assessed for beneficial reuse, in accordance with applicable commercial / industrial land use criteria.	In situ: one sample per 500 m^3 (unbulked) Ex situ (if required): per **Table 6-1** and **Table 6-2**	■ TRH C_6-C_{40}; ■ BTEX; ■ heavy metals (As, Cd, Cr, Cu, Ni, Pb, Zn, Hg); ■ PAHs; ■ PCBs; ■ OCP / OPP; ■ AF / FA quantification (500 mL sample)	In situ: per Section 6.1.20 Ex situ (if required): per Section 6.1.20	■ ASC NEPM Health Investigation Levels (HIL) and Health Screening Level (HSL) for commercial / industrial land use (HIL-C and HSL-C) ■ CRC CARE (2011) Soil Health Screening Levels for Direct Contact (Commercial / Industrial) and Intrusive Maintenance Worker ■ ASC NEPM Management Limits ■ ASC NEPM Ecological Investigation Level and Ecological Screening Levels for commercial/industrial land use	To be reported within the SVR (refer to **Section 9.7.4**).
VENM *Offsite beneficial reuse*	The Protection of the Environment Operations Act 1997 defines VENM as: 'natural material (such as clay, gravel, sand, soil or rock fines) that has been excavated or quarried from areas that are not contaminated with manufactured chemicals or process residues, as a result of industrial, commercial, mining or agricultural activities, and that does not contain any sulfidic ores or soils or any other waste'. No other criteria for VENM have been approved. By definition, VENM cannot be 'made' from processed soils. Excavated material that has been stored or processed in any way cannot be classified as VENM.	In situ: one sample per 500 m^3 (unbulked) Ex situ (if required): per **Table 6-1** and **Table 6-2**	■ TRH C_6-C_{40}; ■ BTEX; ■ heavy metals (As, Cd, Cr, Cu, Ni, Pb, Zn, Hg); ■ PAHs; ■ PCBs; ■ OCP / OPP; ■ asbestos (presence / absence)	In situ: per Section 6.1.20 Ex situ (if required): per Section 6.1.20	■ No visible asbestos containing materials; ■ No visible man-made materials; ■ No staining or odour indicative of contamination; ■ No PID results indicative of contamination (< 20 ppmv); ■ No Acid Sulfate Soils (ASS) or Potential Acid Sulfate soils (PASS); and ■ Laboratory results consistent with no presence of contaminants (generally <detection limits for most analytes)	A VENM classification report will be prepared by the Environmental Consultant, which can be provided to the consumer of the material. The VENM classification report will also be included within the SVR (refer to **Section 9.7.4**).
ENM *Offsite beneficial reuse*	The excavated natural material order 2014 defines ENM as: 'naturally occurring rock and soil (including but not limited to materials such as sandstone, shale, clay and soil) that has: a) Been excavated from the ground, and b) Contains at least 98% (by weight) natural material, and c) Does not meet the definition of Virgin Excavated Natural Material in the Act.' ENM does not include material located in a contamination hotspot; that has been processed; or that contains asbestos, ASS, PASS or sulfidic ores.	As per the sampling densities required within The excavated natural material order 2014 – Table 1, Table 2 and Table 3	As per the analysis required within The excavated natural material order 2014	As per the methodology required within The excavated natural material order 2014. Since the sampling and analytical requirements are different than those for other material types, material proposed as ENM would likely need to be identified early and segregated separately from other material types.	As per the maximum average and absolute maximum concentrations set out within Table 4 of The excavated natural material order 2014	An ENM classification report will be prepared by the Environmental Consultant, which can be provided to the consumer of the material. The ENM classification report will also be included within the SVR (refer to **Section 9.7.4**).
EPRM *Offsite beneficial reuse*	The excavated public road material order 2014 defines EPRM as: ■ being rock, soil, sand, bitumen, reclaimed asphalt pavement, gravel, slag from iron and steel manufacturing, fly and bottom ash, concrete, brick, ceramics and materials that hold a resource recovery order for use in road making activities; and ■ that have been excavated during the construction and maintenance of council and RMS public roads and public road infrastructure facilities. This does not include any waste that contains coal tar or asbestos, or any waste that is classified as hazardous, restricted solid, special or liquid waste as defined in the Act.	Not required, but visual assessment must be undertaken to assess against the requirements of the excavated public road material order 2014	Not required	Visual inspection during excavation or ex-situ during stockpiling to observe visual indicators of coal tar, asbestos or ASS.	Per the requirements of The excavated public road material order 2014	An EPRM classification report(s) will be prepared by the Environmental Consultant, which can be provided to the consumer of the material. The EPRM classification report(s) will also be included within the SVR (refer to **Section 9.7.4**).

Material Classification	Overview	Sampling Density	Laboratory Analysis	Classification Methodology	Assessment Criteria	Reporting
Waste *Offsite disposal*	All waste disposal activities will be undertaken in accordance with the Protection of the Environment Operations (POEO) Act 1997 (NSW), the Waste Classification Guidelines (NSW EPA, 2014a), the Waste Avoidance and Resource Recovery Act 2001 (NSW), as well as relevant requirements of Contaminated Land Management, Guidelines for the NSW Site Auditor Scheme (3rd edition) (NSW EPA, 2017). Material considered not suitable to remain onsite and requires remediation and material that cannot be transported offsite for beneficial reuse but is in excess to site requirements can be disposed offsite at a landfill or resource recovery facility that is legally able to accept the waste.	In situ: one sample per 500 m^3 (unbulked) Ex situ (if required): per **Table 6-1** and **Table 6-2**	■ TRH C_6-C_{40}; ■ BTEX; ■ heavy metals (As, Cd, Cr, Cu, Ni, Pb, Zn, Hg); ■ PAHs; ■ PCBs; ■ OCP / OPP; ■ asbestos (presence / absence); ■ TCLP leachate for metals (Pb and Ni) at a minimum.	In situ: per Section 6.1.20 Ex situ (if required): per Section 6.1.20	As per Table 1 and Table 2 of NSW EPA (2014). It should be noted that if the waste was to be disposed at a resource recovery facility, facility-specific criteria and limitations may be present. Therefore, the Principal Contractor should obtain these criteria / requirements from the intended facility for disposal and provide to the Environmental Consultant to enable accurate classification.	A waste classification report(s) will be prepared by the Environmental Consultant, which can be provided to the consumer of the material. The waste classification report(s) will also be included within the SVR (refer to Section 9.7.4).
Waste *Placement of asbestos-impacted soils within the AWRC asbestos placement location*	In the event that soils impacted with asbestos are encountered during the construction program, these soils will be excavated and stockpiled temporarily in close proximity to the excavation for further assessment. If laboratory results meet the assessment criteria in this table, this material would be suitable for transport and placement within the AWRC asbestos placement location.	Ex situ: per **Table 6-1** and **Table 6-2**	Dependent on COPCs, but at a minimum: ■ TRH C_6-C_{40}; ■ BTEX; ■ heavy metals (As, Cd, Cr, Cu, Ni, Pb, Zn, Hg); ■ PAHs; ■ PCBs; ■ OCP / OPP; ■ AF / FA quantification (500 mL sample); ■ ASLP leachate for key COPCs where leachability is a concern (based on total results for individual COPCs).	Ex situ: per **Section 6.1.2**	■ ASC NEPM Health Investigation Levels (HIL) and Health Screening Level (HSL) for commercial / industrial land use (HIL-D and HSL-D) ■ CRC CARE (2011) Soil Health Screening Levels for Direct Contact (Commercial / Industrial) and Intrusive Maintenance Worker ■ ASC NEPM Management Limits ■ ASC NEPM Ecological Investigation Level and Ecological Screening Levels for commercial/industrial land use ■ ASLP leachate only: ANZECC (2000) / ANZG (2018) freshwater criteria with a 10x attenuation factor applied 1.	To be reported within the SVR (refer to **Section 9.7.4**).

Notes:

1. *The application of the 10x attenuation factor for ANZECC (2000) / ANZG (2018) freshwater criteria is based on the approach outlined in Regional Screening Levels (RSLs) – User's Guide, November 2023 (United States Environmental Protection Agency, 2023), which recommends that factors of 10-20x can be applied to groundwater criteria when assessing migration of contaminants from soil to groundwater via (1) release of contaminant from soil to soil leachate and (2) transport of the contaminant through the underlying soil and aquifer to a receptor well. Given the clayey soils present at the AWRC site, which are expected to be associated with low hydraulic conductivity, and the lack of shallow groundwater, this is considered to be appropriate.*

6.3 Materials Handling and Tracking

John Holland will track the movement of all materials excavated and handled as part of the remediation program. This will include (but is not limited to) tracking of:

- Stockpile locations, with corresponding source of materials;
- Off-site disposal records for soils (trucking record, landfill dockets);
- Transport of asbestos-containing materials to the USC AWRC site asbestos containment area;
- Estimated volume(s) of soils exported from the Pipelines Alignment; and
- Importation records for fill, including estimated volumes.

Transport and disposal of waste must be conducted in accordance with the requirements of the POEO Act 1997 and other applicable NSW regulatory requirements. Licenses and approvals required for disposal of the waste material will be obtained prior to removal of materials from the Pipelines Alignment. Removal of waste materials from the Pipelines Alignment will only be carried out by contractors holding appropriate licenses, consent and/ or approvals to manage, handle or dispose of the waste materials.

7. EXTENT OF REMEDIATION REQUIRED

7.1 General

Excavation works will occur to enable pipeline construction; as part of this process, as well as during the excavated material classification investigation and Pipeline AECs DSI, it is expected that some contamination will be encountered which will require remediation. Whilst the nature and extent of the required remediation across the Pipelines Alignment was not known at the time of writing, this RAP sets out a framework with sufficient flexibility to address potential contamination and to allow for management of unexpected finds.

Areas that require remediation will be identified following the completion of the scope of works detailed within the Pipelines AECs SAQP, as well as the proposed investigation scope for in situ material classification detailed within **Section 6.1**. Areas which require remediation will be remediated in accordance with the procedures set out within the following sections of this RAP.

This RAP has been prepared with consideration of CoPCs that could potentially be encountered, given the location of the majority of the pipelines construction being undertaken within and adjacent to road corridors, areas of open space and agricultural activities.

Groundwater has not been encountered during previous investigations and is not anticipated to be encountered in significant amounts during the proposed pipeline development program; therefore, groundwater remediation is not considered to be required. In the event that groundwater impacts are encountered as a result of the Pipelines AECs DSI or as unexpected finds, the contingency actions set out in Section 12 will be implemented.

7.2 Bonded ACM – Farm Dam Site and Range Road (AEC8) Site

Two areas within the Pipelines Alignment containing bonded ACM fragments were recently identified.

A limited area containing demolition waste, including suspected bonded ACM, was identified in mid-September 2023 by John Holland personnel during a walkover in a portion of the treated water pipeline 10 km to the west of the USC AWRC plant site in Kemps Creek referred to as ‘the Farm Dam’. The location of this area is presented in **Appendix A** - **Figure 4c**. This area, which is estimated to comprise approximately 700 m^2, was subsequently confirmed to contain bonded ACM following sampling by ERM on 26 September 2023 and laboratory analysis. Remediation of this area will be completed in accordance with the procedures set out in this RAP and will be documented in the SVR.

AEC8, located at the corner of Elizabeth Drive and Range Road, Kemps Creek, was confirmed to contain bonded ACM fragments on the ground surface following investigation in October and November 2023 (in accordance with the investigation scope in this RAP). The affected area is estimated at approximately 2000 m^2 and asbestos impacts were identified at the ground surface only during investigation. No buried asbestos was identified. The location of this area is presented in **Appendix A – Figure 4g**. Remediation of this area will be completed in accordance with the procedures set out in this RAP and will be documented in the SVR.

8. SELECTION OF PREFERRED REMEDIATION STRATEGY

8.1 Remediation Objectives

The overall objective is to effectively manage the identified contamination within soils to render the Pipelines Alignment suitable for the proposed commercial / industrial land use.

The remedial objectives, if remediation activities are required, are provided below:

- Undertake remediation works to mitigate potential risks to future workers and users of the Pipelines Alignment under the commercial / industrial land use following pipeline construction;
- Manage potential human health and/or environmental impacts during and following the remediation works; and
- Validate the completed remediation works through the implementation of a validation sampling program to verify that remedial works have been undertaken in accordance with the RAP and all areas have been successfully remediated.

8.2 Remediation Options Assessment

The *Contaminated Land Management: Guidelines for the NSW Site Auditor Scheme* (NSW EPA, 2017) outlines the hierarchical management of wastes as preferred by the NSW EPA. According to this document, the order of preference for soil remediation and management is:

1. On-site treatment of the soil so that the contaminant is either destroyed or the associated hazard is reduced to an acceptable level;
2. Off-site treatment of excavated soil so that the contaminant is either destroyed or the associated hazard is reduced to an acceptable level, after which the soil is returned to the Pipelines Alignment;
3. Removal of contaminated soil to an approved site or facility, followed where necessary by replacement with clean fill; and
4. Consolidation and isolation of the soil on-site by containment within a properly designed barrier.

An assessment of the suitability of available soil remediation methods and technologies is provided in **Table 8-1** below.

Table 8-1 Soil Remediation Options Assessment

Option	Description	Suitability
On-site treatment	On-site treatment may include in-situ methods such as soil vapour extraction and oxidation, and ex-situ methods such as thermal desorption and bioremediation. Ex-situ on-site treatment requires sufficient land area to facilitate the process for the life of the remediation program. Both in-situ and ex-situ remediation methods often take an extended period of time to complete and may be incompatible with construction programming. The progression of the construction program may not allow for a large area to be utilised to undertake on-site treatment. There can be significant costs associated with mobilisation and monitoring. This is not a preferred method for the Pipelines Alignment since better suitable options are available.	Not suitable
Off-site treatment	Off-site treatment includes the same methods as on-site treatment however remediation is undertaken in an alternate location. This method is typically adopted when the remediation site has an insufficient land area to accommodate the remediation technology. Unlike on-site treatment, off-site treatment requires excavation of contaminated soils, and transportation to the treatment site. Reinstatement of on-site excavations is also required following treatment. Timeframes and logistics may be incompatible with construction programming, and this method is not considered cost effective as there are alternate suitable options available.	Not suitable

Option	Description	Suitability
Off-site disposal	Off-site disposal to a suitably licensed landfill is the simplest of the relevant remediation methods. This option would include excavation of the impacted material, classification as waste and transportation to a suitably-licensed off-site waste facility. The excavation is then backfilled using clean, validated fill materials (site won or imported).	Suitable – excluding asbestos-contaminated soils
On-site capping and containment	On-site capping and containment involves the installation of a physical barrier around the contaminated material to prevent potential exposure pathways. The USC AWRC remediation program outlined in *Remediation Action Plan, Upper South Creek Advanced Water Recycling Centre* (ERM, 2023b) includes construction of an on-site containment area for asbestos-impacted soils which can be utilised for asbestos-impacted soils excavated from the Pipelines Alignment (refer to **Appendix A – Figure 3**). Transportation of asbestos-impacted soils to the USC AWRC plant site for on-site containment is considered a feasible and cost-effective remediation method. Soils contaminated with other COPCs above commercial/industrial land use criteria are not suitable for placement with the USC AWRC containment area and will be required to be classified and disposed off-site as waste. Capping and containment of contaminated soils within the Pipelines Alignment is not feasible due to the nature of the construction program.	Suitable – asbestos-contaminated soils only

8.3 Preferred Remediation Strategy

The remediation strategy selected must be the most cost-effective solution which does not result in unacceptable long-term liabilities, and which does not impose unreasonable constraints on future site developments or present operations. The strategy must also be capable of achieving the technical, environmental and economic objectives of the overall project, whilst not adversely affecting nearby human and ecological receptors.

Based on the analysis undertaken in previous sections, the preferred remediation strategy comprises:

SOIL: EXCAVATION AND ON-SITE CONTAINMENT AT THE USC AWRC SITE (ASBESTOS-CONTAMINATED SOILS) OR OFF-SITE DISPOSAL (NON ASBESTOS-CONTAMINATED SOILS)

Considering the Pipelines Alignment will undergo extensive excavation due to the nature of the construction program, excavation of impacted soils and off-site disposal or encapsulation at the USC AWRC site has been selected as the preferred remediation option.

GROUNDWATER: REMEDIATION NOT REQUIRED

Groundwater has not been encountered during previous investigations and is not anticipated to be encountered during the pipeline construction program; therefore, groundwater remediation is not considered to be required. The contingency plan outlined within **Section 12** details procedures to be followed in the event groundwater is encountered in significant amounts during the construction program.

9. REMEDIATION STRATEGY IMPLEMENTATION

9.1 General

This section provides specific details relating to implementing the proposed remedial works. The remedial strategy incorporates the following elements: Assigning of roles and responsibilities;

- Step 1 – Assigning of Roles and Responsibilities;
- Step 2 – Engagement of Environmental Consultant;
- Step 3 – Planning, Permitting, Approvals and Procurement;
- Step 4 – Site Establishment and including Environmental Controls;
- Step 5 – Soil Remediation Works;
- Step 6 – Validation and Clearance Activities; and
- Step 7 – Demobilisation.

9.2 Step 1 – Assigning Roles and Responsibilities

For the purposes of the remedial work under this RAP, the roles and responsibilities are presented within **Table 9-1**.

Table 9-1 Roles and Responsibilities

Role	Party	Responsibilities
Principal Contractor	John Holland	■ The Principal Contractor will retain overall responsibility for ensuring the RAP is appropriately implemented. ■ The Principal Contractor will also be responsible for acquiring all necessary approvals and licenses for the proposed remediation works. ■ The Principal Contractor will provide relevant information regarding site environmental management to contractors and subcontractors working at the Pipelines Alignment and will ensure that they are fulfilling the responsibilities for the work.
Remediation Contractor	John Holland	■ The Remediation Contractor and the Principal Contractor may be the same entity. ■ The Remediation Contractor is responsible for day-to-day environmental performance of the remediation works, including the implementation and maintenance of acceptable environmental controls and plans during all remediation works. ■ The Remediation Contractor will nominate a Site Manager who will be responsible for initial response to any unexpected finds encountered during remediation works. ■ The Remediation Contractor will maintain records and documents produced as required by this RAP, and will implement an inspection and maintenance program.
Environmental Consultant	ERM	■ Oversight of all remediation requirements specified within this RAP. ■ Conduct remediation validation in accordance with the RAP, including observations of the materials encountered, undertake sampling and analysis of materials as deemed necessary. ■ Make an evaluation of potential risks to human health and the environment posed by the materials and ensure the risk to health and the environment are acceptable (if required). ■ Provide guidance to assist with the appropriate re-use and/or disposal of material, including characterisation and classification under the POEO Act 1997 (NSW).

Role	Party	Responsibilities
Subcontractors	Various	■ Subcontractors will be advised of required work procedures through induction, training, and meetings provided by the Principal Contractor. ■ Maintenance of subcontractor equipment will be the responsibility of the subcontractors. ■ Subcontractors are responsible for ensuring that all work executed by the subcontractor complies with the RAP and relevant SafeWork NSW requirements, as necessary.
Asbestos Removal Contractor	TBC	■ An appropriate licensed contractor should carry out the excavation and transportation of asbestos impacted soil in accordance with Managing asbestos in or on soil (Safework NSW, 2014). ■ The Asbestos Removal Contractor and the Principal Contractor may be the same entity if the Principal Contractor is a Class A or Class B licenced contractor (if and as required).
Site Auditor	Andrew Lau, JBS&G	■ Review contamination assessment, remediation and site management works completed within the Project (inclusive of the Pipelines Alignment as well as the USC AWRC) in accordance with the project Conditions of Approval; in particular the Site Auditor will review any reports produced following investigation and/or remediation; ■ Provide a Site Audit Statement and Site Audit Report at the completion of the program in accordance with the project Conditions of Approval.

9.3 Step 2 – Engagement of Environmental Consultant

An Environmental Consultant, which is suitably qualified and experienced in accordance with the requirements of the ASC NEPM, is to be engaged to advise, provide oversight and undertake all validation requirements specified within this RAP. ERM has been engaged by John Holland as the Environmental Consultant.

9.4 Step 3 – Planning, Permitting, Approvals and Procurement

The following documentation is to be prepared prior to commencement of the remedial works:

- Project-Specific Health and Safety Plan (HASP), including Safe Work Method Statements (SWMS);
- Obtain any necessary local planning approvals, if required beyond the existing CSSI and Commonwealth project approvals;
- In the event that asbestos-contaminated soils are encountered, an Asbestos Management Plan (AMP) meeting NSW regulatory requirements in relation to working with asbestos (including *Code of Practice: How to Safely Remove Asbestos* (SafeWork NSW, 2022)); and
- In the event that asbestos-contaminated soils are encountered, SafeWork NSW authority notifications.

The existing Construction Environmental Management Plan (CEMP) for the Project, incorporating sediment and erosion controls, is also relevant to the works outlined within this RAP.

9.5 Step 4 – Site Establishment and Environmental Controls

Prior to the commencement of remedial works, the environmental and asbestos management controls documented in the CEMP and AMP are to be implemented.

Controls should include, but are not limited to, the following:

- In the event that asbestos-contaminated soils are encountered, asbestos works notification and management controls;

- Sediment/erosion management;
- Identification of temporary stockpiling locations;
- Dust emission controls, including fugitive fibre emission controls in the event that asbestos-contaminated soils are encountered;
- Reference to health and safety management including provisions for personal protective equipment;
- Stockpile management;
- Material tracking and disposal;
- Limits on site access to remediation/ encapsulation areas and managing access tracks;
- Noise, odour and vibration controls; and
- Monitoring requirements.

9.6 Step 5 – Remediation Works

The remediation process will be carried out by the Principal Contractor and will include excavation of material that requires remediation.

Pre-excavation works should include:

- Clear demarcation of the areas requiring additional remedial excavation; and
- Implementation of health and safety / environmental controls as specified within the HASP and CEMP (and AMP if required) prepared for the works. It should be noted that all remediation works including excavations, stockpiling, material handling and transportation is to be undertaken in accordance with the HASP and CEMP (and AMP if required) prepared for the works.

The expected remedial excavation and material handling requirements are outlined within **Table 9-2.**

Table 9-2 Remedial Excavation and Material Handling Requirements

Work Stage	Required Scope of Works / Methodology
Excavation Works	The following should be undertaken following the identification of material required to be remediated: ■ Carefully excavate impacted materials using appropriate equipment (e.g., excavators) from the areas requiring remediation. Works are to be conducted in accordance with the HASP and CEMP. Asbestos works, if required, are to be conducted in accordance with the AMP. ■ To reduce the area of disturbed material, the number of areas subject to remedial excavation works at any one time should be minimised. ■ Materials should be excavated and placed directly into a truck for transport to: - Suitably licensed waste facilities, or the asbestos-contaminated soils containment area at the USC AWRC plant site, in the event that in situ classification has been completed previously; or - The designated temporary stockpiling location at the relevant construction support site within the Pipelines Alignment in the event that in situ classification has not been completed previously.
Temporary Stockpiling	■ Environmental controls should be implemented at the designated temporary stockpiling location to minimise potential exposure risks to site workers during temporary stockpiling activities. Controls may include, but not limited to, wetting stockpiles with water and covering temporary stockpiles with HDPE liner. ■ Where temporary stockpiles are required, all relevant management controls detailed within **Section 9** should be implemented. Following removal of temporary stockpiles, validation of stockpile footprints is to be undertaken as per **Section 10.1.2**.

9.7 Step 6 – Validation

9.7.1 Imported Materials

Where imported fill is required at the Pipelines Alignment for reinstatement of excavations, only material certified by John Holland (with the involvement of the Environmental Consultant) as VENM, ENM or natural quarried product is expected to be imported to the Pipelines Alignment for this purpose.

It is expected that other materials may be required for specific engineering/landscaping purposes from time to time, including ballast, aggregates and landscape growing media. These materials may be classified as VENM, ENM or under the NSW EPA's resource recovery framework (i.e., Resource Recovery Orders and Exemptions).

9.7.1.1 Requirements for All Imported Materials

The Environmental Consultant is required to observe all materials as they are imported to the Pipelines Alignment and document such observations for inclusion in the SVR. The observations will include visual assessment to confirm that the imported material is consistent with the documentation provided by the source site and that the material does not contain the following:

- building waste or other foreign materials (unless specifically allowed under a Resource Recovery Order and Exemption);
- asbestos;
- staining and/or discoloration;
- odours;
- evidence of potential or actual acid sulfate soils; and
- other evidence of contamination.

In the event that imported material is not consistent with the documentation provided from the source site or there is evidence of acid sulfate soils or contamination, the material should be immediately rejected and treated as an unexpected find and managed in accordance with **Section 12.3**.

The Environmental Consultant is to prepare a document, such as an Imported Material Review Record, which indicates that the Environmental Consultant is satisfied that the imported material is suitable for use within the Pipelines Alignment. These records will be included in the SVR.

9.7.1.2 VENM Import Requirements

Material proposed to be imported to the Pipelines Alignment as VENM is required to be accompanied by an appropriate VENM report which meets NSW EPA requirements for VENM classification. If appropriate documentation is available for a proposed VENM source, a source site inspection and additional sampling and laboratory analysis will not be required prior to import.

The VENM certificate should include a summary of the history of the source site, a review of the Pipelines Alignment setting in relation to potential migration of contamination onto the source site from surrounding areas, the findings of any environmental site investigations undertaken at that site and the results of any laboratory analyses undertaken.

If the VENM certificate does not meet these requirements, or if otherwise required by John Holland (in consultation with the Environmental Consultant), the source site is required to be visited by the Environmental Consultant for inspection and to enable collection and analysis of soil samples as described in **Section 6.1.2.**

Regardless of whether additional source site inspection and/or sampling and laboratory analysis is required, the John Holland/Environmental Consultant review of the proposed source documentation must be recorded and kept for inclusion in the SVR at the completion of the remediation program.

9.7.1.3 ENM Import Requirements

Material proposed to be imported to the Pipelines Alignment as ENM is required to be accompanied by an appropriate ENM report which meets NSW EPA requirements for ENM classification, including the requirements set out in the Excavated Natural Material Order 2014. If appropriate documentation is available for a proposed ENM source, a source site inspection and additional sampling and laboratory analysis will not be required prior to import.

If the ENM documentation does not meet these requirements, the source site is required to be visited by the Environmental Consultant for inspection and to enable collection and analysis of samples, as described in **Section 6.1.2.**

Regardless of whether additional source site inspection and/or sampling and laboratory analysis is required, the John Holland/Environmental Consultant review of the proposed source documentation must be recorded and kept for inclusion in the SVR at the completion of the remediation program.

9.7.1.4 Recycled Material Import Requirements

If fill material other than VENM or ENM is proposed to be imported to the Pipelines Alignment, it will require a Resource Recovery Order and Exemption issued by the NSW EPA. Any recycled materials proposed to be imported will be subject to the following requirements:

- the recycled material must be provided by a facility licensed by the NSW EPA to process and provide such material, the source of the material must be well understood and a product report/certificate must be provided by the facility clearly stating that the material complies with the relevant Resource Recovery Order, including sampling and laboratory analysis at a NATA-accredited laboratory in accordance with the Resource Recovery Order;
- in the event that EPRM, recovered aggregate or similar material is provided by a construction site, a classification report must be provided by the generator clearly stating that the material complies with the relevant Resource Recovery Order, including sampling and laboratory analysis at a NATA-accredited laboratory in accordance with the Resource Recovery Order; and
- regardless of the requirements of applicable Resource Recovery Orders, asbestos analysis must be undertaken on the material by a NATA-accredited laboratory at a frequency that sufficiently demonstrates that the material does not contain asbestos (this is expected to be reviewed by the Environmental Consultant on a case-by-case basis).

In the event that recycled material is not accompanied by appropriate documentation from the supplier as summarised above, the source of the material is not well understood, or the results of sampling and laboratory analysis are insufficient, the material may be rejected or subjected to additional inspection and laboratory analysis prior to importation to the Pipelines Alignment. If this occurs, samples are to be collected at a rate of 1 sample per 25 m^3 and submitted for laboratory analysis for a range of potential contaminants, as described in **Section 6.1.2.**

9.7.2 Material Tracking

During remediation works, materials will be handled during excavation and placement of impacted materials, offsite waste disposal, and importation (where necessary) of cover materials.

A Material Tracking Register will be maintained onsite which will provide information regarding the source, characteristics, destination and quantities of material placed within the placement location, disposed offsite or imported to the Pipelines Alignment for capping / backfilling purposes.

9.7.3 Remediation Validation

To confirm the completion of remediation works detailed above, remediation validation activities will be required. The Validation Sampling and Analysis Quality Plan (VSAQP) for remediation validation activities is provided within **Section 10** of this RAP.

9.7.4 Validation Reporting

The SVR will be compiled by the Environmental Consultant following completion of the remediation and validation program. The SVR will include the scope, methods, results and conclusions of the remediation program in accordance with the requirements of *Consultants reporting on contaminated land, Contaminated Land Guidelines* (NSW EPA, 2020) and any project-specific approval condition requirements. In the event that remediation is not required, the reporting will comprise a Materials Classification Report or similar, following discussion with John Holland, Sydney Water and the Site Auditor.

This report will contain an overview of the remediation activities conducted within the Pipelines Alignment, including details of the following:

- Materials tracking:
  - Volumes and characterisation of excavated material and location of excavations. The Environmental Consultant will describe and document the nature of the material being excavated during excavation activities;
  - Volumes and locations of stockpiled material; and
  - Volumes of soil reinstated into excavations and disposed offsite.
- Figures showing sampling locations;
- Analytical results of soil validation samples (where required);
- Survey details, where applicable;
- Figures showing placement of asbestos-contaminated materials at the AWRC plant site (where required);
- A post-remediation CSM; and
- A statement that the remediated areas within the Pipelines Alignment have been rendered suitable for the ongoing land use following completion of construction.

Supporting factual evidence will be included in the report inclusive of illustrative figures. This will include surveys of excavation areas and placement locations, NATA-registered laboratory analysis certificates, imported material documentation, landfill disposal certificates (if material is transported offsite), interpretative summary tables and an overview of the works carried out during the remediation program.

The conclusions regarding site suitability will apply to both the remediated (excavated) areas and any other areas used for temporary stockpiling (if any).

In the event that asbestos-containing soils from the Pipelines Alignment are transported to the USC AWRC site's asbestos containment area, materials classification and tracking information will be included within the Pipelines Alignment SVR. Completion of the marker and capping layers at the USC AWRC site's asbestos containment area will be documented in the USC AWRC's SVR or an addendum to that SVR (dependent on timing for completion of other works at the USC AWRC site). A LTEMP for the USC AWRC site's asbestos containment area will be prepared separately, inclusive of the asbestos-containing material placed in that area from the USC AWRC site as well as the Pipelines Alignment.

9.8 Step 7 – Demobilisation

Following completion of remediation and validation works, all plant, machinery and amenities that were utilised for the purposes of the remediation and validation works will be removed.

Environmental controls such as silt fencing and any other general rubbish will also be removed from the Pipelines Alignment.

The Environmental Consultant will inspect the Pipelines Alignment following completion of the remediation and validation works and subsequent demobilisation.

10. VALIDATION SAMPLING AND ANALYSIS PLAN

10.1 Extent of Validation

10.1.1 Excavations

The extent of validation required was not yet confirmed at the time of writing; however it is expected to be required at the Farm Dam and AEC8 asbestos-impacted areas described in **Section 7.2** at a minimum. The expected remediation approach, and the associated validation extent, is based on the likely COPCs expected to be encountered based on the setting and history of the Pipelines Alignment and the construction methodology for the pipelines. The validation approach may be altered on the basis of data collected during the investigation undertaken in accordance with the Pipelines AECs SAQP, subsequent investigations for in situ materials classification, unexpected finds and observations made during the remediation and validation program.

The validation plan for remedial excavations is presented in **Table 10-1** and **Table 10-2** below.

Table 10-1 Soil Excavation Validation Plan (General)

Locations	Number of Samples	Laboratory Analysis
Base	Minimum of one sample per 10 m by 10 m grid	Dependent on the remediation driver (i.e., COPCs) Where asbestos is a COPC: Refer to **Table 10-2**
Walls	Minimum of one sample from each wall per 10 lineal meters. Where the excavation is greater than 2 m depth, validation samples are to be collected from the upper 2 m (i.e., 0-2 m) and the lower 2 m (i.e., 2-4 m) of each excavation wall	

Where the results of the validation indicate that residual contamination remains, the excavation will be further excavated and re-validated at the following rate:

- one sample per wall and base, or one sample per 10 lineal meters, whichever is greater; and
- one sample at each sampling point from each 2 m depth interval (i.e., 0-2 m, 2-4 m, etc.).

Excavation work will not be undertaken outside of the approved boundaries of the Project.

Validation works will be performed with reference to the Data Quality Objectives presented in **Appendix B**.

In the event that asbestos within fill materials is driving the requirement for remediation and available investigation data for the area is sufficient to rule out other CoPCs, the validation procedures outlined in **Table 10-2** will be undertaken.

Table 10-2 Validation Requirements (Asbestos Only)

Area / Material	Remediation Approach	Validation Approach	Required Analysis	Sample Frequency Requirements
ACM Impacted Fill Materials	■ Complete excavation exposing natural materials	■ Visual assessment of excavation surface on a systematic basis for asbestos by the Environmental Consultant and licenced asbestos assessor.	■ Not Applicable (NA) -where natural material is confirmed at the base of excavation works.	■ NA
	■ Excavation with residual fill remaining in-situ	■ Residual fill materials will be assumed to be impacted by asbestos unless validated as otherwise.	■ Asbestos - Asbestos sampling and analysis will be undertaken in accordance with NEPC 2013/DoH 2009 requirements and includes gravimetric analysis for asbestos.	■ Validation sampling from the excavations at a density of 1 sample per 10m x 10m grid.
Areas Beneath Temporary Stockpiled Asbestos Containing Materials (Outside of the Placement Location) And Haul Roads	■ Removal of stockpiled materials, exposing natural materials	■ Visual assessment of excavation surface on a systematic basis for asbestos by the Environmental Consultant and licenced asbestos assessor.	■ Not Applicable (NA) - where natural material is confirmed at the base of excavation works.	■ NA
	■ Removal of stockpiled materials, exposing fill materials	■ Residual fill materials will be assumed to be impacted by asbestos unless validated as otherwise.	■ Asbestos - Asbestos sampling and analysis will be undertaken in accordance with NEPC 2013/DoH 2009 requirements, and includes gravimetric analysis for asbestos.	■ Validation sampling from the stockpile footprint at a density of 1 sample per 50 m².

10.1.2 Stockpile Footprints

Validation sampling of near-surface soils within the footprint of stockpiles generated as part of the remediation program will be carried out to assess whether contamination of the ground surface has occurred.

Where appropriate ground covering (geofabric and/or plastic) is not present, stockpile footprints will be validated through the collection and analysis of approximately one sample per 50 m^2, or part thereof. Validation samples will be analysed for the analytes outlined in **Table 10-1** and **Table 10-2**.

Where stockpiling is carried out on hardstand, validation sampling will not be required.

10.2 Validation Methodology

Samples will be collected in accordance with the methodology outlined in **Table 10-3**.

Table 10-3 Sampling Methodology

Media / Location	Sample Collection Methodology	Analytical Suite	Sample Container	Limit of Reporting (LOR) (mg/kg)
Soil	Grab sample from excavator bucket or excavation face	Dependent on the remediation driver (i.e., COPCs)	Laboratory supplied glass jar with Teflon-lined plastic lid	Dependent on the remediation driver (i.e., COPCs)

Unique identifiers will be assigned to all samples according to the protocol set out in **Table 10-4**.

Table 10-4 Sample Nomenclature

Sample Type	Sample ID	Sample Description
Excavation Footprints (Soil)	B_TP01_0.5 or TW_TP01_0.5	Brine pipeline: test pit 01, sample collected at 0.5m bgl. Treated water: test pit 01, sample collected at 0.5m bgl.
Ground Surface, Including Stockpile Footprints (Soil)	B_SS01_0.05 or TW_SS01_0.05	Brine pipeline: validation sample collected from surface sampling location 01 at 0.05 m bgl Treated water: validation sample collected from surface sampling location 01 at 0.05 m bgl
Stockpiles (Soil)	STP01_05	Stockpile STP01, sample 05

10.3 Validation Criteria

10.3.1 General

Validation of remediation works will be undertaken with reference to the following guidelines:

- *National Environment Protection (Assessment of Site Contamination) Measure 1999 ('ASC NEPM')* (NEPC, 1999, as amended 2013); and
- *Health screening levels for petroleum hydrocarbons in soil and groundwater, Part 2: Application document, CRC CARE Technical Report no. 10* (CRC CARE, 2011).

It is noted that the exceedance of Tier 1 assessment criteria does not indicate remediation is necessarily required. The decision on whether remediation is required (and to what extent) should be based on a site-specific assessment. Additionally, concentrations marginally exceeding the adopted assessment criteria do not imply unacceptability or that a significant risk to human health is present.

Where NSW EPA endorsed screening levels are not available for a contaminant of concern, international guidelines will be referenced where applicable in accordance with the hierarchy of data sources presented in the ASC NEPM and/or the reported contaminant concentration will be assessed on a case-by-case basis with respect to the risk to identified receptors.

Validation of materials proposed for beneficial reuse within the Project boundaries was described in **Section 6.2**.

10.3.2 Rationale for Selection of Validation Criteria

Selection of appropriate soil validation criteria was largely based on the planned future use of the Pipelines Alignment for non-sensitive commercial / industrial purposes following pipeline construction. Given that the general underlying geology is variable over the Pipelines Alignment, a conservative approach has been adopted whereby the soil type utilised for the derivation of human health and ecological screening levels was sand.

10.3.3 Soil Validation Criteria

Validation criteria applicable to the assessment of soil include:

- ASC NEPM Health Investigation Levels (HIL);
  - HIL D (Commercial/Industrial);
- ASC NEPM Health Screening Level (HSL);
  - HSL D (Commercial/Industrial);
- ASC NEPM Management Limits;
  - Commercial / Industrial;
- ASC NEPM Ecological Investigation Level (EIL);
  - Commercial/Industrial;
- ASC NEPM Ecological Screening Level (ESL);
  - Commercial/Industrial;
- CRC CARE (2011) Soil Health Screening Levels for Direct Contact;
  - HSL D (Commercial/Industrial); and
  - Intrusive Maintenance Worker.

In the event that additional COPCs are encountered through investigation or unexpected finds, they will be assessed against screening levels derived from the above sources and requirements for remediation determined.

10.3.4 Aesthetic Criteria

The ASC NEPM requires the consideration of aesthetic issues (as a result of contamination) arising from soils within the Pipelines Alignment; therefore the following criteria will be adopted when considering soil aesthetics:

- No highly malodourous soils, taking into consideration the natural state of the soil at the Pipelines Alignment;
- No staining or discolouration in soils, taking into consideration the natural state of the soil; and
- No large or frequently occurring anthropogenic materials present (to the extent practicable).

10.3.5 Application of Validation Criteria

Validation of soils will be considered to have been achieved when laboratory analytical results are reported below the validation criteria, thereby not posing an unacceptable risk. For laboratory analytical results, the following statistical criteria shall be adopted with respect to the validation criteria:

- The 95% Upper Confidence Limit (UCL) of the arithmetic mean for chemical contaminants does not exceed the validation criteria;

- The individual contaminant concentration does not exceed the validation criterion by more than 250%; and
- The standard deviation of individual contaminants does not exceed 50% of the validation criteria.

10.4 Imported Material Criteria

Imported material assessment criteria will be in accordance with the appropriate NSW EPA Resource Recovery Orders and Exemptions (for recycled materials), NSW EPA (2014) Waste Classification Guidelines: Part 1: Classifying Waste (for VENM) or the NSW EPA (2014) Excavated Natural Material Order 2014 (for ENM).

VENM, ENM and/or recycled material sampling will be undertaken in accordance with the above guidelines and the procedures described in **Section 9.7.1.**

The imported VENM would be considered appropriate for import based on the following acceptance criteria based on the analytical results obtained for the material:

- Metals are representative of natural background conditions (if detected); and
- Organic contaminants are below the laboratory limit of reporting.

The imported ENM would be considered appropriate for import based on the ENM / Other Fill Material analytical results adhering to the criteria outlined in Table 4 of the NSW EPA Excavated Natural Material Order 2014 Maximum Average Concentration for Characterisation limits.

10.5 Waste Classification Criteria

The characterisation of materials for off-site disposal/reuse or recovery will be completed in accordance with:

- *Waste Classification Guidelines* (NSW EPA, 2014a); and
- *Protection of the Environment Operations Act 1997* (NSW) and associated regulations.

Where surplus material is suitable for reuse under a resource recovery exemption, characterization will be completed in accordance with:

- *Excavated Natural Material Order* (NSW EPA, 2014b); or
- Other relevant resource recovery orders, resource recovery exemptions and approvals issued by the NSW EPA, as applicable.

11. SITE ENVIRONMENTAL MANAGEMENT PLAN

11.1 General

The Principal Contractor will be responsible for control of the Pipelines Alignment during remediation works.

The Principal Contractor will be responsible for preparing Remediation Work Method Statements (RWMS) that address environmental, health and safety hazards, and risks during the remediation. The RWMS shall address, but may not be limited to, the issues and controls presented in the following subsections.

11.2 Health and Safety

The Principal Contractor will prepare a project-specific health and safety plan for the remediation program. This plan shall identify the potential risks associated with the works and detail the health and safety measures and procedures that are to be adopted to protect both on-site workers and the general public.

11.2.1 Hours of Operation

Working hours for any on-site remedial works would be agreed by John Holland in consultation with each local Council, but it is envisaged the likely hours would be as follows:

Mondays to Fridays	7:00 am to 5:00 pm
Weekends and Public Holidays	No Work Expected

11.2.2 Contact Details

Principal Contractor / Remediation Contractor	John Holland Aidan O'Driscoll M: 414 945 464 E: Aidan.o'driscoll@jhg.com.au
Environmental Consultant	ERM Joe Ferring M: +61 424 970 468 E: Joseph.Ferring@erm.com
Asset Owner	Sydney Water Cheryl Cahill M: +61 456 666 573 E: CHERYL.CAHILL@sydneywater.com.au
Site Auditor	Andrew Lau JBS&G Pty Ltd M: 0412 512 614 E: alau@jbsg.com.au
NSW EPA	T: 131 555
SafeWork NSW	T: 13 10 50

The health and safety plan, incorporating the RWMS, will outline plans to respond to incidents associated with the works (e.g. fires, spills or other uncontrolled releases).

As part of site induction procedures, all employees, subcontractors and visitors to the Pipelines Alignment will be made aware of the emergency protocols in place.

11.2.3 Site Access and Site Security

Access to the Pipelines Alignment will be restricted to authorised staff and contractors who have been inducted and appropriately trained for the works being undertaken. Fencing will be installed and maintained around the perimeter of the Pipelines Alignment when work is active and the remediation area will also be secured from unauthorised entry.

Signage, including site contact details, will be erected near the Pipelines Alignment entry gate. The signage will remain displayed at the entrance throughout the duration of the remediation works.

All heavy vehicle access and egress from the Pipelines Alignment should follow a designated heavy vehicle route specified by John Holland. As a minimum, the following traffic control measures will be implemented:

- All streets along the designated heavy vehicle route will be kept free from detritus material sourced from the Pipelines Alignment during the course of the project. A representative of John Holland will, on a daily basis, monitor the roadways leading to and from the Pipelines Alignment, and take steps to clean any adversely impacted pavements;
- Materials such as soil, mud, earth or similar tracked onto the driveways will be removed by means such as sweeping and shovelling, but not washing; and
- Vehicles carrying impacted materials should have covered loads and adhere to the relevant speed limits. Washdown of trucks carrying impacted soils should be undertaken prior to trucks departing the Pipelines Alignment (i.e., driving on public roads following site works).

11.2.4 Personal Protective Equipment

All workers will be provided with and will use the appropriate personal protective equipment (PPE).

When working in, or visiting, designated remediation areas of the Pipelines Alignment, the minimum level of PPE required will include hard hats, disposable overalls, boots (steel toe cap), work gloves and eye protection.

All PPE shall conform to approved standards.

First aid and safety equipment, including fire extinguishers, will be provided within restricted zones for use in an emergency. In addition, reflective high visibility clothing shall be provided and worn on-site at all times.

11.2.5 Asbestos Management Plan

Where asbestos is identified as a contaminant of concern that requires remediation, prior to the commencement of works, an AMP for the remediation works is to be prepared by the Environmental Consultant and reviewed / endorsed by the Site Auditor. The AMP shall meet requirements of SafeWork NSW codes of practice for working with and removing asbestos.

The AMP should be developed in consideration of site-specific risks and proposed development works, but should consider the following:

- The location and extent of asbestos within the Pipelines Alignment;
- Existing asbestos register (if relevant);
- Site-specific risks;
- Site-specific control measures and safe work method statements;
- Procedures for the stockpiling, transport and handling of asbestos impacted materials;

- Monitoring requirements;
- Roles and responsibilities;
- Emergency response procedures; and
- Training requirements.

11.2.6 Training

All site personnel shall be informed and appropriately trained through an induction procedure in relation to the potential site hazards. Site-specific training requirements will be developed by John Holland and will include operational safety and first aid requirements.

11.3 Erosion and Sediment Control

A site-specific erosion and sediment control plan will be developed by John Holland under the CEMP. The plan will show the location of sediment control devices as required based on remediation works to be undertaken and the following should be considered:

- Sediment control;
- Clean water diversions; and
- Stormwater drain protection.

Sediment and clean water diversion control measures (i.e. silt fencing, hay bales, gravel bags etc.) should be strategically placed at the following locations:

- Down-gradient of temporary stockpiles;
- Up-gradient of temporary stockpiles to redirect water; and
- Down-gradient of any surrounding stormwater channels that flow within / through the Pipelines Alignment as a contingency against overflow into bunded stockpile locations.

Erosion and sediment control measures will be inspected at the start of each day during remediation works and also during and immediately following periods of heavy rainfall to ensure they are in good condition.

For the remaining remediation area, erosion and sediment control will be maintained, as applicable, by ensuring silt fences are upright and securely fixed, and that any sediment or residue behind the fence or barrier is removed and disposed appropriately to maintain retention capacity of the structure.

The area of exposed surfaces at any one time will be minimised through controlled sequencing of works and progressive excavation and restoration.

Where control measures are found to be damaged or defective, the issue will be reported to John Holland to arrange for repair or modification.

11.4 Stockpile Management

The following management measures should be undertaken:

- Stockpiles will be designated and handled to ensure that excavated material is properly tracked and classified to avoid mixing of different classes of waste from occurring;
- Where possible, to assist in efficient classification and off-site disposal, less impacted soils will be segregated from those which have visual or olfactory indicators of contamination;
- Stockpiles will be bunded with sediment control barriers to mitigate runoff from the stockpile areas to surrounding areas;

- Stockpiles will be positioned and formed to minimise potential for stockpile erosion where possible; and
- If stockpiles are identified to contain asbestos, they should be covered with plastic or geofabric during temporary storage. Wetting may also be necessary to manage potential for dust generation.

11.5 Haulage of Soils

Soil must not be tracked from the Pipelines Alignment as a result of vehicle, plant and equipment movements. To limit the potential for tracking of soil or sediment off-site via vehicle, plant or equipment movement, the following controls should be implemented:

- Vehicle, plant and equipment use on the Pipelines Alignment will be kept to a practical minimum; and
- Plant and equipment will be cleaned to remove loose soil/dust before it leaves the Pipelines Alignment.

Any vehicles carrying soil materials for off-site treatment or disposal will be covered in accordance with good industry practice, prior to leaving the Pipelines Alignment.

In the event that asbestos-contaminated soils from the Pipelines Alignment are transported to the USC AWRC site's asbestos containment area, procedures for preventing cross-contamination will be outlined within an Asbestos Management Plan prepared for the Pipelines Alignment. These procedures are expected to include, but may not be limited to, the following items:

- Establishment of asbestos work areas, including access restrictions such as fencing and signage;
- Dust suppression measures within asbestos work areas;
- Establishment of a decontamination area for each asbestos work area;
- Establishment of transportation routes from the Pipelines Alignment to the USC AWRC site;
- Establishment of 'clean' loading zones for trucks within the asbestos work areas; and
- Use of dedicated equipment within asbestos work areas, and decontamination of that equipment prior to exiting the asbestos work area.

11.6 Noise Controls

Noise-producing machinery and equipment will only be operated during working hours as approved by the local Council and/or NSW EPA. Australian Standard AS2436-2010 *Guide to noise control on construction, maintenance and demolition sites,* outlines guidelines for the minimisation of noise on construction and demolition sites which are to be followed at all times.

No 'offensive noise' as defined under the *POEO Act* 1997 should be created during remediation works/activities.

Mechanical plant, equipment and the like used during remediation works/activities will use practical and reasonable noise attenuating devices and measures to minimise noise being transmitted from the Pipelines Alignment. All equipment and machinery must be properly maintained and operated in an efficient manner to minimise the emission of noise. Plant and equipment shall be switched off or throttled to a minimum when not in use.

11.7 Odour and Dust Control

Controls to minimise dust and odour emissions from the Pipelines Alignment may include:

- Use of odour neutralising or suppressant sprays. If strong odour is noticed on or off the Pipelines Alignment, work will cease and odour sources will be covered (and treated, if necessary) until the odour dissipates; and
- Covering contaminated excavation faces and/or stockpiles with synthetic barriers or wetting down during periods of high wind.

11.8 Communication and Complaints

Where complaints are made directly to John Holland, on-site workers or subcontractors, this will be recorded on a complaint register. Where complaints are received by Sydney Water or other stakeholders, these would be communicated back to the Principal Contractor via the usual communication channels (e.g. email, phone, site meetings, etc.).

Separate incident reporting will also be completed for complaints relating to environmental issues, which may include pollution arising from the works. Monitoring and/or corrective actions will be taken as soon as possible depending on the nature of the complaint and followed up on the incident report. The Principal Contractor will report to the local Council as soon as practicable following an incident.

12. CONTINGENCY PLAN

The purpose of the contingency plan is to identify unexpected situations that could occur, to specify procedures that can be implemented to manage such situations and to prevent adverse impacts to the environment and human health should these situations occur.

12.1 General Contingency

The conditions that may be encountered when excavating are uncertain. As unknown and variable sub-surface conditions impose a degree of uncertainty for the project, a set of anticipated conditions has been assumed in developing the excavation plan. However, because field conditions may vary, flexibility has been built into the excavation plan to adapt to differing conditions.

The conditions that can reasonably be expected, the resulting problems they may cause, and how these problems may be resolved within the context of the excavation program have been summarised below:

Table 12-1 Potential Project Risks

Anticipated Project Risks	Corrective Action
Chemical spill / exposure	■ Stop work, refer to Health and Safety Plan and immediately contact the John Holland Pipelines Alignment Supervisor.
Excessive rain	■ Cover those working areas not located under cover, where possible, with plastic sheeting during off-shifts. Inspect and maintain sediment controls and filter fences in accordance with the RWMS and the CEMP.
Excessive drainage	■ Minimise active/contaminated work area, improve diversion of clean run-on; maintain sufficient onsite wastewater storage capacity, or mobilise additional storage and/or treatment systems as needed.
Excessive dust	■ Use water sprays, biodegradable dust sprays, cease dust-generating activity until better dust control is achieved, or apply interim capping systems. ■ If necessary, install dust deposition gauges prior to and during works to monitor the effectiveness of dust controls implemented onsite.

Anticipated Project Risks	Corrective Action
Excessively wet materials	■ Stockpile and dewater onsite or add absorbents.
Equipment failures	■ Maintain spare equipment or parts, maintain alternative rental options; or shut down affected operations until repairs are made.
Release of fuel/oil from machinery	■ Remove source, use absorbent booms to remove oil and make any repairs and clean-up as required. If necessary, implement temporary measures until booms can be deployed; (e.g. earth embankments) to prevent movement of spilled liquids into water courses. Soil remediation, undertaken in accordance with the procedures outlined in this RAP, may be required to address spills. ■ Appropriate numbers of suitable spill kits are to be located in the work zone.
Silt fence fails	■ Stop work and repair fence to specifications.
Excessive noise	■ Identify source and review noise attenuation equipment and as necessary provide silencers on noisy equipment.
Asbestos-contaminated soils from the Pipelines Alignment exceed storage capacity at the USC AWRC containment area	■ Asbestos-contaminated soils requiring remediation within the Pipelines Alignment have been identified at the Farm Dam site and AEC8 as discussed in **Section 7.2**. Remediation of these areas will be undertaken in accordance with this RAP. The footprint and capacity of the containment area at the USC AWRC has been designed to allow for some flexibility in the event that significant additional volumes of asbestos-contaminated soils are encountered within the Pipelines Alignment. ■ In extreme cases, off-site disposal of asbestos-contaminated soils at suitably licensed facilities can also be undertaken after all other options have been ruled out.
Excavated materials fail classification requirements for beneficial reuse (either within the Project boundary or off-site under Resource Recovery Orders)	■ Asbestos-contaminated soils can be placed within the containment area at the USC AWRC. ■ Soils contaminated with other COPCs can be classified for off-site disposal at suitable licensed facilities after all other options have been ruled out.

12.2 Remediation Contingency

If there are events or discoveries made at the Pipelines Alignment that would prevent the proposed works conforming to the validation criteria, or if the selected remediation strategy is unable to proceed or is unsuccessful, then the following contingencies should be considered and discussed with relevant stakeholders prior to implementation:

SCENARIO 1: Excavation does not effectively remove all contaminated material:

Option A	Continue controlled excavation until validation of excavation(s) is achieved.
Option B	Reassessment of remedial options for excavated materials.

SCENARIO 2: Treatment is required to facilitate disposal of excavated soil to landfill:

Option A	Identify and implement appropriate treatment strategy in consultation with relevant stakeholders to facilitate off-site disposal of excavated soil to landfill.
Option B	Reassessment of remedial options for excavated materials.

12.3 Unexpected Finds

In addition to the above listed contingencies, the following steps are required to be undertaken should unexpected finds such as stained or odorous materials, buried drums or tanks, or suspected impacted materials be discovered during the remediation works.

In the event that unexpected finds of impacted materials or items are encountered, the Unexpected Finds Procedure for Contamination outlined in the existing Construction Environment Management Plan (CEMP) is to be followed. This procedure is provided in **Appendix C** of this RAP.

Additional environmental and occupational safety controls may be required in the event of unexpected finds as follows:

- Upgrade of personal protective equipment (PPE), for workers within the active work zone, in accordance with the Health and Safety Plan;
- Segregation and bunding of impacted material/items;
- Use of odour suppressants (where appropriate);
- Covering of the impacted material/items with plastic sheeting (where appropriate/possible);
- Appropriate sampling and analysis to assess potential contaminants; and
- Appropriate treatment and/or disposal of the materials/items following receipt of laboratory analytical results and any associated regulatory approvals required.

Discussion with key project stakeholders, such as the Site Auditor and Sydney Water, should be undertaken in accordance with the Unexpected Finds Procedure.

12.3.1 Groundwater

Groundwater is not anticipated to be encountered during the pipelines construction. However, in the event that groundwater is encountered, management and off-site disposal of the groundwater will be carried out in accordance with the following:

- Based on the requirements of the waste facility proposed to receive the water, the water may be sampled to allow classification to facilitate appropriate off-site disposal;
- Appropriate erosion and sediment control measures will be implemented to minimise the potential for unauthorised discharge or runoff off-site; and
- The water will be pumped out and disposed off-site to an appropriately licensed wastewater treatment facility legally able to accept the waste.

Characterisation of groundwater, aside from the information required for dewatering and off-site disposal, is not required to achieve the purposes of this RAP.

13. CONCLUSION

This RAP was developed to provide a working plan detailing the proposed soil investigation, material classification and handling, excavation, soil stockpiling, validation and occupational health and safety and environment management strategies associated with the remediation of impacted soils at the Pipelines Alignment.

ERM considers this RAP is sufficient to provide a framework for remediation of impacted material within the Pipelines Alignment, if identified during the proposed investigation works or the construction program, which subsequently would render the Pipelines Alignment suitable for the proposed Upper South Creek Advanced Water Recycling Pipeline development following completion of remedial / validation works outlined within this RAP.

14. REFERENCES

Aurecon ARUP (2021), Upper South Creek Advanced Water Recycling Centre – Soils and Contaminated Land Impact Assessment, 27 July 2021 (“the SCLI Assessment”) (Aurecon ARUP, 2021);

ERM (2023a), Sampling and Analysis Quality Plan, Upper South Creek Advanced Water Recycling Centre, 06 June 2023 (ERM, 2023a);

ERM (2023b), Remediation Action Plan, Upper South Creek Advanced Water Recycling Centre, 29 August 2023 (ERM, 2023b);

JBS&G Australia Pty Ltd (2023), Interim Audit Advice (IAA) (0503-2307-03) – Sydney Water Corporation – Upper South Creek Advanced Water Recycling Centre – Review of the Upper South Creek Advanced Water Recycling Centre - Soils and Contaminated Land Impact Assessment, 17 March 2023 (“IAA03”) (JBS&G, 2023);

National Environment Protection Council (NEPC) (2013). National Environment Protection (Assessment of Site Contamination) Measure 1999 (ASC NEPM);

NSW EPA (2017), Guidelines for the NSW Site Auditor Scheme 3rd edition (NSW EPA, 2017);

NSW EPA (2020), Consultants reporting on contaminated land - Contaminated Land Guidelines (NSW EPA, 2020);

NSW Government (2022), Upper South Creek Advanced Water Recycling Centre – Concept and Stage 1, Conditions of Approval (NSW Government, 2022);

National Occupational Health and Safety Commission (2005), Guidance Note on the Membrane Filter Method for Estimating Airborne Asbestos Fibres 2nd Edition (NOHSC, 2005);

State Environmental Planning Policy (Resilience and Hazards) 2021;

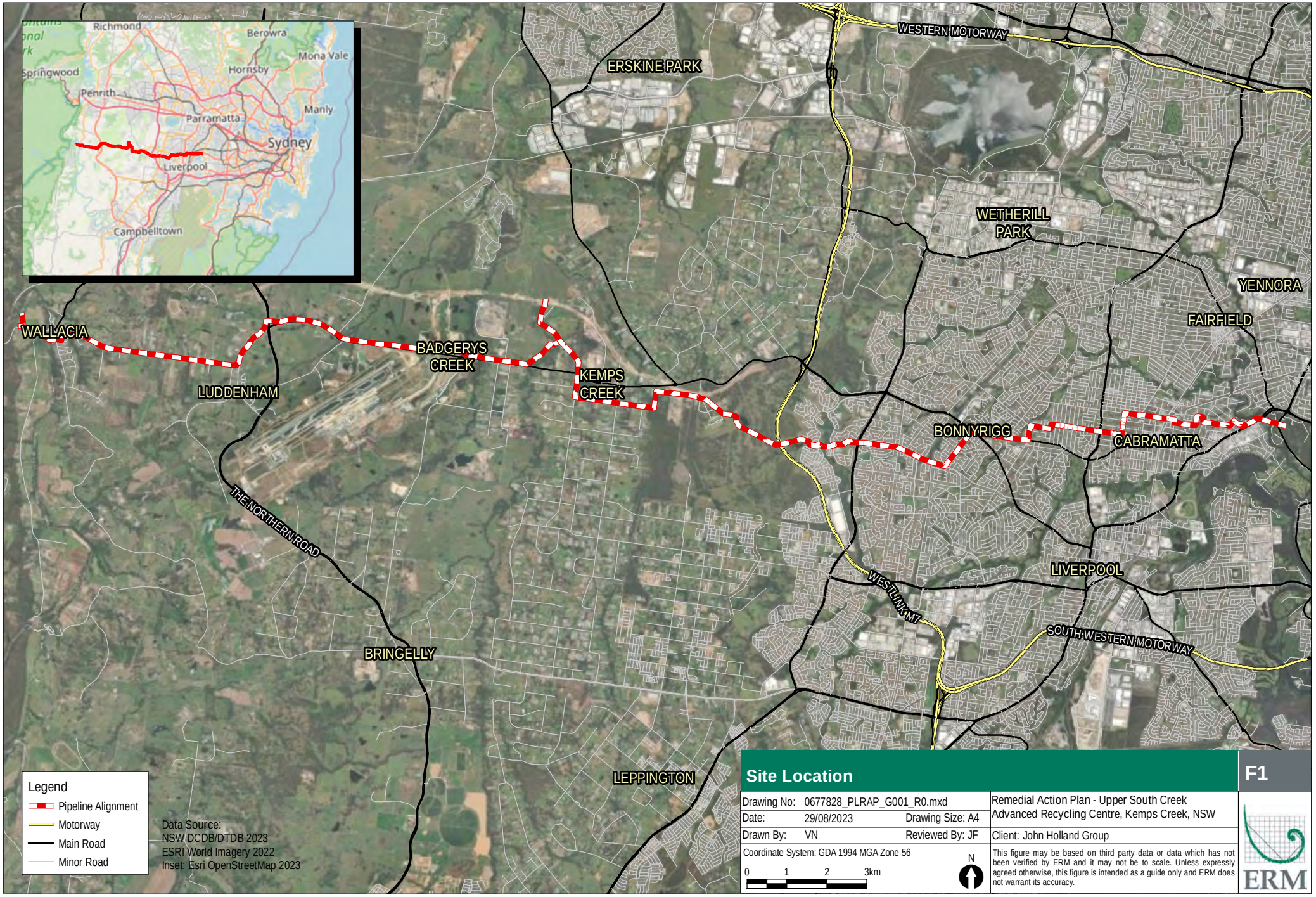
WA Department of Health (2021). Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia (WA DoH, 2021).

15. STATEMENT OF LIMITATIONS

1. This report is based solely on the scope of work as described within this RAP dated 6 March 2024 and performed by Environmental Resources Management Australia Pty Ltd (ERM) for John Holland Pty Ltd (the Client). The Scope of Work was governed by a contract between ERM and the Client (Contract).
2. No limitation, qualification or caveat set out below is intended to derogate from the rights and obligations of ERM and the Client under the Contract.
3. The findings of this report are solely based on, and the information provided in this report is strictly limited to that required by, the Scope of Work. Except to the extent stated otherwise, in preparing this report ERM has not considered any question, nor provides any information, beyond that required by the Scope of Work.
4. This report was prepared between September 2023 and March 2024 based on information collected during previous investigations as detailed within Section 4 and is based on conditions encountered and information reviewed at the time of preparation. The report does not, and cannot, take into account changes in law, factual circumstances, applicable regulatory instruments or any other future matter. ERM does not, and will not, provide any on-going advice on the impact of any future matters unless it has agreed with the Client to amend the Scope of Work or has entered into a new engagement to provide a further report.
5. Unless this report expressly states to the contrary, ERM's Scope of Work was limited strictly to identifying typical environmental conditions associated with the subject site(s) and does not evaluate the condition of any structure on the subject site nor any other issues. Although normal standards of professional practice have been applied, the absence of any identified hazardous or toxic materials or any identified impacted soil or groundwater on the Site(s) should not be interpreted as a guarantee that such materials or impacts do not exist.
6. This report is based on one or more site inspections conducted by ERM personnel, the sampling and analyses described in the report, and information provided by the Client or third parties (including regulatory agencies). All conclusions and recommendations made in the report are the professional opinions of the ERM personnel involved. Whilst normal checking of data accuracy was undertaken, except to the extent expressly set out in this report ERM:
    a. did not, nor was able to, make further enquiries to assess the reliability of the information or independently verify information provided by;
    b. assumes no responsibility or liability for errors in data obtained from, the Client, any third parties or external sources (including regulatory agencies).
7. Although the data that has been used in compiling this report is generally based on actual circumstances, if the report refers to hypothetical examples those examples may, or may not, represent actual existing circumstances.
8. Only the environmental conditions and or potential contaminants specifically referred to in this report have been considered. To the extent permitted by law and except as is specifically stated in this report, ERM makes no warranty or representation about:
    a. the suitability of the Site(s) for any purpose or the permissibility of any use;
    b. the presence, absence or otherwise of any environmental conditions or contaminants at the Site(s) or elsewhere; or
    c. the presence, absence or otherwise of asbestos, asbestos containing materials or any hazardous materials within the Pipelines Alignment.

9. Use of the Pipelines Alignment for any purpose may require planning and other approvals and, in some cases, environmental regulator and accredited Site Auditor approvals. ERM offers no opinion as to the likelihood of obtaining any such approvals, or the conditions and obligations which such approvals may impose, which may include the requirement for additional environment works.
10. The ongoing use of the Pipelines Alignment or use of the Pipelines Alignment for a different purpose may require the management of or remediation of site conditions, such as contamination and other conditions, including but not limited to conditions referred to in this report.
11. This report should be read in full and no excerpts are to be taken as representative of the whole report. To ensure its contextual integrity, the report is not to be copied, distributed or referred to in part only. No responsibility or liability is accepted by ERM for use of any part of this report in any other context.
12. Except to the extent that ERM has agreed otherwise with the Client in the Scope of Work or the Contract, this report:
    a. has been prepared and is intended only for the exclusive use of the Client;
    b. must not to be relied upon or used by any other party;
    c. has not been prepared nor is intended for the purpose of advertising, sales, promoting or endorsing any Client interests including raising investment capital, recommending investment decisions, or other publicity purposes;
    d. does not purport to recommend or induce a decision to make (or not make) any purchase, disposal, investment, divestment, financial commitment or otherwise in or in relation to the Site(s); and
    e. does not purport to provide, nor should be construed as, legal advice.

APPENDIX A FIGURES


Richmond
Berowra
Mona Vale
Springwood
Hornsby
Penrith
Manly
Parramatta
Sydney
Liverpool
Campbelltown
WESTERN MOTORWAY
ERSKINE PARK
WETHERILL PARK
YENNORA
FAIRFIELD
WALLACIA
BADGERYS CREEK
KEMPS CREEK
LUDDENHAM
BONNYRIGG
CABRAMATTA
THE NORTHERN ROAD
LIVERPOOL
WESTLINK M7
SOUTH WESTERN MOTORWAY
BRINGELLY
LEPPINGTON
Legend
Pipeline Alignment
Motorway
Main Road
Minor Road
Data Source:
NSW DCDB/DTDB 2023
ESRI World Imagery 2022
Inset: Esri OpenStreetMap 2023
Site Location
F1
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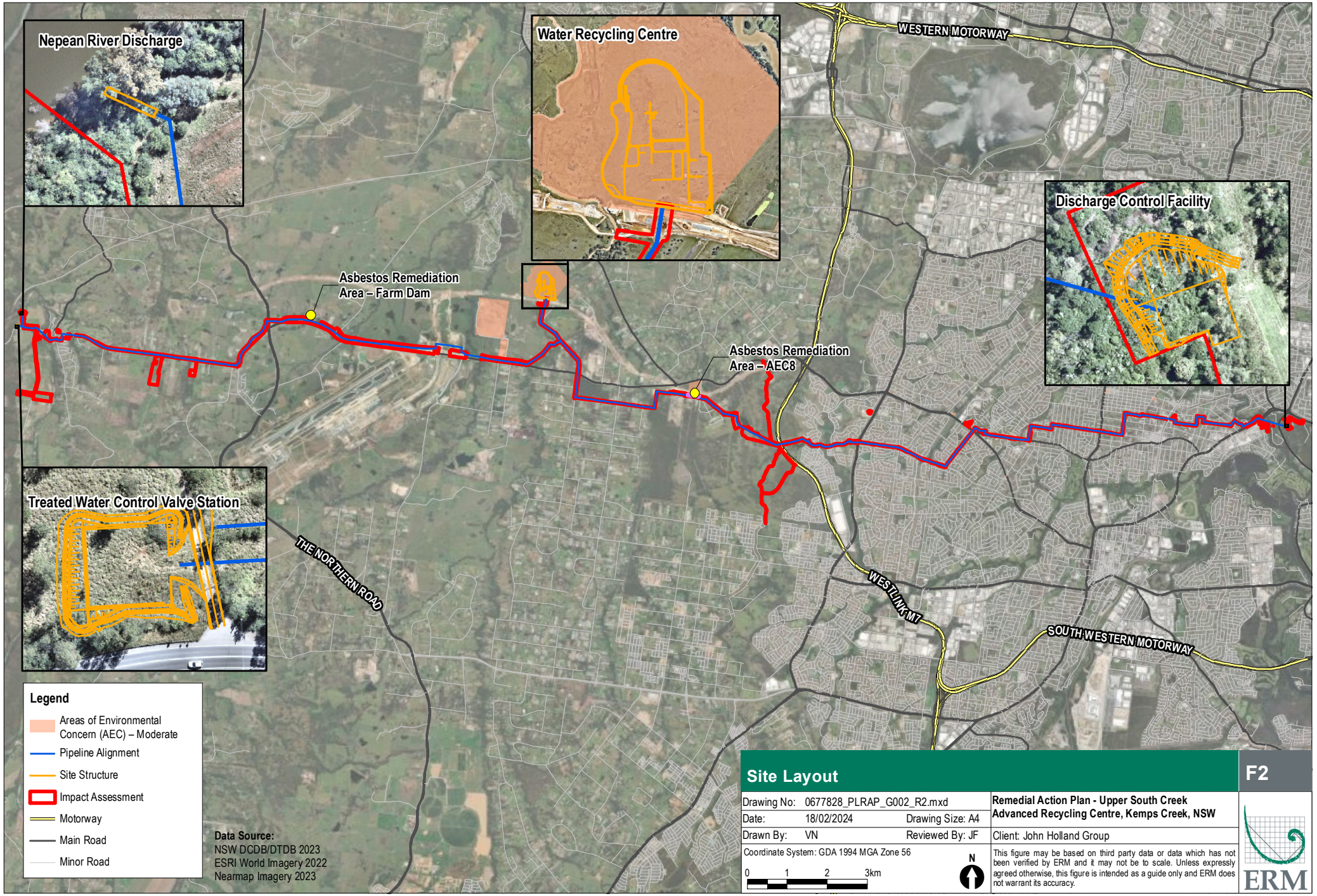
Date: 29/08/2023
Drawing Size: A4
Drawn By: VN
Reviewed By: JF
Coordinate System: GDA 1994 MGA Zone 56
0 1 2 3km
N
Remedial Action Plan - Upper South Creek
Advanced Recycling Centre, Kemps Creek, NSW
Client: John Holland Group
This figure may be based on third party data or data which has not been verified 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


Nepean River Discharge
Water Recycling Centre
Discharge Control Facility
Treated Water Control Valve Station
Asbestos Remediation Area – Farm Dam
Asbestos Remediation Area – AEC8
WESTERN MOTORWAY
THE NORTHERN ROAD
WESTLINK M7
SOUTH WESTERN MOTORWAY
Legend
Areas of Environmental Concern (AEC) – Moderate
Pipeline Alignment
Site Structure
Impact Assessment
Motorway
Main Road
Minor Road
Data Source:
NSW DCDB/DTDB 2023
ESRI World Imagery 2022
Nearmap Imagery 2023
Site Layout
F2
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Reviewed By: JF
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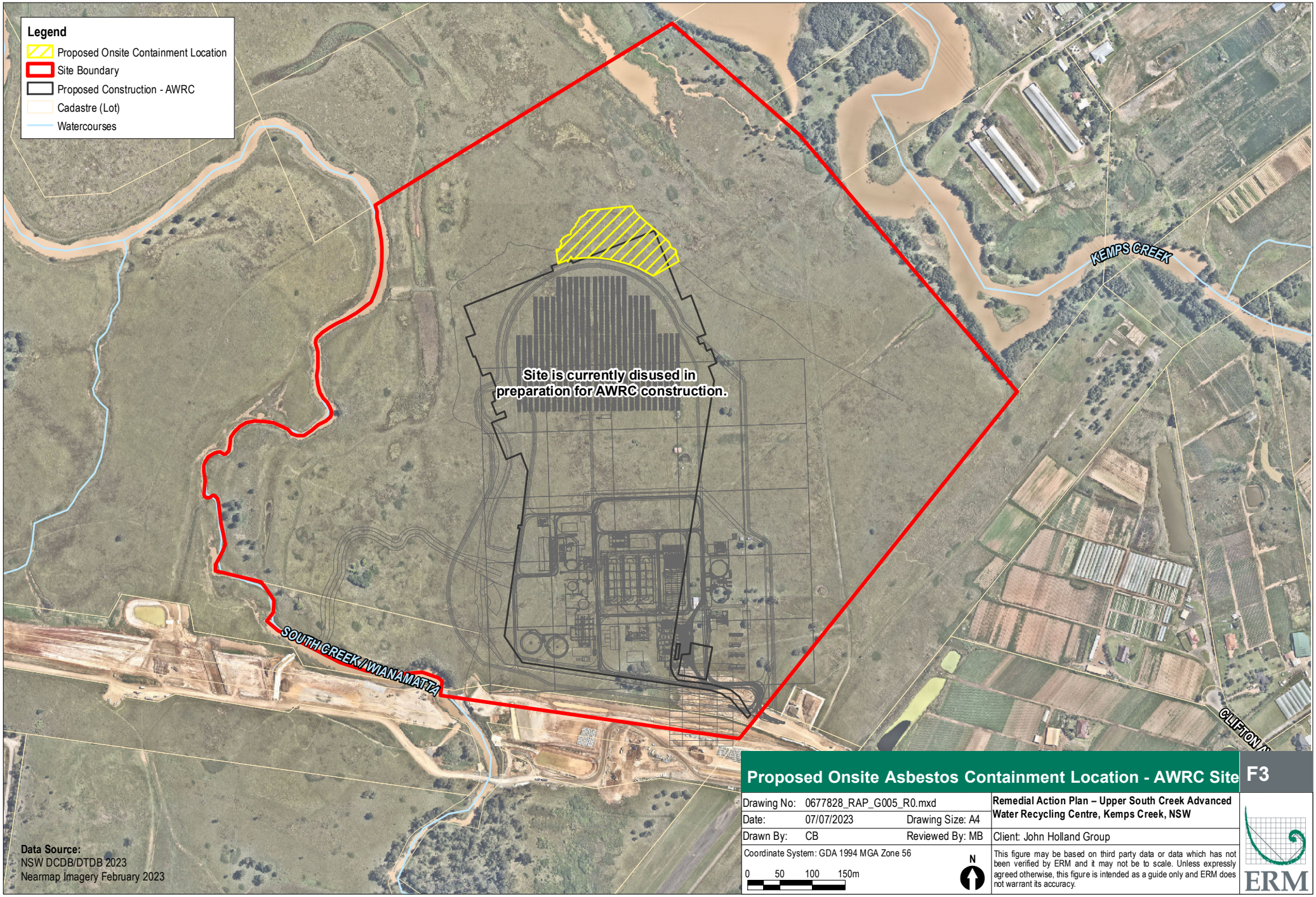
Remedial Action Plan - Upper South Creek Advanced Recycling Centre, Kemps Creek, NSW
Client: John Holland Group
This figure may be based on third party data or data which has not been verified by ERM and it may not be to scale. Unless expressly agreed otherwise, this figure is intended as a guide only and ERM does not warrant its accuracy.
ERM



Proposed Onsite Asbestos Containment Location - AWRC Site

F3

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Date:	07/07/2023	Drawing Size: A4	
Drawn By:	CB	Reviewed By: MB	Client: John Holland Group

Coordinate System: GDA 1994 MGA Zone 56

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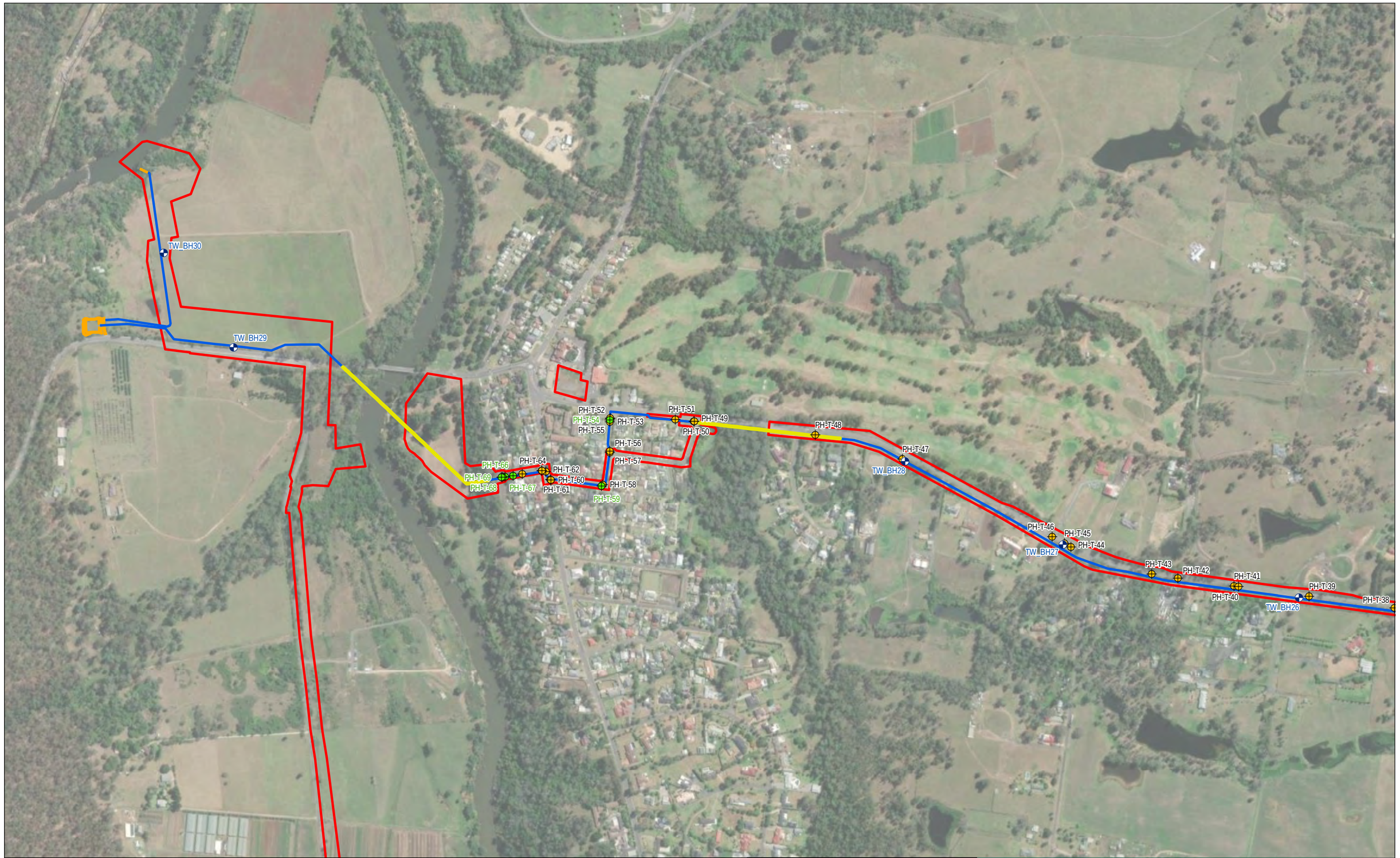
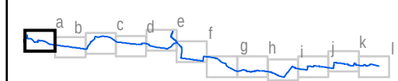
ERM



Legend

- Impact Assessment Area
- Pipeline Alignment
- Site Structure
- Trenchless Excavation
- Proposed In-situ Sampling Location, Brine
- Proposed In-situ Sampling Location, Treatment Water
- JH Proposed Pothole Location
- Completed Pothole Location
- Proposed SAQP Locations (ERM, 2023)

Data Source:
NSW DFSI, DCDB/DTDB 2023
Esri World Imagery March 2023



Sampling Locations

F4a

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Date:	11/10/2023	Drawing Size: A3	
Drawn By:	GC	Reviewed By: MB	Client: John Holland Group

Coordinate System: GDA 1994 MGA Zone 56

0 50 100 150m

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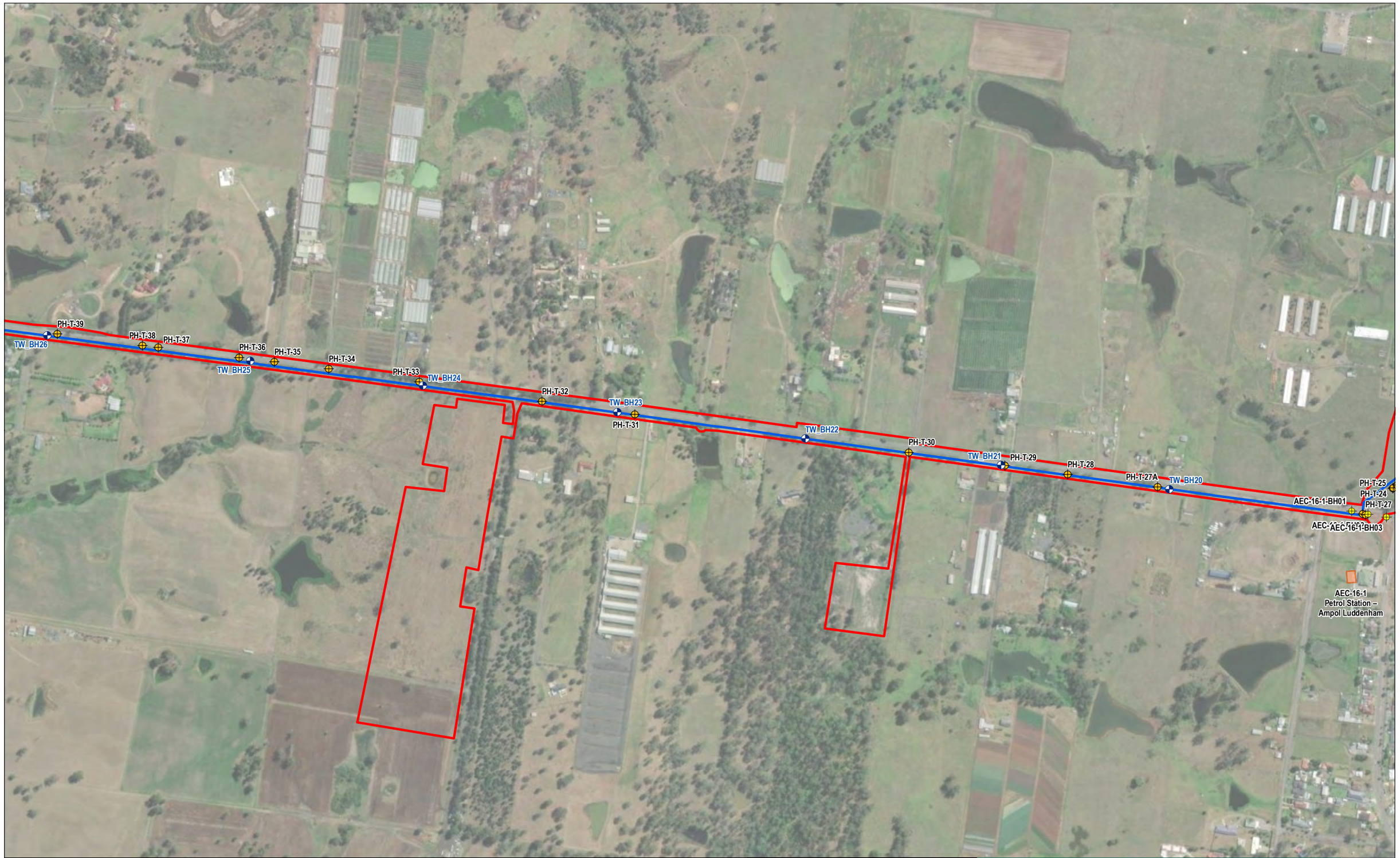
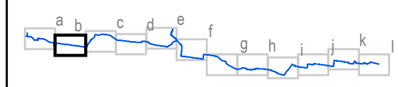
ERM



Legend

- Impact Assessment Area
- Pipeline Alignment
- Site Structure
- Areas of Environmental Concern (AEC) – Moderate
- Trenchless Excavation
- Proposed In-situ Sampling Location, Brine
- Proposed In-situ Sampling Location, Treatment Water
- JH Proposed Pothole Location
- Completed Pothole Location
- Proposed SAQP Locations (ERM, 2023)

Data Source:
NSW DFSI, DCDB/DTDB 2023
Esri World Imagery March 2023



Sampling Locations

F4b

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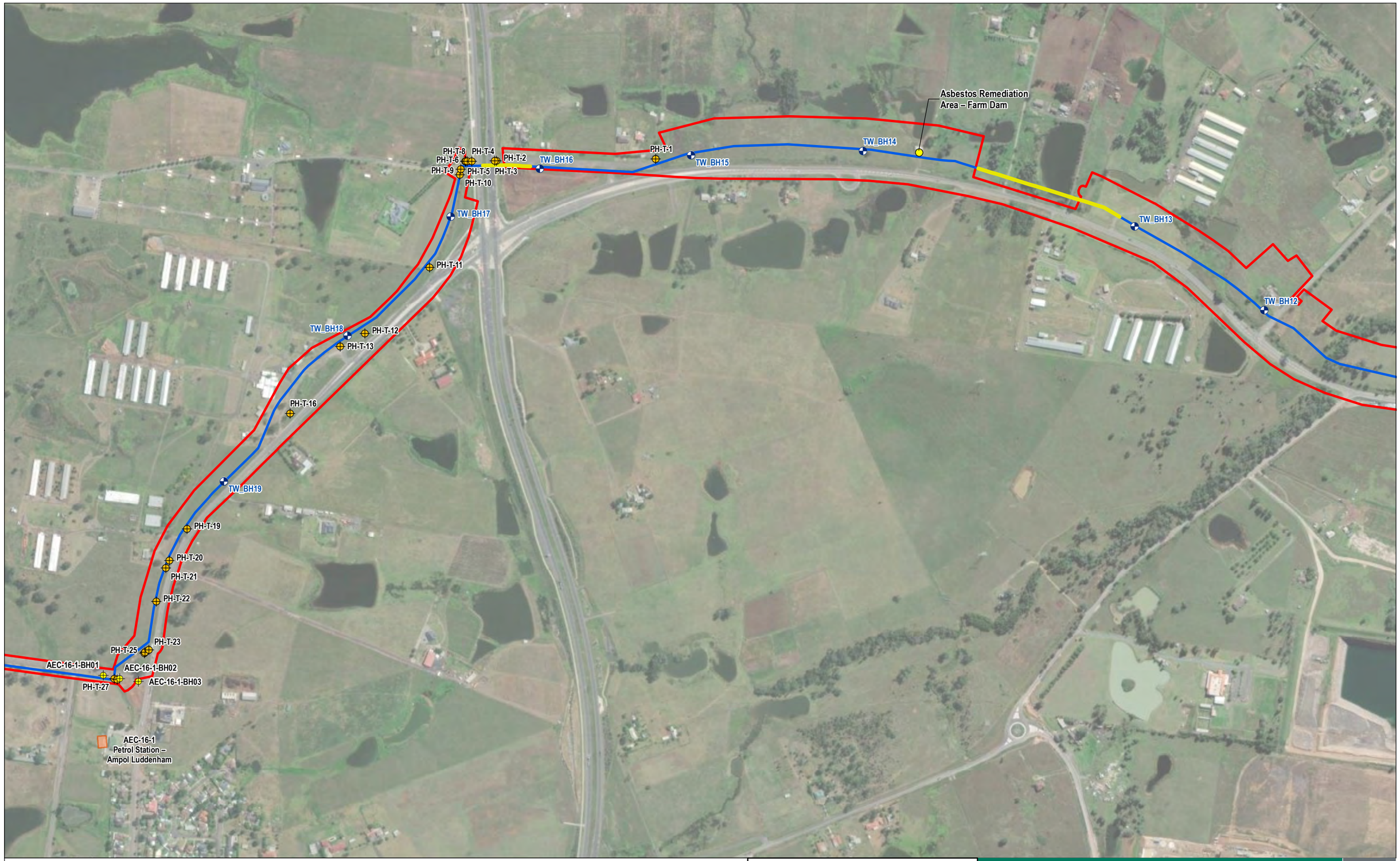
Date:	11/10/2023	Drawing Size: A3	
Drawn By:	GC	Reviewed By: MB	Client: John Holland Group

Coordinate System: GDA 1994 MGA Zone 56

0 50 100 150m

N

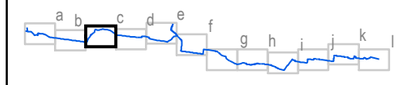
ERM



Legend

- Impact Assessment Area
- Pipeline Alignment
- Site Structure
- Areas of Environmental Concern (AEC) – Moderate
- Trenchless Excavation
- Proposed In-situ Sampling Location, Brine
- Proposed In-situ Sampling Location, Treatment Water
- JH Proposed Pothole Location
- Completed Pothole Location
- Proposed SAQP Locations (ERM, 2023)

Data Source:
NSW DFSI, DCDB/DTDB 2023
Esri World Imagery March 2023



Sampling Locations

F4c

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Date:	15/11/2023	Drawing Size: A3	
Drawn By:	GC	Reviewed By: MB	Client: John Holland Group

Coordinate System: GDA 1994 MGA Zone 56

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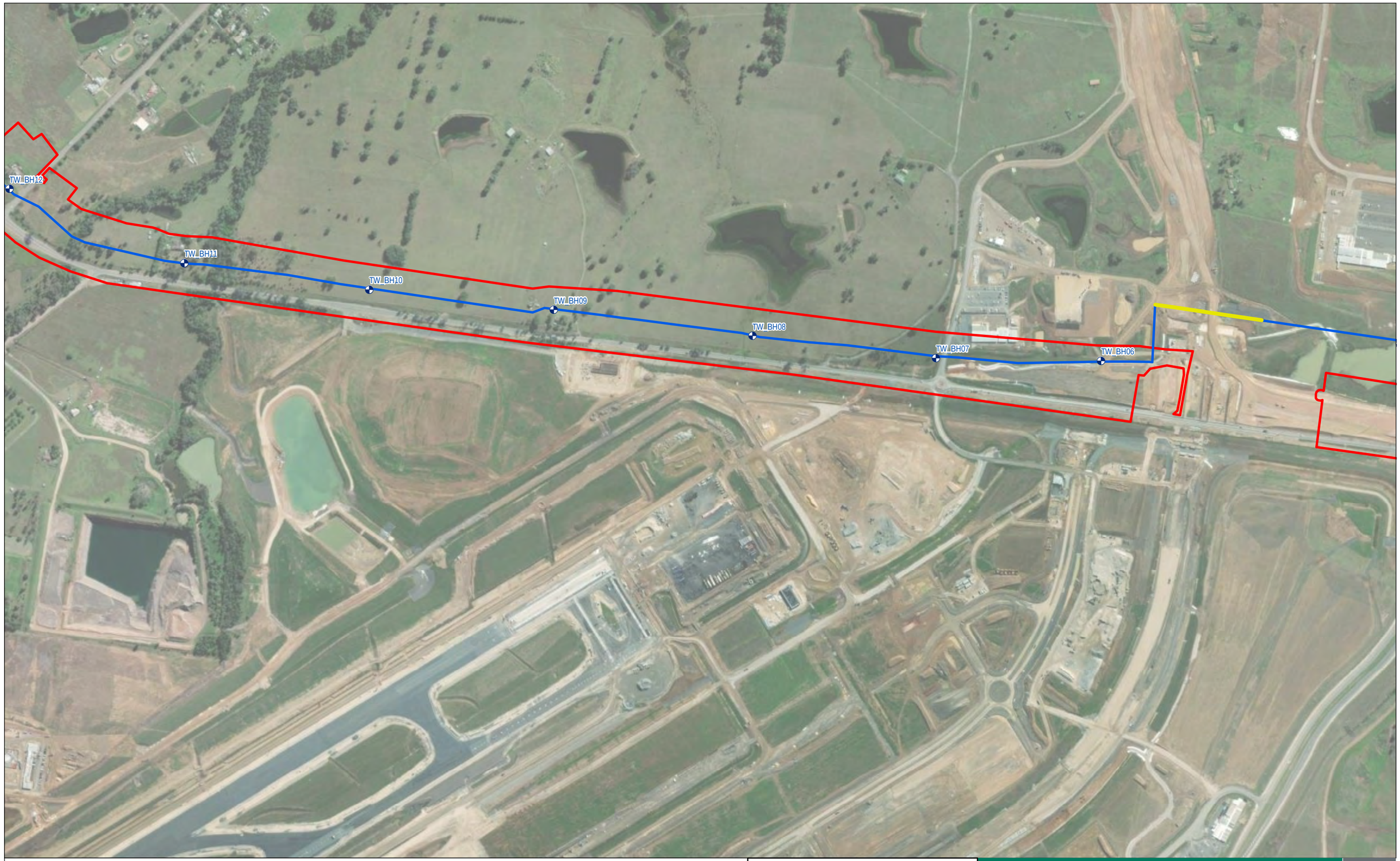
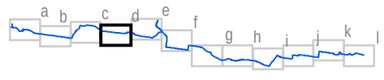


Legend

- Impact Assessment Area
- Pipeline Alignment
- Site Structure
- Trenchless Excavation
- Proposed In-situ Sampling Location, Brine
- Proposed In-situ Sampling Location, Treatment Water
- JH Proposed Pothole Location
- Completed Pothole Location
- Proposed SAQP Locations (ERM, 2023)

Data Source:
NSW DFSI, DCDB/DTDB 2023
Esri World Imagery March 2023



Sampling Locations

F4d

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Date:	11/10/2023	Drawing Size: A3	
Drawn By:	GC	Reviewed By: MB	Client: John Holland Group

Coordinate System: GDA 1994 MGA Zone 56

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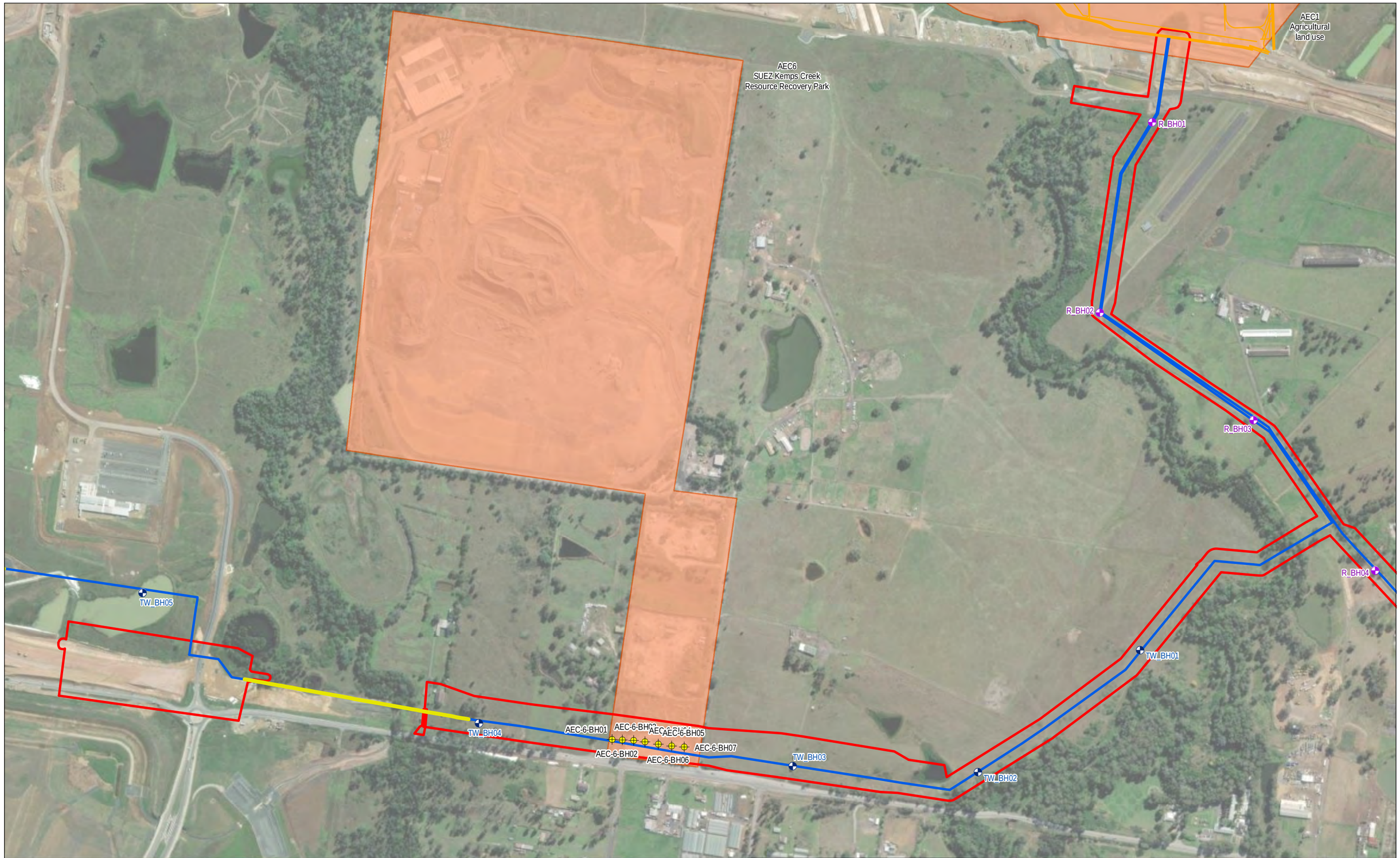

Legend

- Impact Assessment Area
- Pipeline Alignment
- Site Structure
- Areas of Environmental Concern (AEC) – Moderate
- Trenchless Excavation
- Proposed In-situ Sampling Location, Brine
- Proposed In-situ Sampling Location, Treatment Water
- JH Proposed Pothole Location
- Completed Pothole Location
- Proposed SAQP Locations (ERM, 2023)

Data Source:
NSW DFSI, DCDB/DTDB 2023
Esri World Imagery March 2023

a b c d e f g h i j k l

Sampling Locations

F4e

Drawing No:	0677828_PLRAP_G004_R1.mxd		Remedial Action Plan - Upper South Creek Advanced Recycling Centre, Kemps Creek, NSW
Date:	11/10/2023	Drawing Size: A3	
Drawn By:	GC	Reviewed By: MB	Client: John Holland Group

Coordinate System: GDA 1994 MGA Zone 56

0 50 100 150m

N

ERM

R_BH04
R_BH05
PH-B-1
PH-B-2
PH-B-3
PH-B-4
PH-B-4
PH-B-5
PH-B-5A
PH-B-6
R_BH06
PH-B-7
PH-B-8
PH-B-9
R_BH07
PH-B-10
PH-B-11
PH-B-12
R_BH08
PH-B-14
PH-B-16
PH-B-18
PH-B-17
PH-B-19A
PH-B-22
R_BH09
PH-B-24
PH-B-25
PH-B-26
R_BH10
R_BH11
R_BH12
PH-B-26A

Legend

- Impact Assessment Area
- Pipeline Alignment
- Site Structure
- Trenchless Excavation
- Proposed In-situ Sampling Location, Brine
- Proposed In-situ Sampling Location, Treatment Water
- JH Proposed Pothole Location
- Completed Pothole Location
- Proposed SAQP Locations (ERM, 2023)

Data Source:
NSW DFSI, DCDB/DTDB 2023
Esri World Imagery March 2023

a b c d e f g h i j k l

Sampling Locations

F4f

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Date:	11/10/2023	Drawing Size: A3	
Drawn By:	GC	Reviewed By: MB	Client: John Holland Group

Coordinate System: GDA 1994 MGA Zone 56

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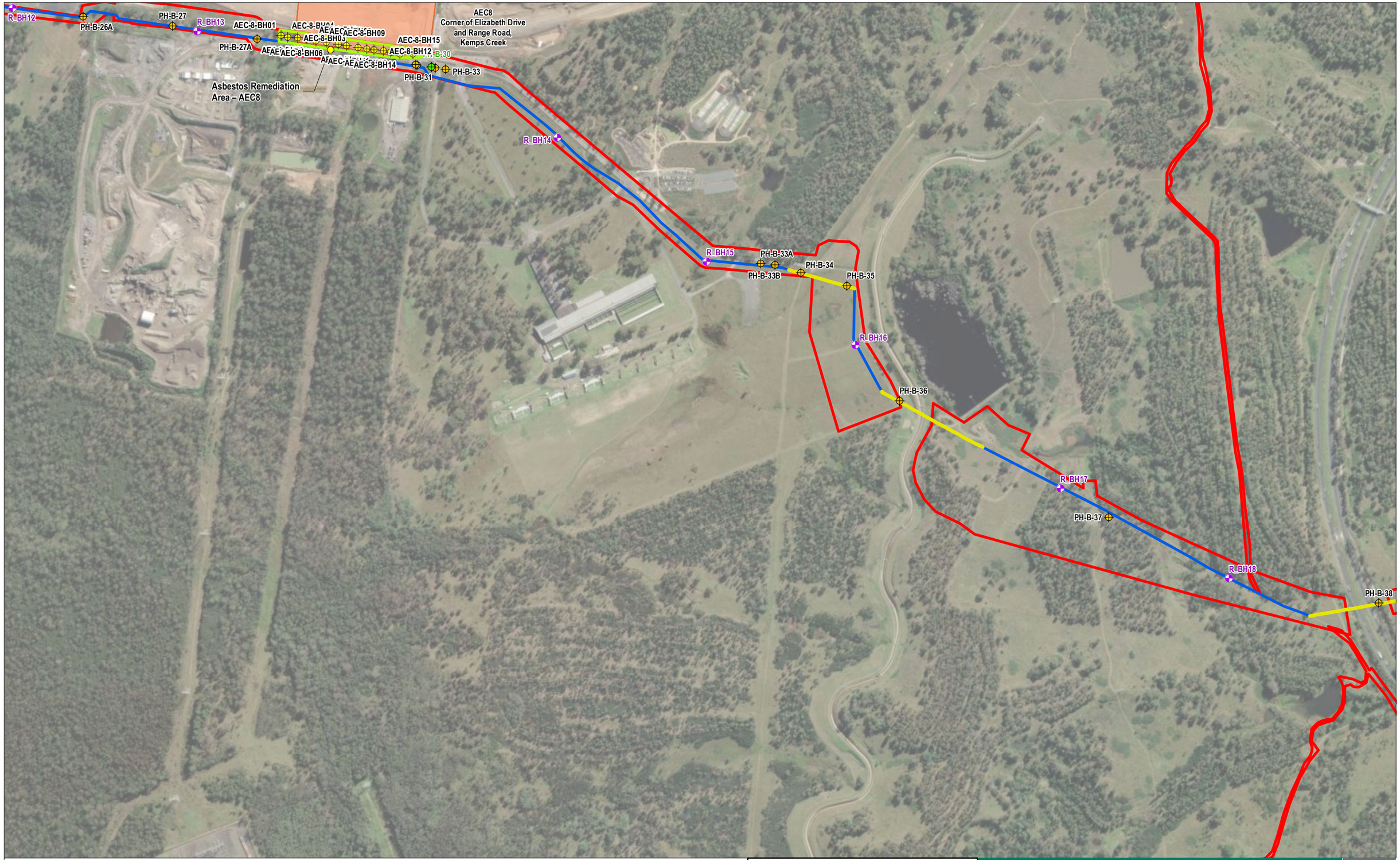

Legend

- Impact Assessment Area
- Pipeline Alignment
- Site Structure
- Asbestos Remediation Area – AEC8
- Areas of Environmental Concern (AEC) – Moderate
- Trenchless Excavation
- Proposed In-situ Sampling Location, Brine
- Proposed In-situ Sampling Location, Treatment Water
- JH Proposed Pothole Location
- Completed Pothole Location
- Proposed SAQP Locations (ERM, 2023)

Data Source:
NSW DFSI, DCDB/DTDB 2023
Esri World Imagery March 2023

a b c d e f g h i j k l

Sampling Locations

F4g

Drawing No:	0677828_PLRAP_G004_R2.mxd		
Date:	21/02/2024	Drawing Size: A3	
Drawn By:	GC/CB	Reviewed By: MB	

Coordinate System: GDA 1994 MGA Zone 56

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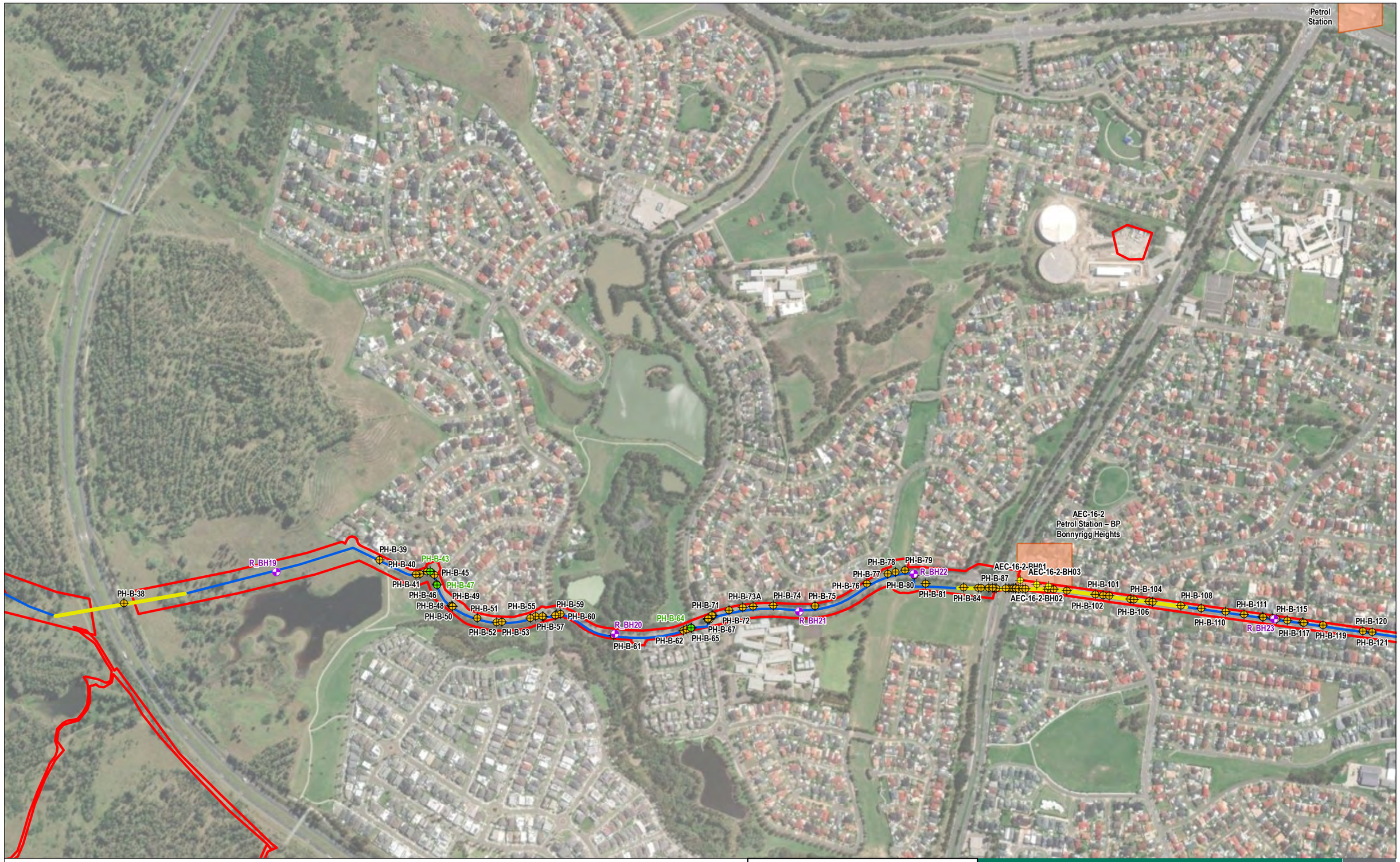
Remedial Action Plan - Upper South Creek Advanced Recycling Centre, Kemps Creek, NSW

Client: John Holland Group

ERM



Legend

- Impact Assessment Area
- Pipeline Alignment
- Site Structure
- Areas of Environmental Concern (AEC) – Moderate
- Trenchless Excavation
- Proposed In-situ Sampling Location, Brine
- Proposed In-situ Sampling Location, Treatment Water
- JH Proposed Pothole Location
- Completed Pothole Location
- Proposed SAQP Locations (ERM, 2023)

Data Source:
NSW DFSI, DCDB/DTDB 2023
Esri World Imagery March 2023

a b c d e f g h i j k l

Sampling Locations

F4h

Drawing No:	0677828_PLRAP_G004_R1.mxd		**Remedial Action Plan - Upper South Creek Advanced Recycling Centre, Kemps Creek, NSW**
Date:	11/10/2023	Drawing Size: A3	
Drawn By:	GC	Reviewed By: MB	Client: John Holland Group

Coordinate System: GDA 1994 MGA Zone 56

0 50 100 150m

N

ERM

Legend

- Impact Assessment Area
- Pipeline Alignment
- Site Structure
- Areas of Environmental Concern (AEC) – Moderate
- Trenchless Excavation
- Proposed In-situ Sampling Location, Brine
- Proposed In-situ Sampling Location, Treatment Water
- JH Proposed Pothole Location
- Completed Pothole Location
- Proposed SAQP Locations (ERM, 2023)

Data Source:
NSW DFSI, DCDB/DTDB 2023
Esri World Imagery March 2023

Sampling Locations

F4i

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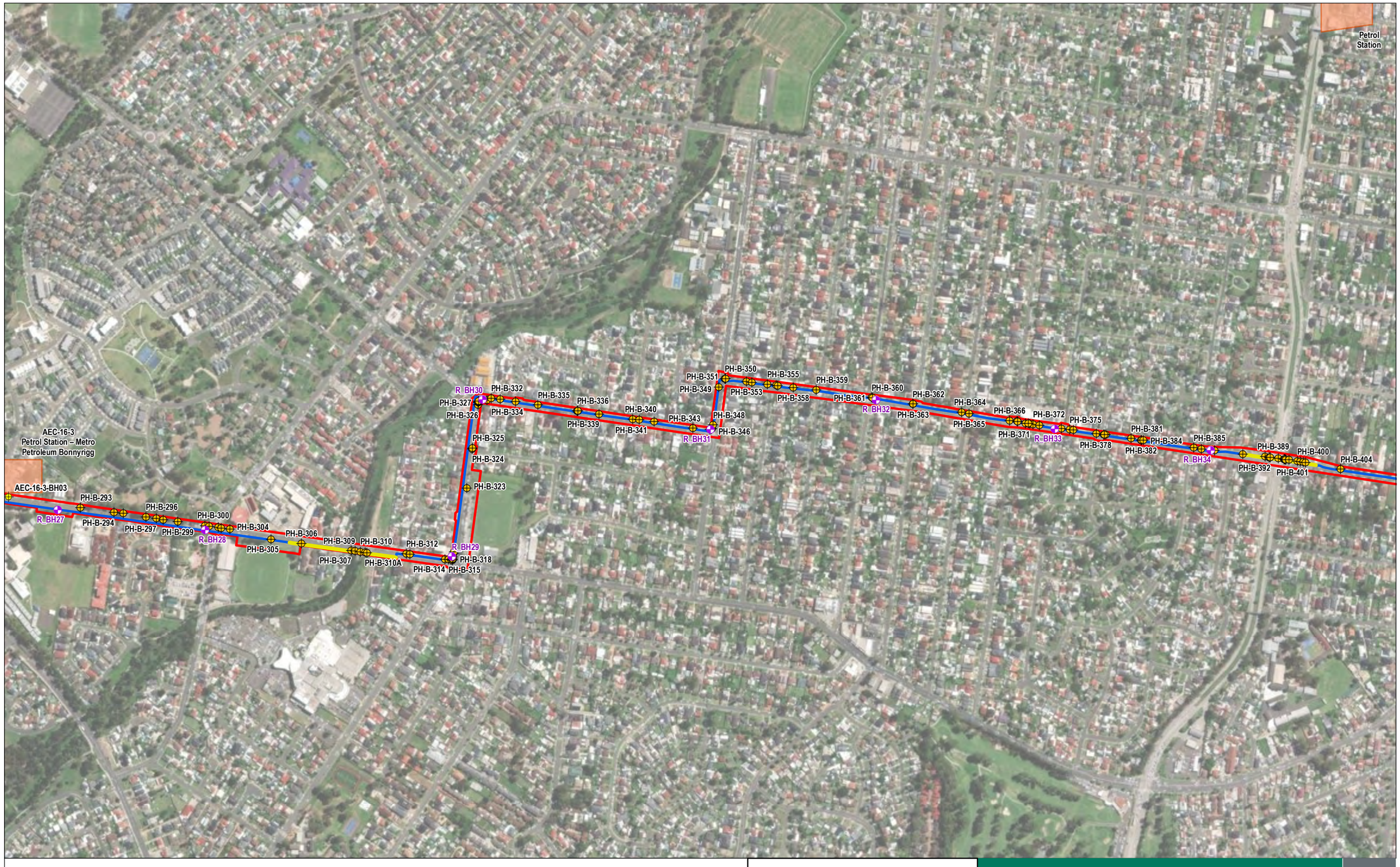
Date:	11/10/2023	Drawing Size: A3	
Drawn By:	GC	Reviewed By: MB	Client: John Holland Group

Coordinate System: GDA 1994 MGA Zone 56

0 50 100 150m

N

ERM



Legend

- Impact Assessment Area
- Pipeline Alignment
- Site Structure
- Areas of Environmental Concern (AEC) – Moderate
- Trenchless Excavation
- Proposed In-situ Sampling Location, Brine
- Proposed In-situ Sampling Location, Treatment Water
- JH Proposed Pothole Location
- Completed Pothole Location
- Proposed SAQP Locations (ERM, 2023)

Data Source:
NSW DFSI, DCDB/DTDB 2023
Esri World Imagery March 2023

a b c d e f g h i j k l

Sampling Locations

F4j

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Date:	11/10/2023	Drawing Size: A3	
Drawn By:	GC	Reviewed By: MB	

Coordinate System: GDA 1994 MGA Zone 56

0 50 100 150m

N

Remedial Action Plan - Upper South Creek Advanced Recycling Centre, Kemps Creek, NSW

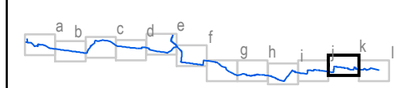
Client: John Holland Group

ERM

Legend

- Impact Assessment Area
- Pipeline Alignment
- Site Structure
- Areas of Environmental Concern (AEC) – Moderate
- Trenchless Excavation
- Proposed In-situ Sampling Location, Brine
- Proposed In-situ Sampling Location, Treatment Water
- JH Proposed Pothole Location
- Completed Pothole Location
- Proposed SAQP Locations (ERM, 2023)

Data Source:
NSW DFSI, DCDB/DTDB 2023
Esri World Imagery March 2023



Sampling Locations

F4k

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Date:	11/10/2023	Drawing Size: A3	
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Coordinate System: GDA 1994 MGA Zone 56

0 50 100 150m

N

Remedial Action Plan - Upper South Creek Advanced Recycling Centre, Kemps Creek, NSW

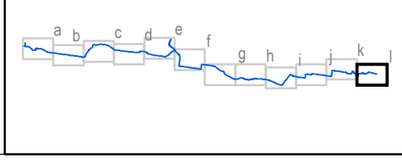
Client: John Holland Group

ERM

Legend

- Impact Assessment Area
- Pipeline Alignment
- Site Structure
- Areas of Environmental Concern (AEC) – Moderate
- Trenchless Excavation
- Proposed In-situ Sampling Location, Brine
- Proposed In-situ Sampling Location, Treatment Water
- JH Proposed Pothole Location
- Completed Pothole Location
- Proposed SAQP Locations (ERM, 2023)

Data Source:
NSW DFSI, DCDB/DTDB 2023
Esri World Imagery March 2023



Sampling Locations

F4I

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Date:	11/10/2023	Drawing Size: A3	
Drawn By:	GC	Reviewed By: MB	Client: John Holland Group

Coordinate System: GDA 1994 MGA Zone 56

0 50 100 150m

N

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

APPENDIX B DATA QUALITY OBJECTIVES

Data Quality Objectives (DQOs)

Data Quality Objectives (DQOs) have been developed to define the type and quality of data required to achieve the project objectives. The DQOs have been prepared in line with the DQO process outlined in the ASC NEPM. The seven-step DQO approach identified in ASC NEPM as it applies to validation of the Pipelines Alignment is described below.

The DQOs have been prepared in line with the DQO process outlined in ASC NEPM (Section 5.2 of Schedule B2) which recommends that DQOs be implemented during the assessment of potentially contaminated sites. The DQO process described in the ASC NEPM outlines seven distinct steps to establish the project goals, decisions, constraints and an assessment of the project uncertainties and how to address these when they arise.

A description of the seven-step DQO approach identified in the ASC NEPM as applied to excavated material classification and validation of the Pipelines Alignment is presented in the following sections.

STEP 1: STATE THE PROBLEM

The objectives of the excavated material classification program and the validation program are to:

- classify excavated materials for:
  - beneficial reuse within the Project boundaries (i.e., within the pipelines alignment or at the AWRC plant site);
  - placement within the asbestos containment area at the AWRC plant site (asbestos-contaminated soils only);
  - transportation off-site for beneficial re-use in accordance with the NSW EPA VENM classification requirements or Resource Recovery Orders; and/or
  - transportation off-site for disposal as waste (in the event that onsite beneficial reuse/containment or off-site reuse is not appropriate);
- assess whether the Pipelines Alignment has been sufficiently remediated to permit a future end use consistent with commercial/industrial use from a contamination perspective.

STEP 2: IDENTIFY THE DECISION

The principal decision statement that will need to be considered is whether or not this RAP has been implemented in a way that adequately classifies the excavated material and mitigates potential ongoing risks to the identified receptors from contamination present on-site (if relevant). Therefore, the decisions will include the following:

- Has sufficient assessment been undertaken to classify the excavated material accurately?
- Has contamination that requires remediation been identified?
- Have the identified impacts within the Pipelines Alignment been satisfactorily remediated in accordance with the objectives of this RAP?
- Have unexpected finds, if any, been appropriately remediated and/or managed in accordance with this RAP?

STEP 3: IDENTIFY INPUTS TO THE DECISION

The inputs required to make the above decisions are as follows:

- Background information from previous reports prepared for the Pipelines Alignment, including previous investigations;
- Direct measurement and observation of environmental variables including soil type and visual/olfactory observations;
- Laboratory measurement of soil samples for the identified COPCs;

- Field and laboratory quality assurance/quality control data;
- The relevant criteria applicable to excavated material classification and soil validation;
- Location and distance to potential receptors;
- Assessment of whether the material classification and soil validation criteria requirements have been met; and
- Feedback received from John Holland, Sydney Water and the Site Auditor.

STEP 4: DEFINE THE STUDY BOUNDARIES

The Pipelines Alignment layout and spatial boundaries of the validation program are displayed in figures provided in **Appendix A.**

Temporal boundaries include when the remediation program described in this RAP commences and when the validation report is approved by the Site Auditor.

STEP 5: DEVELOP A DECISION RULE

The DQOs have been developed to facilitate the collection of adequate field data and soil analytical data to address the decisions outlined in Step Two of the DQO process.

In order to ensure the representativeness and integrity of samples collected from the Pipelines Alignment, and the accuracy and reliability of analytical data, a robust quality assurance / quality control (QA/QC) program will be implemented. This includes decontamination of sampling equipment before and between sampling locations and delivery of samples to the laboratory in good condition and within required holdings times.

The field QC program for the Pipelines Alignment will include the following:

- Intra-laboratory field duplicate samples will be collected at a rate of 10% of the total number of primary samples collected;
- Inter-laboratory field triplicate samples will be collected at a rate of 5% of the total number of primary samples collected;
- Trip blank samples will be collected at a rate of one per batch of soil samples where VOCs are analysed;
- Trip spike samples will be collected at a rate of one per batch of soil samples where VOCs are analysed; and
- Rinsate samples will be collected at a rate of one sample per day where non-disposable sampling equipment is used.

With reference to the QA/QC program, field data and the analytical results, the decision rules for validation purposes are summarised in Table B1.

Table B1: Decision Rules

Decision Required To Be Made	Decision Rule
1. Is data acquired of acceptable quality for interpretive purposes?	Have appropriate controls and operating procedures been used, specifically: ■ Consistent material classification and soil validation methods, including sampling and laboratory analysis for fill materials; and ■ Analytical techniques (if required), both standardised method and detection limits appropriate to investigation criteria for different laboratories and for the same laboratories over time. If the criteria stated above are satisfied, the decision is Yes. If the criteria are not satisfied, the decision is No. In the case that the criteria are not satisfied, implications on the suitability of the dataset to achieve the project objectives will be assessed and resampling / reanalysis undertaken if required.

Decision Required To Be Made	Decision Rule
2. Has a sufficiently robust CSM been established?	Interpretation of the available field observations has enabled the key source-pathway-receptor (SPR) linkages to be adequately defined in terms of the proposed land use and in accordance with the guidance established per the standards outlined in ASC NEPM. The CSM allows risk driving pathways to be established and appropriate application of selected validation criteria. If the criteria stated above are satisfied, the decision is Yes. If the criteria are not satisfied, the decision is No. If the criteria are not satisfied, additional works will be carried out to strengthen the CSM.
3. Is there sufficient data (quantity and distribution) to assess success of the material classification program and the remediation program?	Does the data set allow adequate assessment of the data and results against the identified material classification criteria and soil validation criteria in accordance with the requirements of this RAP? If yes, the decision is Yes. Otherwise, the decision is No. If the decision is No, investigations should be carried out to further understand the relevant impacts, exposure pathways and receptors, thereby allowing detailed assessment of exceedances.
4. Has remediation been successful?	Has the remediation strategy resulted in the mitigation of previously identified potential risks to identified receptors to a degree sufficient to satisfy the remediation objective? If yes, then then no further action is required. If no, then additional actions may need to be implemented (i.e. further remediation, management, etc.).

STEP 6: SPECIFY LIMITS ON DECISION ERRORS

The acceptable limits on decision errors applied during the review of the results were based on the Data Quality Indicators (DQIs) of Precision, Accuracy, Representativeness, Comparability and Completeness (PARCC) in accordance with the ASC NEPM, *Schedule B(3) - Guidelines on Laboratory Analysis*.

Laboratory data is to be within levels specified by laboratory methods, which are largely based on United States Environmental Protection Agency (USEPA) protocols, including specified sample holding times.

A maximum of 50% Relative Percentage Difference (RPD) between intra- and inter–laboratory duplicate samples will be required.

Analytical results for any laboratory-prepared spike samples (including trip spikes) are to be within the recovery limits specified by the laboratory (generally a minimum of 70-130%).

Rinsate and trip blank samples are to demonstrate the effectiveness of decontamination techniques in the field by reporting contaminant concentrations less than the LOR.

The potential for significant decision errors will be reduced by:

- completing a robust QA/QC assessment of the data, requiring that 95% of data satisfy the DQIs and therefore placing a limit on the decision error of 5%;
- selecting validation criteria that are appropriate for future non-sensitive commercial/industrial land use; and
- assessing not only individual data points against validation criteria, but also assessing the 95% UCL of the data set against the criteria, determining if any value are >250% of the criteria and determining whether any identified concentrations are due to elevated background conditions.

Data Quality indicators for the project are summarised in **Table B2** below.

Table B2: Data Quality Indicators

DATA PRECISION AND ACCURACY	
Relative Percentage Difference (RPD) Between Duplicate Samples	>10 x LOR: 30% inorganics; 50% organics (field duplicates) <10 x laboratory LOR: Assessed on individual basis (field duplicates) >5 x laboratory LOR: 50% (laboratory duplicates) <5 x laboratory LOR: No Limit (laboratory duplicates)
Laboratory Performance	Based on laboratory acceptance criteria as specified on the certificates of analysis, including: blank samples, matrix spikes, control samples, and surrogate spike samples.
	Use of analytical laboratories with adequately trained and experienced testing staff experienced in the analyses undertaken, with appropriate NATA certification.
Fieldwork Performance	Use of trained and qualified field staff; including Licensed Asbestos Assessors for visual validation of excavated surfaces, consistent sampling methods used. Appropriate sampling methods used, minimising the opportunity for cross-contamination.
DATA REPRESENTATIVENESS	
Sample Coverage	Representative coverage of COPCs, based on site history, site activities and site features.
Sample and Analysis Selection	Representativeness of all contaminants of potential concern.
Trip Blanks	Trip blank samples will be collected at a rate of one batch of soil samples where VOCs are analysed.
Trip Spikes	Trip spike samples will be collected at a rate of one batch of soil samples where VOCs are analysed.
Laboratory Selection	Adequate laboratory internal quality control and quality assurance methods, complying with the ASC NEPM.
DOCUMENTATION COMPLETENESS	
Documentation Review	Review of acquired documented information pertaining to site history, including previous investigations.
Fieldwork Observations	Preparation of test field logs, field screening results and sample location plans.
Chain of Custody Records	Laboratory sample receipt information received confirming receipt of samples in a good condition and appropriate chain of custody.
	NATA registered laboratory certificates of analysis provided.
DATA COMPLETENESS	
	Analysis for all required contaminants of potential concern.
	Validation requirements meant as per details in this RAP.
	Trip spike samples prepared and sent with field samples regularly.
COMPARABILITY	
Fieldwork Performance	Use of consistent analytical methods for each sample.
	Using appropriate techniques for field sample recovery.
	Using trained and experienced samplers.
Laboratory Performance	Use of NATA registered laboratories.
	Analytical methods are comparable between primary and secondary laboratory.
	Acceptable RPDs between original samples and field duplicates and inter-laboratory triplicate samples.

STEP 7: DEVELOP (OPTIMISE) THE PLAN FOR COMPLETING THE WORKS

The DQOs have been developed based on a review of existing data and discussions with John Holland and the Site Auditor. The scope of works to complete the outlined objective described herein was assessed as the most efficient from both a technical and cost perspective.

APPENDIX C UNEXPECTED FINDS PROCEDURE

APPENDIX C – UNEXPECTED FINDS PROCEDURE FOR CONTAMINATION

Unexpected Finds Procedure for Contamination

Scope: This Procedure has been prepared in accordance with Environmental Planning and Assessment Act 1979 (EP&A Act), Protection of the Environment Operations Act 1997 and the Contaminated Land Management Act 1997 (CLM Act) for the management of unexpected contamination finds on the Upper South Creek Advanced Water Recycling Centre Project (USC).

KEY STEPS AND RESPONSIBILITIES	ROLES

INDUCTION AND TOOLBOX TALKS

All USC personnel are to be inducted and receive ongoing training and awareness via toolbox talks and pre-start meetings regarding unexpected finds related to contamination. JH Environment Manager to provide relevant content for the induction and other relevant training and awareness material.

JH Environment Manager

OBSERVATION OF SOIL / GROUND DURING EXCAVATION WORK

JH Site Supervisor and Construction Team to observe and document in site diary records, soil during excavations for any indicators of contamination. Indicators of potential contamination include:

1. Fibre cement or other asbestos containing materials
2. Discolouration of the soil including staining
3. Odorous soil or groundwater (including seepage)
4. Buried chemical drums or containers

JH Site Supervisor

JH Construction Team

Has any indication of contamination been observed?

NO

YES

STOP WORK

Notify the JH Site Supervisor and JH Environment Manager and advise all personnel to stay clear of the area. Do not touch or disturb the item / material. JH Site Supervisor to establish and communicate to relevant personnel, a 'no-go zone' at the site of the find. The JH Construction Team will cover, bund or contain the contaminated material (may be stockpiled or in-situ).

The JH Construction Team will provide the following details to the Environment Team (including Sydney Water Leads):

- The location of the potential contamination
- Visual appearance
- Odour (if any)
- Depth
- Surrounding material and mode of discovering the material
- Containment method

JH Environment Manager

JH Site Supervisor

JH Construction Team

JH Safety Team

ASSESSMENT VIA EXTERNAL PERSONNEL

The JH Construction Manager / Environment Manager is to obtain assistance from a suitably qualified Contamination Consultant, in consultation with EPA accredited Site Auditor and Sydney Water Environment Leads (as required) to identify the potential hazard to human health or the environment in accordance with legislative requirements. This may include sampling and laboratory analysis.

JH Construction Manager/ Environment Manager

Contamination Consultant

EPA Accredited Site Auditor

SWC Environment Lead

JH Safety Team

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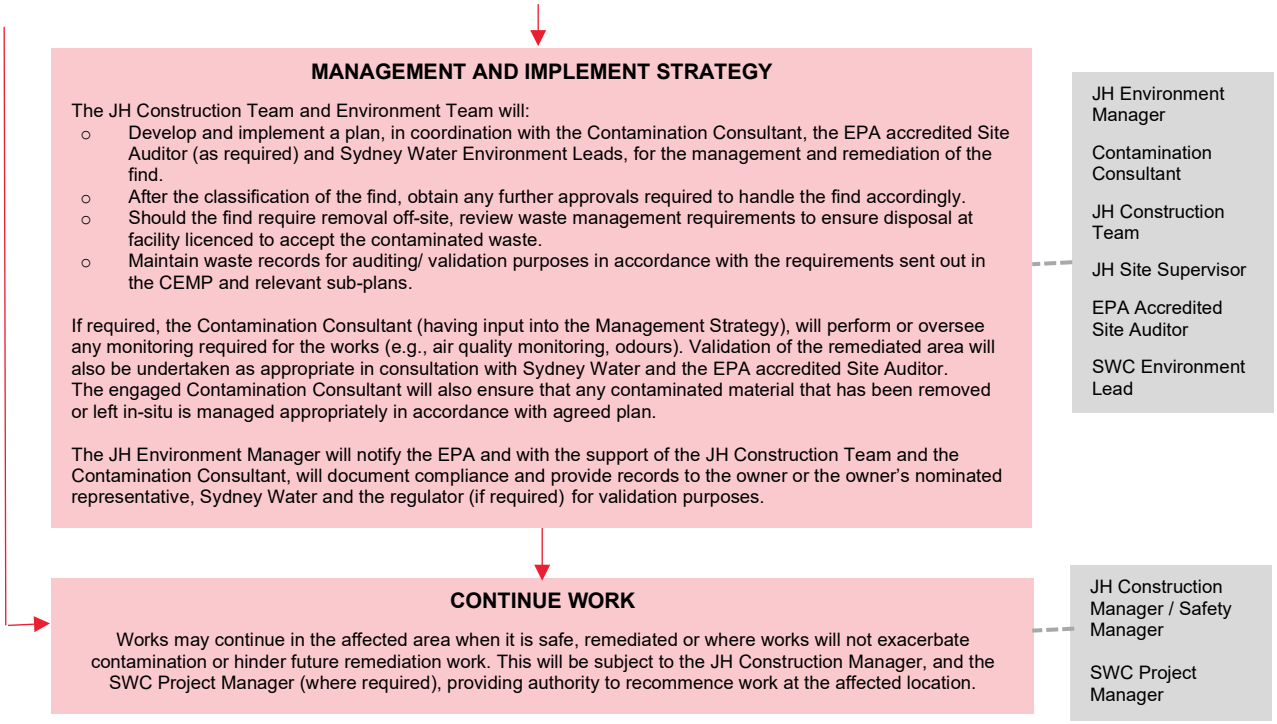
Unexpected Finds Procedure for Contamination

Scope: This Procedure has been prepared in accordance with Environmental Planning and Assessment Act 1979 (EP&A Act), Protection of the Environment Operations Act 1997 and the Contaminated Land Management Act 1997 (CLM Act).



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