SYDNEY METRO - WESTERN SYDNEY AIRPORT
STATION BOXES AND TUNNELLING WORKS

St Marys Station
Remedial Action Plan

Sydney Metro Western Sydney Airport Station Boxes and Tunnelling Works

Project number	WSA-200-SBT
Document number	SMWSASBT-CPG-SWD-SW000-GE-RPT-040521
Revision date	23/05/2023
Revision	A08

Document approval

Rev	Date	Prepared by	Reviewed by	Remarks
Rev A01	12/09/2022	[redacted]	[redacted]	-
Rev A02	14/09/2022	[redacted]	[redacted]	-
Rev A02	11/10/2022	[redacted]	[redacted]	-
Rev A04	19/10/2022	[redacted]	[redacted]	-
Rev A05	30/11/2022	[redacted]	[redacted]	-
Rev A06	16/1/2023	[redacted]	[redacted]	-
Rev A07	2/02/2023	[redacted]	[redacted]	-
Rev A08	23/05/2023	[redacted]	[redacted]	-

Table of contents

Table of tables

Table of figures

Annexures

Abbreviations

Abbreviation	Definition
ACM	Asbestos-Containing Material
AEC	Area of Environmental Concern
AHD	Australian Height Datum
AMP	Asbestos Management Plan
ARC	Australian Reinforcing Company
ASS	Acid Sulfate Soils
ATM	Airport Terminal Station
BTEXN	Benzene, toluene, ethylbenzene, xylene and napthalene
BSF	Bringelly Services Facility
CEMP	Construction Environmental Management Plan
CMF	Claremont Meadows Services Facility
CPBG	CPB Ghella Joint Venture
DCE	Dichloroethene
DGB	Densely Graded Base
DP	Deposited Plan
DSI	Detailed Site Investigation
EIS	Environmental Impact Statement
ENM	Excavated Natural Materials
EPA	Environment Protection Authority
EPL	Environment Protection Licence
ESCP	Erosion and Sediment Control Plan
GMP	Groundwater Monitoring Plan
LNAPL	Light Non-Aqueous Phase Liquid
LOR	Limit of Reporting
MIP	Membrane Interface Probe
NATA	National Association of Testing Authorities
OCP/OCP	Organochlorine / organophosphate pesticides
PAH	Polycyclic aromatic hydrocarbons
PCB	Polychlorinated biphenyls

Abbreviation	Definition
PCE	Tetrachloroethene
PFAS	Perfluoroalkyl and Polyfluoroalkyl Substances
PID	Photo-Ionisation Detector
POEO	Protection of the Environment Operations
RAP	Remedial Action Plan
RL	Reduced Level
SGAR	Supplementary Groundwater Assessment Report
SSRA	Site-Specific Risk Assessment
SSTOM	Stations Systems Trains and Operations and Maintenance
STM	St Marys Station Site (the STM site)
SWMP	Soil and Water Management Plan
TCE	Trichloroethene
TRH	Total Recoverable Hydrocarbons
TTMP	Tetra Tech Major Projects Pty Ltd
UST	Underground Storage Tank
VENM	Virgin Excavated Natural Materials
VC	Vinyl Chloride
WHS	Work Health and Safety
WSI	Western Sydney International

1. Introduction and Background

Sydney Metro has engaged the CPB Ghella Joint Venture (CPBG) for the design and construction of the Station Boxes and Tunnelling Works (SBT Works) of the Sydney Metro Western Sydney Airport project (the Project).

The STM site is located off Station St and Chesham St adjacent to the existing St Marys Railway Station on the T1 Western Line in St Marys, NSW (the STM site). The location of the STM site is outlined in Table 4 in Section 4 and shown on Figure 1 Appendix 1.

SBT Works at the STM site includes demolition of existing buildings/structures, establishment of temporary offices, amenities, car parking and access roads, site levelling (bulk excavation) and reuse of excavated material, piling and station box excavation to approximately 18.5 m Australian Height Datum (AHD).

An Interim Remedial Action Plan (Interim RAP) was prepared to cover the work described in Table 1 which included preparatory work and bulk excavation within the station box above the groundwater table (refer to TTMP (2022) St Marys Station Remedial Action Plan (Interim) Preparatory Works and Initial Bulk Excavation. SMWSASBT-CPG-SWD-SW000-GE-RPT-040521. 19/10/2022. Rev A04).

Table 1: RAP Scope

Construction Activity	Comment
Site levelling (cut and fill)	A portion of the STM site will be subject to cut and fill to support construction activities including: • Removal of a batter down to the original rail alignment elevation, approximately 9m below existing ground surface (m bgs). • Levelling works in the Station Box to allow construction of a piling pad. • Fill (up to 4 m bgs) within the former St Marys Station Plaza) property. A copy of the cut to fill plan is provided in Appendix 2.
Importation of fill for a piling platform	A piling pad using imported fill (sandstone) will be constructed within the footprint of the station box to facilitate piling.
Piling	Bored piles will be constructed around the perimeter of the station box. A capping beam will be constructed at the top of the constructed piles to provide additional structural support. Piling will commence in the eastern portion of the station box and progress towards the west as shown on a staging plan in Appendix 3.
Bulk Excavation	Bulk excavation within the station box above the groundwater table.

This Remedial Action Plan (RAP) has been prepared to cover the work described in Table 1 and the bulk excavation within the station box beneath the groundwater table to approximately 18.5 m AHD. This RAP therefore supersedes the Interim RAP.

This RAP does not include tunnel boring activities between station sites. Management requirements for tunnel boring activities are to be included in a separate document.

Completion of the St Marys Sydney Metro Station is outside the scope of the SBT Works and will be completed under a Stations Systems Trains and Operations and Maintenance (SSTOM) works

package. It is understood that the final land use for the STM site will be analogous with a commercial/industrial land use with hardstand and minimum soft landscaping.

The STM site is subject to a Statutory Site Audit (Audit (TO-095)) by a NSW Environment Protection Authority (EPA) accredited Site Auditor, Tom Onus of Ramboll Australia Pty Ltd, under the NSW Contaminated Land Management Act 1997 (CLM Act). Following a review of a Detailed Site Investigation[1] (DSI) prepared by TTMP in August 2022 (summarised in Section 7), it was concluded by the Site Auditor in Interim Audit Advice[2] that:

> *"Preparatory construction works are not considered to constitute remediation works because significant contamination was not identified in soils. However, the following actions are required to ensure any contamination identified during the works is dealt with appropriately to minimise risks to human health and the environment:*
>
> - *Spoil is to be assessed in accordance with Waste and Recycling Management Procedure*
> - *Spoil is to be inspected for ACM* [asbestos-containing material] *by a competent person and the AMP* [Asbestos Management Plan] *implemented if required.*
> - *Groundwater investigation data is to be obtained to inform requirements for any future remediation/management of groundwater and the dewatering procedures*
> - *Preparation of a site-specific risk assessment and RAP for groundwater remediation if required based on investigation results.*
> - *Bulk excavation below groundwater should not commence until groundwater has been adequately characterised and the site-specific risk assessment and RAP process are complete and approved by the Auditor."*

To inform the development of the RAP and excavation beneath the groundwater table, the following documents were prepared:

- TTMP (2022) *St Marys Station Detailed Site Investigation* (Ref: SMWSASBT-CPG-SWD-SW000-GE-RPT-040513. 29/09/2022. Rev A03) ("St Marys DSI")
- TTMP (2022) *Detailed Site Investigation Addendum St Marys Station - St Marys Plaza (DSI Report Addendum 01* (Ref: SMWSASBT-CPG-SWD-SW000-GE-RPT-040516. Rev A.02. 13/10/2022) ("St Marys Plaza Addendum")
- TTMP (2023) *St Marys Station Former Dry Cleaner, 1-7 Queen St – Assessment of Human Health Risk and Mitigation Options.* (Ref: SMWSASBT-CPG-SWD-SW000-GE-RPT-040540. 26/4/2023. Rev A.05) ("Queen St HHRA").
- TTMP (2022) *Detailed Site Investigation - Addendum St Marys Groundwater Monitoring Data.* (Ref: SMWSASBT-CPG-SWD-SW000-GE-RPT-040518. 22/11/2022. Rev A.02) ("St Marys Groundwater Addendum").

These documents are summarised in Section 7.6 and Section 7.7 respectively.

[1] TTMP on behalf of CPB. St Marys Station, Detailed Site Investigation, Sydney Metro Western Sydney Airport Station Boxes and Tunnelling Works. Document Number: SMWSASBT-CPG-SWD-SW000-GE-RPT-040513. Revision Rev A03, dated 27 September 2022.
[2] Ramboll Australia Pty Ltd. Re: Interim Audit Advice Letter No.2 - Proposed Preparatory Works, Proposed Sydney Metro Western Sydney Airport St Marys Station, Station Street, St Marys NSW. Dated 5 September 2022.

For the purpose of this RAP, groundwater level is considered to be approximately 34 m AHD consistent with the level reported in the Project Groundwater Monitoring Plan (GMP) for the Bringelly Shale Aquifer, which was adopted for the assessment of drawdown impacts associated with construction with an allowance for potential sustained groundwater inflow due to periods of sustained high rainfall.

1.1. Project Overview

The SBT Works involves the construction and operation of a new 23 km metro rail line from the existing Sydney Trains suburban T1 Western Line (at St Marys) in the north and the Aerotropolis (at Bringelly) in the south. The Project includes tunnels and civil structures, including a viaduct, bridges, and surface and open-cut troughs between the two tunnel sections. Figure A overleaf shows the proposed alignment and key features of the Project and the approximate location of the STM site.

The SBT Works are divided into two parts:

- SBT North: STM site to Orchard Hills Station. St Marys Station is an existing heritage-listed suburban rail station. Orchard Hills is a new station for the Sydney Metro line and will include the portal dive structure. Claremont Meadows Services Facility (CMF) is included along this alignment.
- SBT South: Airport business park dive structure to the Western Sydney Airport Aerotropolis station. This section of work is largely greenfield, with construction both on and off-airport land. The Airport Terminal Station (ATM) and Bringelly Services Facility (BSF) are included along this alignment.

Key elements on the SBT Works include:

- Two sections of twin tunnels with a combined length of approximately 9.8 km, plus associated portal structures. This includes one section from St Marys to Orchard Hills and the other under Western Sydney International (WSI) airport to the new Aerotropolis Station.
- Excavations at either end to enable trains to turn back, and stub tunnels to enable future extensions.
- Station box excavations with temporary ground support for four new Metro stations at St Marys (the STM site), Orchard Hills, Airport Terminal and Aerotropolis.
- Excavations for two intermediate services facilities, one in each of the tunnel sections at Claremont and Bringelly.

Figure A: Overview of SBT Works

1.2. Requirements to Prepare a RAP

Table 2 summarises Project documentation relevant to the preparation of a RAP.

Table 2: Requirements and Recommendations for a RAP for the STM site

Document	Comment
Environmental Impact Statement (EIS) and Submissions Report	The Contamination Technical Paper of the EIS and Submissions Report included a mitigation measure (SC3) for off-airport areas regarding the preparation of a RAP where additional data review and detailed site investigation confirmed that contamination would require remediation.
Infrastructure Approval	Condition E93 of Sydney Metro Western Sydney Airport – Conditions of Approval (SSI 10051) requires that should remediation be required to make land suitable for the final intended land use, a RAP must be prepared and include measures to remediate the contamination at the site, to ensure the site will be suitable for the proposed use when the RAP is implemented.
Design and Construct (D&C) Deed	The Project D&C Deed[3] includes a provision for the preparation of RAPs (Clause 20.20) prior to commencing any excavation activities (except in relation to Preliminary Works[4]) in respect of each Detailed Site Investigation. Table 3 overleaf outlines the Deed Requirements in Relation to Preparing RAPs.
Detailed Site Investigation	TTMP recently prepared a DSI in September 2022, a summary of which is provided in Section 7. The DSI did not identify contamination in soil/rock within the station box bulk excavation area which would trigger the requirement for remediation. However, a site-specific risk assessment (SSRA) was required to inform the need for a RAP to mitigate potentially unacceptable risks associated with chlorinated hydrocarbon impacted soil and groundwater identified offsite at 1-7 Queen St which has the potential to migrate toward Whilst these the station box as a result of drawdown during bulk excavation works that extend below the groundwater table. The SSRA is documented in the Queen St HHRA. Groundwater monitoring completed post completion of the DSI Report and reported in the St Marys Groundwater Monitoring Addendum has a range of potential contaminants including metals, hydrocarbons, organic compounds, ammonia and PFAS which are likely to be derived from natural and diffuse urban/industrial sources in the project area. Whilst these COPC are unlikely to pose unacceptable risks to worker health, treatment of water intercepted by the station box excavation is required prior to discharge (refer to Section 11.7).
Queen St HHRA	TTMP prepared a HHRA for the former dry cleaners located at 1-7 Queen St. The Queen St HHRA is summarised in Section 7.6 and has identified potentially unacceptable heath risks to construction workers within the Station Box and Tunnel which requires management during construction. The Queen St HHRA did not identify unacceptable risks to workers managing spoil from the site and public present surrounding the station box excavation.

This RAP has been prepared at the request of CPBG to meet the objectives outlined in Section 2.

[3] Sydney Metro - Western Sydney Airport Station Boxes and Tunnelling Works Design and Construction Deed Contract No: WSA-200-SBT

[4] Preliminary Works means works required for the initial establishment of the Construction Site including site clearance works, demolition, installation of services, de-vegetation, erection of work compounds and site offices, fencing to site boundaries and any Archaeological Clearance Works.

Table 3: Deed Requirements in Relation to Preparing RAPs.

Deed Item			Included in RAP	Report Reference
(a)	The SBT Contractor must prepare and submit to the Principal's Representative and the Independent Certifier a Remediation Action Plan in respect of each Detailed Site Investigation performed in accordance with clause 12.19 prior to commencing any excavation activities (except in relation to Preliminary Works).		✓	This document
(b)	Except in relation to the Remediation Action Plan in respect of Orchard Hills East Station, the SBT Contractor may not submit a Remediation Action Plan under this clause unless and until the Detailed Site Investigation report for the relevant area has been submitted to the Principal's Representative and has not been the subject of a notice under clause 12.19(f)(ii) within the time period specified in clause 12.19(f)(ii) (or clause 12.19(g)) as applicable.		✓	This document
(c)	Each Remediation Action Plan must:			
	(i)	describe the nature and extent of Contamination based on the Detailed Site Investigation, the Information Documents and any other relevant information which is necessary to characterise the risk to the construction, operation and maintenance of Sydney Metro - Western Sydney Airport;	✓	7
	(ii)	describe the manner in which the SBT Contractor will Remediate Contamination within the proposed areas of excavation and/or disturbance;	✓	8
	(iii)	include a detailed risk assessment to determine and describe the requirements for Remediation of Contamination of land (including soil, groundwater, ground gas and vapour) within the Construction Site or Extra Land surrounding the areas of proposed excavation or disturbance with respect to potential exposure scenarios, including but not limited to migration of Contamination via groundwater, ground gas and odour into the areas of excavation or disturbance;	✓	Note 1
	(iv)	present a preferred Remediation option based on:		
		(A) whole-of-life costs;	✓	8
		(B) to the extent practicable, maintaining the Overall D&C Program;	✓	8
		(C) benefits (as far as is practicable based on available infrastructure design information); and	✓	8
		(D) compliance with this deed;	✓	8
	(v)	define what will constitute Remediation Practical Completion of the Remediation;	✓	8
	(vi)	be prepared in accordance with Law, Approvals, applicable Codes and Standards, the lawful requirement of any Authority, Good Industry Practice, all guidelines made or approved by the EPA, the National Remediation Framework, the Human Health and Environment Risk Assessment and any other requirements of this deed;	✓	3
	(vii)	be reviewed and approved by a Certified Contaminated Land Consultant;	✓	Front Page
	(viii)	be reviewed and endorsed by an Accredited Site Auditor;	Note 2	N/A

Deed Item			Included in RAP	Report Reference
	(ix)	be accompanied by an Interim Site Audit Advice prepared by the Accredited Site Auditor when submitted to the Principal's Representative and the Independent Certifier	Note 2	N/A
	(x)	include details of any Remediation completed during the performance of any Preliminary Works; and	Note 3	N/A
	(xi)	consider and plan to mitigate the migration of Contamination from the Construction Site.	N/A	N/A
(d)	In addition to the requirements set out in clause 1.1(c) and without limiting clause 12.20(j), each Remediation Action Plan must contain sufficient detail and justification to enable the determination of any Agreed Remediation Scope, including:			
	(i)	an ACC Classification and Excavation Map, being a detailed map or maps, drawn to a practical scale of the relevant area the subject of a Remediation Action Plan that accurately identifies:	✓	9.5
		(A) the location of any samples that have been taken by and/or made available to the SBT Contractor, including the Detailed Site Investigation samples or any relevant information provided to the SBT Contractor in the Information Documents; and	✓	7, Appendix 1 and Appendix 5
		(B) a detailed mapping of remaining Solid Waste and its respective waste classification in accordance with the Waste Classification Guidelines and the relevant provisions of the POEO Act including resource recovery exemptions and orders across the relevant area the subject of a Remediation Action Plan, based on the relevant Detailed Site Investigations and clearly detailing the extent of lateral and vertical classification of Waste within each area the subject of a Remediation Action Plan;	✓	9.5
	(ii)	a detailed excavation plan that is consistent with the ACC Classification and Excavation Map prepared under clause 1.1(d)(i) describing the quantities in tonnes and cubic metres of each material, including a register in estimated tonnes and cubic metres of each waste classification of Solid Waste, proposed to be excavated and to be reused and/or disposed offsite (ACC Excavation Quantity Register);	✓	9.5
	(iii)	details of any other elements of Remediation that are required to mitigate risks to the construction, operation and maintenance of Sydney Metro - Western Sydney Airport including, but not limited to infrastructure design requirements, treatment of Contamination, capping and containment; and	✓	9, 10, 11
	(iv)	precise details of how the validation of Remediation will be achieved and demonstrated.	✓	10, 12

Notes:

1) Qualitative assessment of risk to human health and ecological receptors were included in the St Marys DSI and the supporting addendums. A detailed risk assessment relating to chlorinated hydrocarbons detected offsite at 1-7 Queen St and is provided in the Queen St HHRA

2) these items are requirements of the Deed and relates to an administrative process

3) information on any remediation undertaken as part of Preliminary Works is to be included in the Validation Report.

2. Remediation Objective

NSW EPA guidance[5] defines the objective of a RAP as being "*to set remediation objectives and document the process to remediate the contaminated site*". The primary objective for the remediation of the site is to make it suitable for its intended use as train station.

The specific layout of the proposed train station development post construction of the SBT Works was not available for consideration during the DSI and this RAP. It has been assumed that the site will be predominately covered in hard pavements (i.e. buildings and carparking associated with a train station,) with minimal soft landscaping (e.g. small landscaped bed in carpark with trees or shrubs). This type of land use is analogous with a generic commercial/industrial land use as defined in Schedule B7, Section 3.2.4 of the ASC NEPM. It has also been assumed that the station box is to be an undrained (tanked) structure, and therefore groundwater inflow into the station box is expected to be minimal.

Remediation of the site is required to mitigate the drawdown of groundwater contaminated with volatile chlorinated hydrocarbons from 1-7 Queen Street which pose an unacceptable risk to human health (construction workers and future users of the site).

TTMP has prepared this RAP in general accordance with the reporting requirements for a RAP outlined in guidelines presented in Section 3.

[5] Section 1.5, EPA (May 2020) "Consultants reporting on contaminated land"

3. Technical and Regulatory Framework

This RAP has been developed in general accordance with the following legislation, industry standards, codes of practice, and guidance documents, where relevant:

- NSW Work Health and Safety (WHS) Act 2011 (WHS Act 2011)
- NSW WHS Regulation 2017 (WHS Regulation 2017)
- Protection of the Environment Operations (POEO) Act 1997 (POEO Act 1997)
- POEO (Waste) Regulation 2014 (POEO Waste Regulation 2014)
- National Environment Protection Council, National Environment Protection (Assessment of Site Contamination) Measure, 1999 (amended April 2013) (ASC NEPM 2013)
- NSW EPA Contaminated Land Guidelines: Consultants Reporting on Contaminated Land, 2020 (NSW EPA 2020)
- NSW EPA Waste Classification Guidelines: Part 1 – Classifying Waste, 2014 (NSW EPA Waste Classification Guidelines)
- Addendum to the Waste Classification Guidelines (2014 Part 1: Classifying Waste (NSW EPA, 2016).
- NSW EPA Sampling design guidelines for contaminated land (Part 1 and Part 2), 2020 (NSW Sampling Design Guidelines)
- NSW EPA Contaminated Land Management: Guidelines for the NSW Site Auditor Scheme (3rd Edition), 2017 (NSW EPA 2017)
- PFAS National Environmental Management Plan (HEPA, 2020; Version 2.0) (PFAS NEMP)
- CRC Care Technical Report No. 10, Health Screening Levels for Petroleum Hydrocarbons in Soil and Groundwater, 2011 (CRC CARE 2011).

4. STM Site Information

4.1. STM Site Identification

The STM site is located in St Marys and is shown in Figure 1 in Appendix 1. Key attributes of the site are summarised in Table 4.

Table 4: Site Information

Attribute	Description
Address (centre of STM site)	63 Station Street, North St Marys NSW 2760 (Approx. Chainage 17,300m to 17,900m, as shown in Figure 2 in Appendix 1)
STM Site Area	Approximately 3.9 hectares (Ha).
Title Identification Details	Lots 175, 176, Part 177 and Part 210 Deposited Plan (DP) 26908 Part Lot SP12965 Lots 4, 5 and Part 6 DP18072 Lot 3A DP397002 Part Lot 1 DP 1040178 Lot 1 and Part Lot 2 DP1001735 Part Lot 1 DP1267484 Lot 7 and Part Lot 8 DP734738 Part Lot 1 DP997698 Part Lot 9 DP840717 Road Reserve for Station Street, West Lane
Current Land Use	**Station Box and Surface Works Construction Area:** • St Marys Bus Interchange • Sydney Trains Emergency Response Depot (Bus Driver Rest Compound east of bus interchange) – 1 Station Street • Cleared land within the rail corridor • Station Street • St Marys Station Plaza (commercial/retail centre) **Tunnel Section from the Station Box to Chainage 17,900m (refer to Figure 2 in Appendix 1):** • Commercial land use between Queen Street and West Lane (Tattoo parlour, and vacant buildings) • Public car park and residential house between West Lane and Carinya Avenue
Current Land Zoning	Land zones SP2 Railway, B4, R4 and IN1 under the Penrith Local Environment Plan 2010

Attribute	Description
Adjoining Land Uses	**North:** St Marys Train Station and Railway corridor. North of the rail corridor is the St Marys Commuter Carpark (surface and multistorey carpark) in the north-east, and commercial/light industrial (warehouse) activities in the northwest (Showerama, Evolution Windows System, Wilkins Windows). In the far north-western corner (and north of the rail corridor) is a substation. In the far north-eastern corner is the Australian Reinforcing Company (ARC) manufacturing facility (west of Forrester Road) who supply steel reinforcement to the construction industry. Land use along the northern side of Harris Street includes a range of commercial / light industrial activities (smash repairs, automotive mechanic, veterinary laboratory, agricultural chemical warehouse, timber yard, commercial cleaning, driving school, vehicle inspection service, motorhome yard). The EIS technical report indicates that two of the facilities (Vetlab and Autopak Formulations) are licenced under the POEO Act to undertake activities including: chemical production, storage, and waste generation; pesticide production, waste storage, pharmaceutical and veterinary product production, and non-thermal treatment of hazardous and other waste. **South**: South of site and east of Gidley Street is a residential area with a mixture of single detached houses and units / apartments. South of site and west of Gidley Street are commercial / retail activities and the car park for St Marys Station Plaza, and other public car park facilities. **East:** Glossop Street. East of Glossop Street is a residential area south of the rail corridor, and a commercial / industrial area north of the rail corridor. **West:** West of the site include the car park for the St Marys Station Plaza, commercial / retail premises between Gidley Street and Carinya Avenue, and a residential area west of Carinya Avenue. Approximately 100 m west north west of the site is a former dry cleaner located at 1-7 Queen St.

4.2. Site Description

The following has been summarised from the DSI[1] which was based on observations prior to site establishment and Preparatory Works by CPBG.

4.2.1. St Marys Station Plaza

- St Marys Station Plaza comprises a vacant, commercial shopping centre.
- The shopping centre comprises one above-ground level and single level basement car park that is accessed from Station Street.
- The below-ground car park was surfaced with hardstand pavement that was observed to be in good condition with some minor oil staining from motor vehicles on the hardstand.
- A small area used for the storage of cleaning chemicals was observed.
- A car wash with an oil separator and sub-surface drainage was present in the car park.
- There is the potential for some fill to be present in the exterior portions of this area of the site most notably in the northern portion of the property along Station Street.

4.2.2. 1-2 Station Street and 11-13 Chesham Street

- At the time of the inspection, the property was being used as a stockpiling area and the ground surface could not be inspected.
- Anecdotal information provided by Sydney Metro staff indicated that a building had previously been situated there but had been removed to facilitate usage of the area for stockpiling and placement of some portable site offices.
- Sydney Metro personnel indicated that they were not aware that an underground storage tank (UST) noted in the EIS may have existed on this property, and no records or anecdotal reporting were provided to Sydney Metro that a UST had been found or removed when the building was demolished.
- Sydney Metro provided a photograph of a gatic, or lid shown within the interior of the former building which may have been indicative of a possible UST, however the photograph was inconclusive. No information was provided indicating what the UST may have been present. This portion of the alignment was elevated approximately 10 m above the track line.
- Within 2 Station Street the land sloped upwards towards the intersection with Chesham Street.
- On the northern side of Chesham Street (east of the intersection with Station Street), the area was being used as a construction compound. The compound was surrounded by a chain-link fence and was surfaced with either gravel or bare soil. Several portable site offices and amenities were situated in this area.

5. Environmental Site Setting Summary

The following has been summarised from the DSI[1].

Table 5: Site Environmental Setting

Aspect	Description
Topography	A review of the topographic map of NSW indicates the site is situated at an elevation of approximately 36 m to 50 m AHD. The land slopes down in a westerly direction towards South Creek located approximately 900 m west of the site.
Geology	A review of the Penrith 1:100 000 scale geology map indicates that the site is underlain by Bringelly Shale of the Wianamatta Group which was deposited in a deep marine environment of the Middle Triassic. The Bringelly Shale is described as shale, carbonaceous claystone, laminite, lithic sandstone, with rare coal. Site specific ground conditions as summarised from the DSI is presented in Section 7 and a geotechnical cross-section of the site is included in Appendix 4.
Hydrology and Hydrogeology	There are no surface water bodies within the site. The nearest surface watercourses to the site include a minor, unnamed tributary of South Creek present approximately 420m to the north, and South Creek which is located approximately 900m to the southwest (at its nearest point). The existing groundwater level at the site within the Bringelly Shale is assessed to be approximately 34 m AHD, although a perched water may be present at the soil/rock interface. Groundwater flows in a westerly direction towards South Creek.
Registered Groundwater Bores	The nearest licensed groundwater bores (GW112625, GW112626 and GW112627) are located approximately 750 m northwest of the site and are located on residential properties (previously a service station). All three bores were installed as monitoring wells to 6 m below ground surface (bgs).
Salinity	A review of the map indicates that the site is mapped as having moderate salinity.
Acid Sulfate Soils (ASS)	ASS risk mapping indicates that the site is located in an area with Extremely Low Probability of Occurrence of ASS.
List of Contaminated Sites Notified to the EPA	A search of the List of NSW Contaminated Sites Notified to NSW EPA (as of 8 March 2022) was carried out on 13 April 2022. Two properties were recorded on the register comprising the following: • NS1513: 1 to 7 Queen Street (Former dry cleaner that is now vacant). This site is located above the Tunnel from approximately Chainage 17,800 to 17,850. • NS1189: 76 Glossop Street (Service station) located approximately 300 m north of the site.
NSW EPA Contaminated Land Public Record	A search of the NSW EPA Contaminated Land Public Record was carried out on 13 April 2022 for declaration notices, orders made by the EPA under the CLM Act 1997, voluntary management proposals approved under the CLM Act 1997, and site audit statements relating to significantly contaminated land. The search of the database revealed that the site, or properties within 250 m of the site, are not listed on the contaminated land public record.

6. Site History Summary

The following has been summarised from the DSI[6] which is based on information presented in the EIS and review of historical aerial imagery available through the NSW Government Historical Imagery portal:

- The 1943 historical aerial image shows the site comprised of St Marys Station, a rail line / siding, and low-density residential housing surrounding the station. A rail siding is present south of the station (what is now the St Marys Bus Interchange) and the siding appears to have been in place through to the 1990s when it was redeveloped into the bus interchange.
- Land between the rail siding and Station Street appeared to have been cleared in 1943. At the time land in this area appeared to be disturbed and used for the stockpiling of materials. Within this area buildings were added in the 1980s (now the Bus Driver Rest Compound). The configuration of these buildings changed between the 1980s through to 2013. A single building and shed remained in this area in 2013 to the present day. It is understood that this area is currently used as a rest area for bus drivers.
- A former Girl Guides building was constructed in the 1970s at the eastern end of the site between the rail line and Chesham Street. The building was demolished between 2009 and 2011. Anecdotal records indicate that remediation works were completed, which included excavation and off-site disposal of asbestos impacted soils, and reinstatement of remedial excavation with clean fill. The works were reportedly validated by an environmental consultant, although no formal documentation has been provided to Sydney Metro, CPBG or TTMP for review.
- From 1943 to the present-day, the density of residential housing increased, and units / apartments were also developed on land south of Station Street and east of Gidley Street. St Marys Station Plaza was developed in the late 1980s. During this time period, land west of Gidley Street and south of the rail line was developed for commercial use. Several service stations, motor vehicle service centres and dry-cleaning facilities were also located in this area between the 1950s and 1990s.
- Land north of the rail line was progressively redeveloped into commercial / industrial use between 1943 and 1965. The commuter car parks for the rail line were developed in the late 1970s and early 1980s, and the multi-storey carpark developed between 2009 and 2010.

7. Site Characterisation

TTMP prepared a DSI[1] in August 2022 which included an assessment of soil and groundwater conditions at the site with a focus on the redevelopment of the site as a Station Box and Tunnel for the Project. A copy of soil and groundwater laboratory results presented in the DSI, DSI Addendums and Queen St HHRA is included in Appendix 5 and investigation locations are shown on Figures 3 and 4 in Appendix 1.

7.1. DSI Objectives and Scope Summary

The objectives of the DSI which were to:

- Investigate areas of proposed excavation or disturbance.
- Investigate land within the construction site and selected areas surrounding the proposed excavation or disturbance.
- Provide in-situ classification of solid waste (i.e., spoil).

The DSI included:

- A desktop study review of previous investigations and readily available online information pertaining to contamination, site history and the environmental setting of the site.
- An intrusive investigation including soil sampling from boreholes, installation and sampling of groundwater monitoring wells, and a membrane interface probe (MIP) survey.
- Preparation of a refined conceptual site model based on the results of the investigation in light of a commercial / industrial land use and identified groundwater receptors.
- Provision of preliminary waste classifications for anticipated spoil during bulk earthworks.

7.2. Ground Conditions

In summary, ground conditions generally comprised:

- Hardstand in some investigation locations:
  - Commercial car park between West Lane and Carinya Ave (asphalt in SBT-CM-1022).
  - At grade car park north of St Marys Station Plaza building (asphalt in SBT-BH-1220 to SBT-BH-1222).
  - St Marys Bus Interchange (concrete in SBT-BH-1200 and brick pavers in SBT-BH-1215).
  - 1 Station Street (concrete in SBT-BH-1007, SBT-BH-1202 and SBT-BH-1232).
- Fill materials, including topsoil, were typically to depths of between 0.2 m and 1.5 m. Deeper fill was encountered in SBT-BH-1200 to a depth of 2.5 m.
  - Brick fragments were observed in shallow fill in SBT-BH-1215 (St Marys Bus Interchange) which were attributed to the brick pavers.
  - Brick, terracotta tiles and potential asbestos-containing material (ACM) as fibre cement debris was identified in fill in the off site property of 1-7 Queen Street (SBT-GW-1018 and SBT-GW-1019).

- Residual soils were encountered beneath the fill and were generally described as silty clay with sandy clay from 6.5m bgs and increasing sand from 14m to 16m bgs. An approximately 3-metre-thick band of weathered siltstone with clay was encountered at 16m bgs, with bedrock (assumed siltstone) from 19m bgs.
- The Bringelly Shale Formation within the site was described as distinctly bedded, inter-laminated siltstone and sandstone. Based on the cross-section presented in Appendix 4, and the Bringelly Shale Formation was encountered at approximate elevations of 42m AHD in the east of the site (Chainage 17,300m) reducing to approximately 23m AHD in the west of the site (Chainage 17,900m).

7.3. Groundwater

The following summary includes information from the DSI, Queen St HHRA and St Marys Groundwater Addendum.

Groundwater flows in a westerly direction towards South Creek (refer to Figure 5, Appendix 1). Groundwater elevations recorded ranged between approximately 30 m AHD and 40 m AHD.

Electrical conductivity ranged from fresh to brackish. Groundwater pH ranges from acidic to mildly alkaline, and had low to moderate levels of dissolved oxygen given the temperature ranges reported.

Project Area Excluding 1-7 Queen Street

Monitoring groundwater via wells installed in the project area (excluding 1-7 Queen Street) did not report visual signs of contamination or Non-Aqueous Phase Liquids (NAPL). Sulphurous odours were detected in several wells.

Within the project area (excluding 1-7 Queen Street) groundwater monitoring has identified a range of potential contaminants including metals, hydrocarbons, organic compounds, ammonia and PFAS that exceed the adopted assessment criteria for the project. The DSI concluded these COPC were likely to be derived from natural and diffuse urban/industrial sources within and surrounding the project area.

1-7 Queen Street

Elevated concentrations of hydrocarbons in the F1 (C6-10) fractions were reported in groundwater samples collected from 1-7 Queen St (former dry cleaners). The hydrocarbons reported are predominately made up of the chlorinated hydrocarbon PCE and to a lesser extent DCE, vinyl chloride, and TCE[6,7]. The maximum concentration of PCE reported was 24.5 mg/l from SBT-BH-1018. The maximum concentration of vinyl chloride reported was 0.32 mg/l from BH1/MW1.

The maximum concentrations of chlorinated hydrocarbons reported are higher than those reported in previous investigations and is the result of the installation and sampling of deeper groundwater

[6] Chlorinated hydrocarbons reported include tetrachloroethene (PCE) and trichloroethene (TCE), cis-1,2-dichloroethene (cis-1,2 DCE), trans-1,2-dichloroethene (trans-1,2-DCE) and vinyl chloride
[7] TCE, DCE and vinyl chloride are breakdown products of PCE.

monitoring wells at this site, and the location of monitoring wells which targeted areas which reported highest levels of impact from a member interface probe (MIP) survey.

Phenolic compounds were also detected in SBT-BH-1019.

In comparison to the project area excluding 1-7 Queen St, concentrations of PFAS were reported in monitoring wells from the former dry cleaners 1-7 Queen St. The highest concentration of PFOS reported from groundwater monitoring wells was 1.07 µg/l which exceeded the Freshwater Guidelines with 95% species protection[8]. Dry cleaners are known potential sources of PFAS.

Elevated concentrations of ammonia were also reported in monitoring wells at 1-7 Queen Street.

7.4. Key Findings of DSI and Queen St HHRA

The DSI (including Addendums to the DSI) and the Queen St HHRA identified the following contamination issues:

- Potential ACM (as fibre cement debris) was identified in fill at the 1-7 Queen Street Property however the presence of asbestos was not confirmed through laboratory analysis. The presence and extent of asbestos impact at this property is unknown however the risk was considered to be low given no excavation works are planned at this property. Zinc was also identified in soil at this property above ecological criteria however no soil disturbance is proposed in this area during construction.
- At 1-7 Queen Street chlorinated hydrocarbons (PCE, TCE, DCE and vinyl chloride) were identified in soil and groundwater and soil vapour at the 1-7 Queen Street Property (former dry cleaners) with highest concentrations reported close to the building. The concentrations reported were considered to pose potentially unacceptable risks to future occupants of the property and subsurface construction workers during construction of the station box and tunnel. In addition to posing a potential unacceptable risk to human health, contaminated groundwater migrating towards the station box has the potential to impact on the classification of soil/rock materials requiring excavation and disposal for construction of the tunnel and station box.
- Perfluoroalkyl and Polyfluoroalkyl Substances (PFAS), heavy metals and nutrients (ammonia) were identified in groundwater which are derived from diffuse sources in the project area and were considered unlikely to pose an unacceptable risk to construction workers and future users of the site. Groundwater intercepted by the project containing these COPC would be treated to comply with Planning Condition E129 or an Environmental Protection License (EPL) approved by the NSW EPA.
- Fill, soil and rock materials within the Station Box and St Marys Plaza site did not pose an unacceptable risk to future users of the site where the completed train station is predominately covered in hardstand with minimal soft landscaping.

[8] LDPE hydrasleeves were used in the monitoring wells at 1-7 Queen St and HDPE sleeves were used in all other monitoring wells. LDPE hydrasleeves have the potential to absorb PFAS however it is considered unlikely that the deployment of these hydasleeves would have changed findings which have reported elevated concentrations of PFAS at this site. HDPE hydraleelves will be deployed in future sampling events.

It was concluded in the DSI that widespread contamination across the site was not identified, however additional assessment was recommended to determine the need for and scope of remediation (if any) comprising:

- Preparation of a site-specific risk assessment (SSRA) to assess risks associated with chlorinated hydrocarbons and PFAS identified in groundwater at the 1-7 Queen Street property. The SSRA was reported in the Queen St HHRA.
- Preparation of the St Marys Groundwater Addendum following completion of additional groundwater monitoring at the site to assess the potential source (i.e., type of hydrocarbon (e.g., petrol/diesel)) and potential impacts to the Project associated with hydrocarbons identified in groundwater within 1 Station Street (Sydney Trains Emergency Response Depot) and western portion of 2 Station Street.
- Assessment of soil within a portion of the St Marys Station Plaza was required to be completed following demolition of the building; several planned boreholes could not be completed as part of the DSI which presented a data gap. This investigation was reported in the St Marys Station Plaza Addendum.

Furthermore, the DSI provided recommendations for spoil management including the:

- Engagement of a competent person during disturbance of topsoil/fill materials to visually monitor for signs of potential contamination and potential ACM.
- Segregation and stockpiling of spoil according to material type and management of stockpiles in accordance with the requirements of the Project Construction Environmental Management Plan (CEMP). Particularly, fill material excavated from Area of Environmental Concern (AEC) AEC 3A (*Former Girl Guides Hall with potential for contamination (asbestos and lead) associated with the demolition of this building*) and a surrounding buffer area (approximately 2,000m^2 denoted as 'Former AEC 3A Buffer Area', as shown in Figure 3C in Appendix 1) be segregated from fill materials won from elsewhere during the Preliminary Works.
- Reuse of soil within the larger Western Sydney Airport Site (FS01); TTMP concluded that soils sampled would be suitable (from a contamination perspective) for reuse at the FS01 site, however checks would need to be undertaken to confirm such material does not contain asbestos, and CPBG ensure relevant regulatory requirements (e.g., Protection of the Environment Operations (Waste) Regulation 2014 and Protection of the Environment Operations Act 1997) and / or the Federal Material Import and Reuse Procedures are complied with.
- Classification of waste spoil prior to offsite disposal.

With regards to uncertainty of asbestos and lead within AEC 3A noted above, TTMP prepared a Technical Memorandum[9] discussing preliminary results of the DSI. The Technical Memo concluded that there was a low-risk of contamination within area AEC3A based on a review of additional information including a Valuation Report which stated that remediation works had taken place at 11-13 Chesham Street (which includes the former location of the Girls Guide Hall (AEC3A)) including the excavation and off-site disposal of asbestos impacted soils; validation of removal by

[9] TTMP. Technical Memorandum: Preliminary Soil Results Eastern Portion of St Marys. Prepared for CPG. Ref: SMWSASBT-CPG-SWD-SW000-GE-MEM-040551, dated 15 July 2022.

environmental consultant; and reinstatement of remedial excavation with validated Virgin Excavated Natural Materials (VENM). A recommendation was made in the Technical Memorandum to segregate topsoil/fill within the footprint of AEC 3A and buffer around this area as a precaution prior to reuse/disposal.

7.5. St Marys Plaza DSI Addendum

Investigation locations completed at St Marys Plaza were reported in TTMP (30/9/2022) *Detailed Site Investigation Addendum St Marys Station, St Marys Plaza (DSI Report Addendum 01), SMWSASBT-CPG-SWD-SW000-GE-RPT-040516*. TTMP concluded for the St Marys Plaza site that the land was suitable for commercial/industrial use. Analytica data tables included in this addendum have been included in Appendix 5.

7.6. Groundwater Monitoring DSI Addendum: Findings

The groundwater data included in the Groundwater Monitoring DSI Addendum indicates that within groundwater in the project area potential contaminants including metals, hydrocarbons, organic compounds, ammonia and PFAS which are likely to be derived from natural and diffuse urban/industrial sources in the project area. During construction groundwater will require treatment to comply with Planning Condition E129 or an Environmental Protection License (EPL) approved by the NSW EPA.

7.7. Queen Street HHRA: Findings

Further investigation and the undertaking of a site specific risk assessment was undertaken at the former dry cleaner located at 1-7 Queen Street, St Marys. The location of the former dry clean is shown in Figure 1, Appendix 1 and is located approximately 100 m west north west of the station box.

The scope of work completed included:

- drilling and sampling to refine the understanding of vertical distribution of chlorinated hydrocarbon impact in soil and rock.
- additional groundwater sampling was conducted at multiple depths in new and existing wells, along with hydraulic conductivity testing in all available groundwater wells within 30 m of the suspected source area.
- using the new and existing site-specific information the preparation of a transport model to estimate the time contaminated groundwater would take to reach the station box, once de-watering induces drawdown.
- completion of a Human Health Risk Assessment (HHRA).

Groundwater data showed that chlorinated hydrocarbon concentrations indicative of the presence of free-phase (NAPL) solvents occurred at the top of the tunnel alignment, with lower concentrations at deeper levels within the tunnel section. This suggests that concentrations in some soil or rock encountered in the contaminated zone may be at saturation limits. Direct testing of soils in the area did not verify saturation concentrations at that depth, indicating that the contaminant pathways and concentrations down the profile are not uniform. Testing indicated that the hydraulic conductivity was higher than previously assumed in the source area at tunnel depth and between the source and station box excavation.

The time that groundwater would take to flow from the contaminated zone at 1-7 Queen Street to the Station box excavation, due to construction related drawdown and flow towards the station, was estimated between 6 and 8 months.

The HHRA based on modelled and inferred soil and groundwater concentrations indicated:

- Potential unacceptable risk to station workers from vapour intrusion and direct contact from contaminated groundwater drawn into the station box (6 to 8 months after dewatering commences)
- Potential unacceptable risk to tunnel workers via direct contact and vapour inhalation during TBM and cross passage construction through the contaminated zone, based on 2 days' exposure. Vapour concentrations are also estimated to be above odour thresholds.
- Acceptable risk associated with vapour inhalation around spoil from the contaminated zone, in the spoil holding area.
- Vapour concentrations released from the station box to the surrounding area, where the public may be exposed, was estimated to be below odour thresholds and below levels that would pose a health risk.

Given the potential for unacceptable inhalation or direct contact risk management measures were recommended once construction commences beneath the groundwater table including:

- on-going groundwater monitoring
- contingency mitigation measures if monitoring indicates that concentrations have, or will likely, become unacceptable.

8. Remediation Options Assessment and Remediation Strategy

CPBG propose to carry out SBT Works at the STM site. The SBT Works comprises two main phases which include:

- Preparatory Works, piling and bulk excavation above the groundwater table
- Bulk excavation beneath the groundwater table.

Soil/rock materials excavated from the site are not considered to constitute remediation works because significant contamination was not identified in the materials to be excavated.

However during bulk excavation beneath the groundwater table there is potential for chlorinated hydrocarbons to migrate from the former dry cleaner at 1-7 Queen St to the station box as a result of groundwater drawdown and dewatering. Contamination in groundwater has the potential to pose an unacceptable risk to construction workers and future users of the site, triggering the need for remediation.

A remediation strategy to manage potential risks from chlorinated hydrocarbons is required for both construction and operational phases of the project. The preferred remediation strategy, including technically feasible remediation contingency options for the construction phase is discussed in Section 8.1. A potential strategy for the operational phase in Section 8.2, noting this strategy would need to be evaluated and adopted by the SSTOM Contractor.

8.1. Construction Phase

The Queen Street HHRA has identified the requirement for on-going monitoring following the commencement of bulk excavation beneath the groundwater table, and the potential requirement for mitigation measures for the management of groundwater from 1-7 Queen Street should groundwater monitoring indicate that concentrations have, or will likely, become unacceptable.

Section 7.2 of the Queens St HHRA presented four contingency mitigation options which have been reproduced in Table 6. These include:

- Establishment of a permeable reactive barrier (PRB), such as injected activated carbon, to the west of the Station box site to retard contaminated groundwater migration towards the station.
- Ground treatment to the west of the Station box to decrease the hydraulic conductivity and therefore the flux of chlorinated hydrocarbons.
- Groundwater recharge at the western end of project boundary, adjacent to excavation, to reduce the hydraulic gradient and therefore the groundwater flow rate towards the Station.
- Source remediation.

TTMP and CPBG have considered the contingency mitigation options and advised that the preferred mitigation option is the implementation of the permeable reactive barrier (PRB) based on its technical feasibility, ease of deployment, cost and program requirements.

Other mitigation measures are not preferred based on technical feasibility, cost, program and site access requirements.

The PRB is to be installed in Queen Street within 6 to 8 weeks of commencement of bulk excavation of the station box. The PRB is to be installed to abate the migration of contaminated groundwater from 1-7 Queen Street towards the station box.

The PRB will be installed through the injection of a colloidal activated carbon (AC) product at three 50 mm diameters bores (refer to Figure 4A, Appendix 1) to approximately 20 m AHD in Queen Street (with the screened interval from approximately 5 m bgs to 20 m AHD). The injection bores are to be spaced 5 m apart (centre to centre). The spacing is based on previous experience by TTMP with the installation of a PRB in siltstone of similar permeability to mitigate the migration of chlorinated hydrocarbons due to drawdown related to excavation of the station box. The 5 m well spacing, loading of injectate based on the estimated flux of chlorinated hydrocarbons, will create an effective barrier to reduce the mass flux of chlorinated hydrocarbons by over an order of magnitude for more than two years.

The product is mixed with water ex-situ and injected to the target formation using specialised injection equipment. An example of a product which is readily available and suitable to adsorb chlorinated hydrocarbons detected in groundwater adjoining 1-7 Queen Street is the Regenesis Product PlumeStop™. TTMP anticipate that the product will disperse into the geological formation to form the PRB. The PRB will adsorb and abate the migration of hydrocarbons (including chlorinated hydrocarbons) towards station box.

In conjunction with the installation of the PRB, a monitoring and contingency plan will be implemented which is discussed in Section 11.

8.2. Operational Phase

Sydney Metro has advised that the station box is to be an undrained (tanked) structure, and therefore the volume of groundwater inflow into the station box is expected to be negligible. Notwithstanding this, groundwater inflow into the station and dive structure during operational and maintenance phases is likely to require treatment prior to discharge.

Completion of the St Marys Metro Station is outside the scope of the SBT Works and will be completed by others under a SSTOM works package.

An Addendum to this RAP will need to be prepared as part of the SSTOM works packages which describes how potential impacts to future users of the site will be managed as part of the operational phase of the project and incorporated into the design of the metro station. Potential management measures which could be considered by the SSTOM work package include:

- Continued groundwater monitoring and management/maintenance of PRB as per the requirements of this RAP and the EMP described in Section 12.1 until water proofing of the metro station has been completed and post construction groundwater flow from 1-7 Queen Street into the metro station is negligible.
- Provision of drainage to collect and channel seepage that enters the station box and tunnel towards a water management system.

- Design station ventilation system such that sufficient air exchange occurs within the metro station to mitigate potential risks associated with vapour ingress.

Practical completion of remediation would be considered to have occurred when the following has been completed under the SSTOM work package:

- Waterproofing (tanking) of the station has been completed such that the flow of groundwater has returned to its pre-construction direction. Monitoring of the PRB would cease at this point.
- A Validation Report has been prepared and approved by the Site Auditor (refer to Section 12.2)

Table 6: Summary of potential contingency mitigation during construction.

Mitigation Option	Description	Timeframe	Relative Cost *	Pros/Cons
Permeable reactive barrier (PRB)	Injection of a PRB into three monitoring wells located between the source area and the station box.	Implementation in weeks to months depending on availability of reagent and approvals required Maintenance during construction expected to be low.	Low ($0.2M to $0.5M).	**Pros** Can be delivered using existing and already proposed well network No above-ground infrastructure required post injection **Cons** Additional monitoring well(s) may be required closer to the station to confirm effectiveness of barrier Reagent re-injection event(s) may be required depending on mass of chlorinated hydrocarbons
Ground treatment	Ground treatment into higher permeability zone to reduce drawdown/gradient	Implementation in weeks to months depending on access and approvals required	Low ($0.2M to $0.5M).	**Pros** No above-ground infrastructure required post treatment **Cons** Extent of higher permeability zone between the source area and Station box not well understood
Groundwater recharge	Recharge of potable water or groundwater into line of wells along western project boundary. Sentinel wells could be assessed for recharge potential, however plume may divert around barrier given distance from excavation	Implementation <6 months. Operation required during construction until station tanked.	Low to medium Implementation ($0.5M to $1.5M). Annual cost during station construction ($0.5M/yr).	**Pros** Well understood technology **Cons** Above-ground infrastructure required during operation Implementation may be too slow if high conductivity zone present and contaminant mobilisation is faster than estimated Increase in volume of water entering excavation requiring management Option may not meet program requirements.

Mitigation Option	Description	Timeframe	Relative Cost *	Pros/Cons
Source remediation	Remediation of source areas and associated plume from accessible project land, to project-defined criteria.	Six months to one year (ongoing monitoring required).	High ($2M-$5M).	**Pros** Also reduces risk to Tunnel and Spoil workers as well as Station box workers Good public relations for CPBG – the project cleaning up existing pollution **Cons** Would need to be implemented prior to construction, before requirement for mitigation is confirmed CPBG may be unable to access the site to complete source remediation. Option does not meet program requirements.

* Indicative estimate only.

9. Spoil Management Measures

Prior to Preparatory Works commencing, all relevant licences and approvals shall be obtained from the relevant authorities.

Spoil management shall be carried out in accordance with the Project CEMP and applicable subplans including but not limited to the Project Soil and Water Management Sub-Plan, Project Waste and Recycling Management Sub-Plan and Project Spoil Management Sub-Plan.

9.1. Soil and Water Management Plan

A Soil and Water Management Plan[10] (SWMP) was prepared by CPBG prior to completion of the DSI. Relevant management strategies presented in the SWMP (as outlined in Table 7) shall be implemented during Preparatory Works.

Table 7: Relevant Soil Management Strategies (SWMP)

Management Strategy	SWMP Section Reference
Erosion and sediment control planning	7.4
Management of chemical and refuelling including spill management	7.8
Contamination management (including Unexpected Finds Protocol)	7.9

A copy of the Environment Procedures for the above management strategies are provided in Appendix 6. CPBG have also prepared a draft Erosion and Sediment Control Plan (ESCP) which shall be implemented, a copy of which is provided in Appendix 7.

The roles and responsibilities of the CPBG team and the specialist consultants are detailed in Section 8 of the SWMP, and Section 9 of the SWMP discusses the systems and tools available to implement the SWMP, namely, detailed erosion and sedimentation control plans, training, reporting, review, auditing and continual improvement and keeping records.

9.2. Inspection of Spoil for Asbestos-Containing Material (ACM)

Spoil containing fill and/or topsoil shall be visually inspected for potential ACM during excavation by a competent person. A competent person is considered to be someone who has completed asbestos awareness training and is experienced in the identification of ACM, and may include a CPBG representative, specialist consultant, an occupational hygienist or SafeWork NSW Licenced Asbestos Assessor.

If suspected ACM is observed, then the Project Asbestos Management Plan[11] (AMP) shall be implemented. A copy of the Unexpected ACM Find Procedure from the AMP is included in Appendix 8.

[10] CPG. NSW (Off-Airport) Soil and Water Management Sub Plan (SWMP), Sydney Metro Western Sydney Airport Station Boxes and Tunnelling Works, Rev A dated 19 May 2022
[11] CPG. Asbestos Management Plan, Sydney Metro Western Sydney Airport Station Boxes and Tunnelling Works. Ref: SMWSASBT-CPG -1NL-NL000-SF-PLN-000024 (Rev A, dated 2 February 2022)

9.3. Segregation of Topsoil/Fill within Area AEC3A and Buffer

Topsoil and fill material excavated from the 'Former AEC 3A Buffer Area' shown in Figure 3C, Appendix 1, shall be segregated from other spoil during Preparatory Works.

9.4. Reuse of Spoil

TTMP concluded in the DSI that soils sampled would be suitable (from a contamination perspective) for reuse at the FS01 site, however checks would need to be undertaken to confirm such material does not contain asbestos, and CPBG ensure relevant regulatory requirements (e.g., Protection of the Environment Operations (Waste) Regulation 2014 and Protection of the Environment Operations Act 1997) and / or the Federal Material Import and Reuse Procedures are complied with.

Spoil containing fill and/or topsoil shall be visually inspected for potential ACM during excavation in accordance with Section 9.2.

In the event that additional investigation is carried out to assess the suitability (from a contamination perspective) of spoil for reuse at the STM site or within the FS01 site then the report shall be reviewed/endorsed by the Site Auditor and recommendations made in the assessment report or as part of interim audit advice implemented where relevant.

Soil materials excavated during Preparatory Works which are proposed to be reused (e.g., at St Marys Station Plaza) or in the FS01 site shall be assessed in accordance with the Materials Reused and Importation Procedure (included in Appendix 6) to ensure suitability for reuse. If materials are assessed not to be suitable for reuse, they shall be classified to enable disposal as waste to a licensed landfill.

9.5. Waste Classification and Disposal

Where offsite disposal of spoil is required, such spoil shall be assessed and managed in accordance with the Waste and Recycling Management Procedure (included in Appendix 6), which includes classification in accordance with the NSW EPA Waste Classification Guidelines (2014) and Addendum to the Waste Classification Guidelines (2014 Part 1: Classifying Waste (NSW EPA, 2016).

Where sampling is required to confirm the waste classification of surplus soil, this shall be undertaken in accordance with the ASC NEPM 2013 and the NSW EPA Sampling Design Guidelines (2020).

10. Assessment of Imported Material

10.1. General

CPBG will need to import material to construct the piling platform and potentially to achieve design levels.

Imported material shall be assessed in accordance with the Materials Reuse and Importation Procedure (included in Appendix 6) and this RAP to ensure suitability (from a contamination perspective) for use at the STM site.

Imported soil/aggregate will be required to be classified as either VENM, excavated natural material (ENM), or supplied in accordance with a suitable resource recovery order/exemption

published by the NSW EPA. TTMP recommends that quarried VENM is used where possible to reduce the risk of importing waste/contamination from other construction sites or in recycled products.

Prior to import, the contaminated land consultant shall carry out a review of documentation provided by the material supplier to check whether the material has been appropriately classified as VENM, ENM or is supplied in accordance with a suitable resource recovery exemption and order.

- This may include but not be limited to a review of:
    - VENM certificates, including laboratory reports if available.
    - ENM certificates including laboratory reports.
    - Letters confirming the applicable resource recovery order/exemption and relevant laboratory certificates.
- Commercially quarried material which is extracted and sold from a quarry is exempt from a VENM certificate provided that the supplier can confirm the source/quarry of the material and the quarry has an Environment Protection Licence (EPL) issued by the NSW EPA for extractive purposes.

To be considered suitable for use, the chemical results presented in the supplied documentation shall meet the criteria specified in the appropriate resource recovery order and be less than the assessment criteria presented in Section 10.5. If insufficient information is provided, then the proposed material shall be assessed for due diligence purposes at the source site prior to importation.

Imported soil/aggregate including quarried VENM shall be inspected during import to confirm the material is consistent with the source documentation as outlined in Section 10.2.

Imported soil/aggregate shall be sampled and analysed during importation to confirm that the material is suitable for use as outlined in Section 10.3 to Section 10.7. Quarried VENM is exempt from sampling and analysis provided that adequate information is provided regarding the source and EPL.

10.2. Visual Inspections

Imported materials shall be visually inspected periodically during importation by a CPBG representative or the contaminated land consultant to check that the material is consistent with that described in the source documentation, and for the presence of potential contamination.

10.3. Sampling and Field Screening

Where sampling is required to be carried out to assess imported materials, fieldwork shall be undertaken by experienced and suitably qualified consultant following written field procedures based on industry accepted standard practice and the ASC NEPM 2013 and the NSW EPA Sampling Design Guidelines (2020).

Samples shall be collected from stockpiles during importation of the soil by a suitably qualified consultant. Soil samples shall be collected using a hand tools or excavator depending on the dimensions of the stockpile.

A photo-ionisation detector (PID) with 10.6 eV lamp may be used to screen soil samples for the potential presence of volatile organic compounds (VOCs)[12].

Between each sampling location, new nitrile gloves shall be used to reduce the potential for cross contamination to occur.

Samples collected shall be identified by a unique sample identifier. The sample identifier will be included on all sample jars and associated paperwork including field sheets and chain of custody forms.

10.3.1. Sample Storage and Preservation

Samples shall be placed into laboratory prepared and supplied sample containers that are appropriate for the COPC.

For analysis of VOCs, samples shall be collected as rapidly as possible with zero headspace where practicable, attempting to minimise volatile losses. Samples shall be submitted as soon as possible to the laboratories to prevent loss while in storage or transit and analysed within recommended holding times.

Where analysis of samples for PFAS is required, the sampler shall consider the guidance within the PFAS NEMP (HEPA, 2020)

Sample containers shall be placed directly into an ice filled cooler and transported to the laboratories under chain of custody protocol. All samples are required to be documented as received by the laboratory chilled and intact.

10.3.2. Sampling Equipment Decontamination Procedures

Non-disposable sampling equipment (e.g. trowel, shovel etc.) shall be decontaminated between each sampling location using the following approach or similar depending on the equipment used:

- Scrub all surface of the equipment with a wire brush to remove soil and/or gross contamination.
- Scrub the equipment in a bucket filled with a solution of phosphate and PFAS free detergent (e.g. Liquinox), using a brush that can reach all surfaces.
- Rinse the equipment in clean potable water.

10.3.3. Equipment Calibration

Equipment shall be calibrated as per the manufacturer's instructions.

The PID shall be bump tested at the commencement of each day of sampling and if necessary, during the day in accordance with the procedure provided by the supplier.

Calibration certificates shall be retained and provided within the letter report (Section 10.12).

[12] Chlorinated hydrocarbons including TCE, PCE and vinyl chloride have ionization potentials less than 10eV and should be readily detectable in soil using a PID with 10.6eV lamp. Breakdown products including cis-1,2 DCE have ionization potentials greater than 10.6eV and hence would not be readily detected using a PID with 10.6eV lamp.

10.3.4. Field Quality Control Samples

The following types of field quality control samples shall be collected:

- Intra-laboratory and inter-laboratory duplicates at a minimum rate of 5% (i.e. 1 duplicate per 20 primary samples)
- Rinsate blanks, where non-disposable sampling equipment is used
- Trip blank and trip spike samples prepared by the laboratory.

Field duplicate soil samples shall be collected from soil immediately adjacent to the primary sample by placing approximately equal portions of the primary sample into two sample jars. Samples shall be labelled so as to conceal their relationship to the primary sample from the laboratory.

Rinsate blanks shall consist of pre-preserved bottles filled with laboratory prepared water that is passed over decontaminated field equipment and then collected in containers used for the sampling process. Rinsate blanks shall be preserved in a similar manner to the original samples.

Trip blank and trip spike samples shall be prepared by the primary laboratory during soil validation sampling, carried to the field unopened and subjected to the same preservation methods as the primary field samples.

10.4. Laboratory Analysis

Selected soil/aggregate samples will be analysed by ISO/IEC 17025 certified laboratories with National Association of Testing Authorities (NATA) accredited methods for the analytes outlined in Table 8. The analytical suite shall be determined by the contaminated land consultant based on the source and characteristics of the material. This applies to VENM (other than quarried VENM where adequate information has been provided regarding the source and EPL), ENM and recycled/processed material supplied in accordance with a resource recovery order/exemption.

Table 8: Proposed Laboratory Analysis for Imported Soil/Aggregate Materials

Type	Rate	Analysis
VENM (not quarried or where insufficient information has been provided for quarried material)	• Up to 250 m^3: 1/25m^3 • 250 m^3 - 2,500 m^3: 1/100m3 upto 10 sample • >2,500 m^3: 1/250m^3 With a minimum of 3 samples per source.	Source dependant although may include TRH, BTEX, PAH, OCP, OPP, PCB, PFAS, metals and asbestos.
ENM	As per Table 1 of the NSW EPA current ENM Order 2014	As per Table 4 of the NSW EPA current ENM Order 2014 (metals, electrical conductivity, pH, TRH, BTEX, PAHs, metals, foreign materials), PFAS, OCP, OPP, PCB and asbestos. Asbestos samples to be collected from 500 ml bags (see additional note in this table).

Type	Rate	Analysis
Other recycled/processed soil/aggregate material supplied in accordance with a resource recovery order/exemption	• Up to 250 m3: 1/25m3 • 250 m3 - 2,500 m3: 10 samples • >2,500 m3: 1/250m3 With a minimum of 3 samples per source and per stockpile.	Source dependant although may include TRH, BTEX, PAH, OCP, OPP, PCB, PFAS, metals and asbestos.

TRH: Total recoverable hydrocarbons
BTEX: Benzene, toluene, ethylbenzene and xylene
PAH: Polycyclic aromatic hydrocarbons
OCP/OCP: Organochlorine pesticides/ organophosphate pesticides
PCB: Polychlorinated biphenyls
Metals: Arsenic, cadmium, chromium, lead, nickel, zinc, mercury and copper
PFAS: Perfluoroalkyl and Polyfluoroalkyl Substances

Note on asbestos: If a situation arises where material which has been classified as ENM or a RRO/RRE is imported which is suspect (e.g. due to visual presence of ACM in an imported load) an investigation of the material will be undertaken to determine whether the material can remain and be used on the site. This investigation would include the collection of 10L samples.

10.5. Assessment Criteria

The suitability of imported material shall be assessed again the following criteria presented in ASC NEPM 2013 and CRC CARE 2011.

10.5.1. Human Health Criteria

- Soil health investigation levels (HILs) for a commercial/industrial land use scenario (HIL-D).
- Soil health screening levels (HSLs) (direct contact) for a commercial/industrial land use scenario (HSL-D) and intrusive maintenance workers.
- Soil HSLs (vapour intrusion) for a commercial/industrial land use scenario (HSL-D) and intrusive maintenance workers.

10.5.2. Ecological Criteria

The piling platform will subsequently be excavated to facilitate construction of the station box, as such ecological criteria is not considered relevant. The SBT works do not involve landscaping and as such ecological criteria (such as environmental investigation levels and environmental screening levels) are not considered relevant.

10.5.3. Management Limits

Management Limits for TPH fractions for a commercial/industrial land use scenario.

10.5.4. Asbestos

No asbestos detected at the reporting limit of 0.1g/kg or via trace analysis.

10.5.5. Aesthetics

The majority of the piling platform with the exception of the capping beam area will subsequently be excavated to facilitate construction of the station box, as such aesthetics are not considered relevant.

10.6. Quality Assurance and Control

Project specific quality assurance/quality control (QA/QC) procedures shall be implemented to improve transparency, consistency, comparability, completeness, and confidence in the data collected.

The following data quality indicators (DQIs) shall be adopted.

Table 9:DQIs for Assessment of Imported Material with Sample Analysis

Item	Acceptable Limit
Analysis of blind (intra-laboratory) duplicates and split (inter-laboratory) duplicates.	Rate of 1:20 (5%) primary soil samples for the same analysis of primary samples; Calculation of relative percentage differences between primary and duplicate samples. RPD results for soil samples: • No Limit (where the average concentration is 0-10 x laboratory limit of reporting (LOR); • 50% (where the average concentration is 10-20 x laboratory LOR); and • 30% (where the average concentration is > 20 x laboratory LOR). RPDs will be considered where a concentration is greater than 10 times the LOR.
Analysis of rinsate blanks	Where non-disposable equipment is used, at least one (1) sample per batch of soil sampling or material type where the source and sampling methods are consistent; and Results less than the laboratory LOR.
Analysis of laboratory prepared trip blanks	At least one (1) sample per batch for soil samples or material type where the source and sampling methods are consistent where volatiles are analysed; and Results less than the laboratory LOR.
Analysis of laboratory prepared trip spikes	At least one (1) sample per batch for soil samples or material type where the source and sampling methods are consistent where volatiles are analysed; and Results within 60-120% recovery.
Analysis of laboratory blanks, surrogates, reference and control samples	The laboratories will be required to conduct their own internal quality program for assessment of the repeatability of the analytical procedures and instrument accuracy under their NATA accreditation. This will include analysis of laboratory blank samples, duplicate samples, spike samples, control samples and surrogate spikes. The laboratory QA/QC procedures and results will be described within the laboratory reports. The laboratory internal QA/QC sample results will be reviewed for comparison with the laboratory's NATA guidelines and Schedule B3 of the ASC NEPM 2013.
Laboratories and methods used	National Association of Testing Authorities accredited for the method. Methods should be in accordance with amended ASC NEPM 2013.
Holding times	Samples should be analysed within recommended holding times.
Sample LORs	Results less than the adopted assessment criteria; justify/quantify if different.

10.7. Reporting

A letter report shall be prepared to document the assessment carried out and confirm, or otherwise, the suitability of the imported material for use at the site.

11. Bulk Excavation Beneath the Groundwater Table: Construction Phase Monitoring and Contingency Plan

This section applies to the construction phase involving bulk excavation beneath the groundwater table.

11.1. Groundwater Monitoring

The groundwater monitoring program described in the following table is to be implemented at the commencement of bulk excavation beneath the groundwater water table.

Table 10: Construction Phase Groundwater Monitoring

Monitoring Well	Frequency	Analytes	Purpose	Trigger Value and Contingency Plan
SBT-GW-0001a [1] **SBT-GW-0001b** [1]	Weekly	VHC	Monitor migration of chlorinated hydrocarbons from source area at 1-7 Queen Street	Trigger Value: refer to Section 11.6 Contingency Plan: Refer to Section 11.6
SBT-GW-1012 [2] **SBT-GW-1013** [2] **SBT-GW-1014** [2]	Weekly			
SBT-GW-1347a [3] **SBT-GW-1347b** [3] **SBT-GW-1347c** [3] **SBT-GW-1348a** [3] **SBT-GW-1348b** [3] **SBT-GW-1348c** [3]	Primary mitigation: Weekly for 'c' interval wells (at ~18mAHD) *If contingency mitigation implemented, then all multi-level wells monitored weekly*			

Notes:

1. An additional deeper monitoring well will be installed next to the existing monitoring well SBT-GW-0001. The additional monitoring well will have a screened interval of 10-14 m bgs. The existing well is to be called SBT-GW-0001a, and new deeper adjacent well will be SBT-GW-0001b. The deeper well will be close to tunnel depth and may need to be decommissioned prior to TBM passing through this area
2. SBT-GW-1012, SBT-GW-1013 and SBT-GW-1014 are screened from the pre-construction water table to 20mAHD with a saturated interval of 12m, although this is expected to decrease to 7m during construction. These wells will be used to monitor the effectiveness of the primary PRB, with hydrasleeves will be placed at 30mAHD, 27mAHD, 24mAHD and 21mAHD.

3. SBT-GW-1347a, SBT-GW-1347b, SBT-GW-1347c, SBT-GW-1348a, SBT-GW-1348b, SBT-GW-1348c are multi-level groundwater wells which are to be installed prior to the commencement of bulk excavation beneath the groundwater table. The location of these wells is shown in Figure 4A, Appendix 1. Proposed installation details for these wells are summarised in Table 11.

Table 11: Multi-Level Well Installation Details

Proposed monitoring well ID	Screen top	Screen bottom	Screened lithology	Comment
SBT-GW-1000b	10 m bgs	14 m bgs	Siltstone	Targeted to upper siltstone
SBT-GW-1347-a	4 m bgs (33mAHD)	7 m bgs (30mAHD)	Alluvium	Well expected to become dry due to construction related drawdown
SBT-GW-1347-b	11 m bgs (26mAHD)	14 m bgs (23mAHD)	Siltstone	Targeted to upper siltstone
SBT-GW-1347-c	17 m bgs (20mAHD)	20 m bgs (17mAHD)	Siltstone (or sandstone if intersected)	Targeted to lower siltstone
SBT-GW-1348-a	4 m bgs (33mAHD)	7 m bgs (30mAHD)	Alluvium	Well expected to become dry due to construction related drawdown
SBT-GW-1348-b	11 m bgs (26mAHD)	14 m bgs (23mAHD)	Siltstone	Targeted to upper siltstone
SBT-GW-1348-c	17 m bgs (20mAHD)	20 m bgs (17mAHD)	Siltstone (or sandstone if intersected)	Targeted to lower siltstone

11.2. Groundwater Sampling Methodology

Groundwater samples and field quality control samples are to be collect based on the methodology in the following table.

Table 12: Groundwater Sampling Procedure

Activity	Detail / Comments
Sampling Methods	Groundwater samples from all monitoring wells are to collected using a HDPE hydrasleeves. Field parameters (pH, electrical conductivity (EC), redox potential (Eh), dissolved oxygen (DO) and temperature) are to be recorded from the sample using a calibrated water quality meter. Prior to retrieval of the hydrasleeve, the sentinel wells are to be dipped with a dual-phase interface probe (IP) to record the standing water level (SWL) and presence / absence of NAPL. Groundwater samples collected are to include QA/QC samples as described in Section 11.3. Sampling field records include the following: • Unique sample location identifier • Weather conditions • Water colour, turbidity, odour, present of surface layer • Other observations as considered relevant for the location Field measurements will include: • Time and date • Gauged depth prior to sampling • Water Quality parameters: pH, ORP, EC, DO and temperature • Depth of water sample

Activity	Detail / Comments
	Samples will be collected in laboratory provided sample containers and placed in an ice filled cooler and transported to the laboratories under chain of custody protocol. All samples are required to be documented as received by the laboratory chilled and intact.
Decontamination	Where applicable, the following procedures will be applied for decontamination of sampling equipment. • Re-useable equipment (e.g. Interface Probe) shall be decontaminated prior to first use each day at each site, and between each sampling location. • Disposable (single use) equipment such as nitrile gloves will be disposed of appropriately following each use. This equipment is not to be re-used between sampling locations to avoid cross-contamination of sampling equipment and therefore does not require decontamination. • Care will be taken at all times to handle the cleaned equipment and samples only with clean disposable nitrile gloves. Equipment will be stored after decontamination and prior to use, in clean polypropylene bags, to prevent the cleaned equipment does not come into contact with anything that may introduce contamination to the equipment. • Care will be taken to ensure that the decontamination process does not contribute to the spread of contamination of the site, stormwater or off site locations. The procedure noted below will be followed as a minimum when decontaminating reusable equipment. • Wash the equipment in a bucket of potable water with Liquinox. • Rinse the equipment thoroughly in a second bucket containing potable water. • Dry the decontaminated equipment with disposable towels or air dry on a surface that will not result in the re-contamination of the equipment. • Where equipment is being temporarily stored between sample locations (i.e. where another round of decontamination washing is not being undertaken) the equipment is to be stored in clean polypropylene bags, to prevent re-contamination prior to its next use.
Equipment Calibration	Equipment shall be calibrated as per the manufacturer's instructions. Calibration certificates shall be retained and provided in the Validation Report.
Field Quality Control Samples	The following types of field quality control samples shall be collected: • Intra-laboratory and inter-laboratory duplicates at a minimum rate of 5% (i.e. 1 duplicate per 20 primary samples) (approximately 1 set of samples each month) • Rinsate blanks, where non-disposable sampling equipment is used (1 per sampling event). • Trip blank and trip spike samples prepared by the laboratory (1 per week). Rinsate blanks shall consist of pre-preserved bottles filled with laboratory prepared water that is passed over decontaminated field equipment and then collected in containers used for the sampling process. Rinsate blanks shall be preserved in a similar manner to the original samples. All field quality control samples are to be analysed for VHC.

11.3. Quality Assurance and Control

Project specific quality assurance/quality control (QA/QC) procedures shall be implemented to improve transparency, consistency, comparability, completeness, and confidence in the data collected.

The following data quality indicators (DQIs) shall be adopted.

Table 13:DQIs for Assessment of Groundwater Samples

Item	Acceptable Limit
Analysis of blind (intra-laboratory) duplicates and split (inter-laboratory) duplicates.	Rate of 1:20 (5%) primary soil samples for the same analysis of primary samples; Calculation of relative percentage differences between primary and duplicate samples. RPD results for soil samples: • No Limit (where the average concentration is 0-10 x laboratory limit of reporting (LOR); • 50% (where the average concentration is 10-20 x laboratory LOR); and • 30% (where the average concentration is > 20 x laboratory LOR). RPDs will be considered where a concentration is greater than 10 times the LOR.
Analysis of rinsate blanks	Where non-disposable equipment is used, at least one sample per sampling event; and Results less than the laboratory LOR.
Analysis of laboratory prepared trip blanks	At least one (1) sample per week; and Results less than the laboratory LOR.
Analysis of laboratory prepared trip spikes	At least one (1) sample per week; and Results within 60-120% recovery.
Analysis of laboratory blanks, surrogates, reference and control samples	The laboratories will be required to conduct their own internal quality program for assessment of the repeatability of the analytical procedures and instrument accuracy under their NATA accreditation. This will include analysis of laboratory blank samples, duplicate samples, spike samples, control samples and surrogate spikes. The laboratory QA/QC procedures and results will be described within the laboratory reports. The laboratory internal QA/QC sample results will be reviewed for comparison with the laboratory's NATA guidelines and Schedule B3 of the ASC NEPM 2013.
Laboratories and methods used	National Association of Testing Authorities accredited for the method. Methods should be in accordance with amended ASC NEPM 2013.
Holding times	Samples should be analysed within recommended holding times.
Sample LORs and turn around time.	Primary samples are to be analysed with a 3-day laboratory turn around time. QA/QC samples to be analysed within standard laboratory turn around times (5 days).

11.4. Reporting

Groundwater data from the monitoring wells is to be reported to the Site Auditor and Sydney Metro on a monthly basis. Reporting will include the assessment of groundwater data and trigger values described in Section 11.6.

The CPBG Leadership Team, Sydney Metro and the Site Auditor are to be notified within 5 business days if the assessment of groundwater data shows that the Trigger Values in Table 14 may be exceeded and contingency mitigation measures in Section 11.6 need to be implemented.

11.5. Health and Safety

CPBG is to update the Project Health and Safety Management Plan (PHSMP) with consideration to the findings of the Queen Street HHRA.

Construction phase occupational exposures are to be risk assessed with reference to the requirements of the Sydney Metro Principal Contractor Health and Safety Standard Version 6 under the governance of the project nominated Certified Occupational Hygienist (COH) ®. The Level 2 Health Risk Assessment and Exposure Controls Plan should be reviewed and updated to incorporate risk of exposure to chlorinated hydrocarbons. Exposures shall be quantitatively assessed through monthly Level 3 Health Risk Assessments.

The PHSMP is to describe monitoring and mitigation measures required to protect construction workers and could include but not limited to:

- events which trigger the requirement to implement controls
- air quality monitoring at fixed and mobile locations
- personal gas monitoring
- increase ventilation in work areas
- personal protective equipment

11.6. Trigger Values and Contingency Plan

Trigger Values

The contingency plan outlined in this section will be initiated if predicted concentrations, based on concentrations reported and travel time to the key sentinel monitoring wells[13] as detailed in Table 10, indicates groundwater concentrations exceeding the risk-based trigger values in Table 14 may reach the station box. Figure B provides a diagram which shows how groundwater data from the monitoring wells will be assessed during construction to determine if the implementation of the Contingency Plan is required.

Assessment of groundwater data from the monitoring wells and the predicted concentration of contamination in groundwater at the Station Box is to be undertaken on a weekly basis once the compounds detected in Table 14 are detected in the sentinel monitoring wells. The assessment undertaken is to be reported monthly as per the requirements in Section 11.4.

Where concentration(s) of contaminant(s) are predicted to reach the station box which exceed the Trigger Values in Table 14, the result is to be reported to Sydney Metro and the Site Auditor within 7 days of receipt of the laboratory result.

[13] SBT-GW-0001a, SBT-GW-0001b, SBT-GW-1012 (multi-level), SBT-GW-1013 (multi-level), SBT-GW-1014 (multi-level), SBT-GW-1347c, SBT-GW-1348c

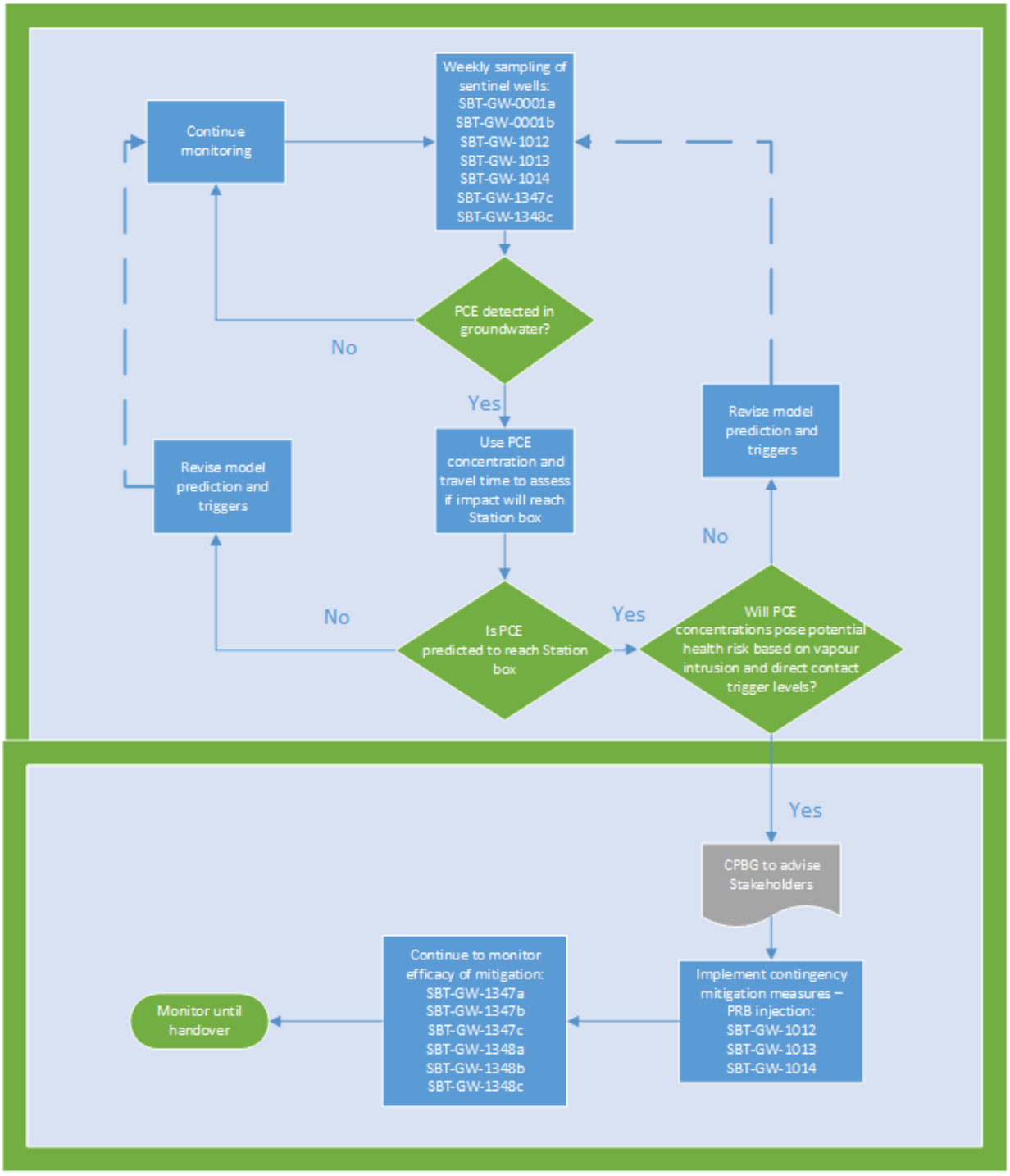


Figure B: Assessment of Trigger Values and Implementation of Contingency Plan

Table 14:Trigger Values[14]

Compound	Trigger value
PCE	0.3 mg/L
TCE	0.055 mg/L
Cis 1,2 DCE	0.25 mg/L
VC	0.2 mg/L

Contingency Plan

1) Briefing of the site workforce on the Contingency Plan and requirements of the PHSMP
2) Implementation of the required actions as per the PHSMP
3) Evaluate the need for additional mitigation which may include:
    - re-inject colloidal AC product into the injection bores installed on Queen Street and/or the inject the product into the wells SBT-GW-1012, SBT-GW-1013, and SBT-GW-1014[15]. This measure will either reinforce the existing reactive barrier located on Queen Street or create a second PRB to further decrease the flux of chlorinated hydrocarbons being drawn toward the station excavation.
    - an active capture system based on extraction from 1012 and 1014 (or possibly the primary PRB wells).
4) Implement additional mitigation (if required) based on evaluation of available data.
5) Collection of groundwater samples from the multi-level sentinel wells and groundwater pumped from the western end of station box[16] on a weekly basis or at another frequency agreed with the Site Auditor.
6) Completion of a report summarising continency mitigations works as outlined in 1) to 4) by a Certified Environmental Practitioner Site Contamination for submission to the Site Auditor and Sydney Metro.
7) Fortnightly reporting of groundwater data from 1-7 Queen Street to Sydney Metro and the Site Auditor.

If following implementation of the contingency plan chlorinated hydrocarbons continue to be detected in the multi-level monitoring wells at concentrations of contaminant(s) predicted to reach the station box exceeding the Trigger Values in Table 13, a review by a Certified Environmental Practitioner Site Contamination will be undertaken including:

- evaluation of whether subsequent re-injection events are required, and
- assessment of appropriate monitoring and mitigation measures for construction workers in the station box.

[14] Refer to the TTMP Queen St HHRA for the determination of the trigger values
[15] SBT-GW-1012, SBT-GW-1013, and SBT-GW-1014 have been installed to a depth of 20 m AHD and were screened from 3.5 m bgs to 15.5m bgs (base of screen at ~20 m AHD).
[16] The sample from the station box is considered to represent groundwater flowing into the station box at its western end.

Supplementary Risk Assessment

If hydrocarbons / chlorinated hydrocarbons are drawn towards the station box there is potential for the plume to migrate beneath the existing buildings between the source area and the station box, and impact building services.

If the Contingency Plan is triggered as detailed in Section 11.6 a Supplementary Risk Assessment is to be completed for the properties between the source area and the station box to assess whether there is a potential for unacceptable risk to human health and ecological receptors, and potential risk to building services and sub-surface infrastructure.

11.7. Construction Water Management

Construction water generated during the SBT Works is to be treated to comply with Planning Condition E129 or an Environmental Protection License (EPL) approved by the NSW EPA.

12. Validation Report

12.1. SBT Works

At the completion of the SBT Works, a Validation Report shall be prepared in general accordance with NSW EPA 2020 and the ASC NEPM 2013, documenting the Preparatory Works completed within the site. This report shall contain information including:

- Information demonstrating compliance with appropriate regulations and guidelines.
- Information demonstrating compliance with this RAP, including the implementation of the PRB and groundwater monitoring data.
- Details on Contingency Plans implemented as a result groundwater contamination which required management during bulk excavation beneath the groundwater table.
- Details of the source, classification and suitability of all imported materials.
- Details of any environmental incidents and/or unexpected finds of contamination occurring during the course of the Preparatory Works and the actions undertaken in response to these incidents.
- Details on waste classification, tracking and off-site disposal (including environment protection licence (EPL) details).
- Details on the reuse of materials on site (e.g. within the Former St Marys Station Plaza) or within the FS01 site.
- Clear statement of the suitability of the site that is the subject of the validation report, for the STB Works.
- Construction phase groundwater monitoring and management measures undertaken in Section 11 to assess the migration of contamination from the former dry cleaners to the station box. The Validation Report is to include but not limited to groundwater monitoring data and reporting undertaken as per Section 11.4, information on the PRB installed, assessment of groundwater data and trigger values in Section 11.6 and details on any contingency actions undertaken.
- Limitations on the use of the site post implementation of the SBT Works and requirement for ongoing management and/or monitoring (if required).

The Validation Report will be accompanied by an EMP. The EMP is to describe the scope of groundwater monitoring required to be implemented during the SSTOM Works to demonstrate the PRB remains effective until the station box and tunnel is tanked and the groundwater flow direction returns to pre-construction direction.

The Validation Report and an EMP is to be submitted to the Site Auditor for review upon completion.

12.2. SSTOM Works

A Validation Report will also be required following completion of the SSTOM works. The scope of and requirement of this Validation Report is to be determined as part of the SSTOM works and documented in the RAP prepared which is specific to this work package.

The Validation Report must:

- be prepared to meet the guidance provided in Contaminated Land Guidelines: Consultants Reporting on Contaminated Land (NSW EPA, 2020)
- include the construction phase groundwater monitoring and management measures undertaken to implement the EMP described in Section 12.1 and mitigate the migration of contamination from the former dry cleaners to the station box. The Validation Report is to include but not limited to groundwater monitoring data and reporting undertaken, comparison with relevant trigger values, and details on any contingency actions undertaken (such as supplementary works to augment the PRB installed for SBT Works as outlined in Section 8) to support the cessation of groundwater quality and level monitoring.
- Confirm the requirement for a Long-Term Environmental Management Plan (LTEMP),
- provide a clear statement of the suitability of the site for its intended use.

Where a LTEMP is required it must succinctly describe:

- The location, depth, nature and types of contamination which needs to be managed.
- The assumptions on which exposure settings and risk management protocols are based.
- Details of management measures which need to be implemented to mitigate unacceptable risk to human health and/or ecological receptors
- A long-term maintenance and monitoring/inspection programme to assess the effectiveness of the management measures.
- An unexpected-finds protocol.
- Details on any requirement for water treatment and disposal
- Long-term groundwater monitoring requirements (if required).

The LTEMP is to be provided to the Site Auditor for approval prior to the operational use of the site.

The LTEMP will be required to be recorded on the planning certificate issued under section 10.7 of the EP&A Act 1979, and noted on the Site Audit Statement.

Where a LTEMP is required it is to be made legally enforceable.

13. Unexpected Finds

Unexpected finds of potential contamination may be identified by visual (appearance) and/or olfactory (odour/stain) evidence during earthworks, or laboratory analysis of soil/groundwater samples collected during the SBT Works. If observations indicate the presence of potential contamination, the unexpected finds procedures included in Appendix 6 and Appendix 8 shall be implemented.

14. Conclusion

CPBG propose to carry out SBT Works at the STM site. The SBT Works include two main phases which include:

- Preparatory Works, piling and bulk excavation above the groundwater table
- Bulk excavation beneath the groundwater table.

Soil/rock materials excavated from the site are not considered to constitute remediation works because significant contamination was not identified in the materials to be excavated.

However during bulk excavation beneath the groundwater table there is potential for groundwater containing chlorinated hydrocarbons to migrate from a former dry cleaner offsite at 1-7 Queen St to as a result of groundwater drawdown and dewatering required to construct the station box. Contamination in groundwater has the potential to pose unacceptable risks to construction workers and future users of the site.

Subject to the successful implementation of the measures described in this RAP, it is concluded that the risks associated with the ingress of contaminated groundwater into the station box excavation can been managed to mitigate the potential risks to construction workers involved in the SBT Works.

Completion of the St Marys Metro Station is outside the scope of the SBT Works and will be completed under a Stations Systems Trains and Operations and Maintenance (SSTOM) works package.

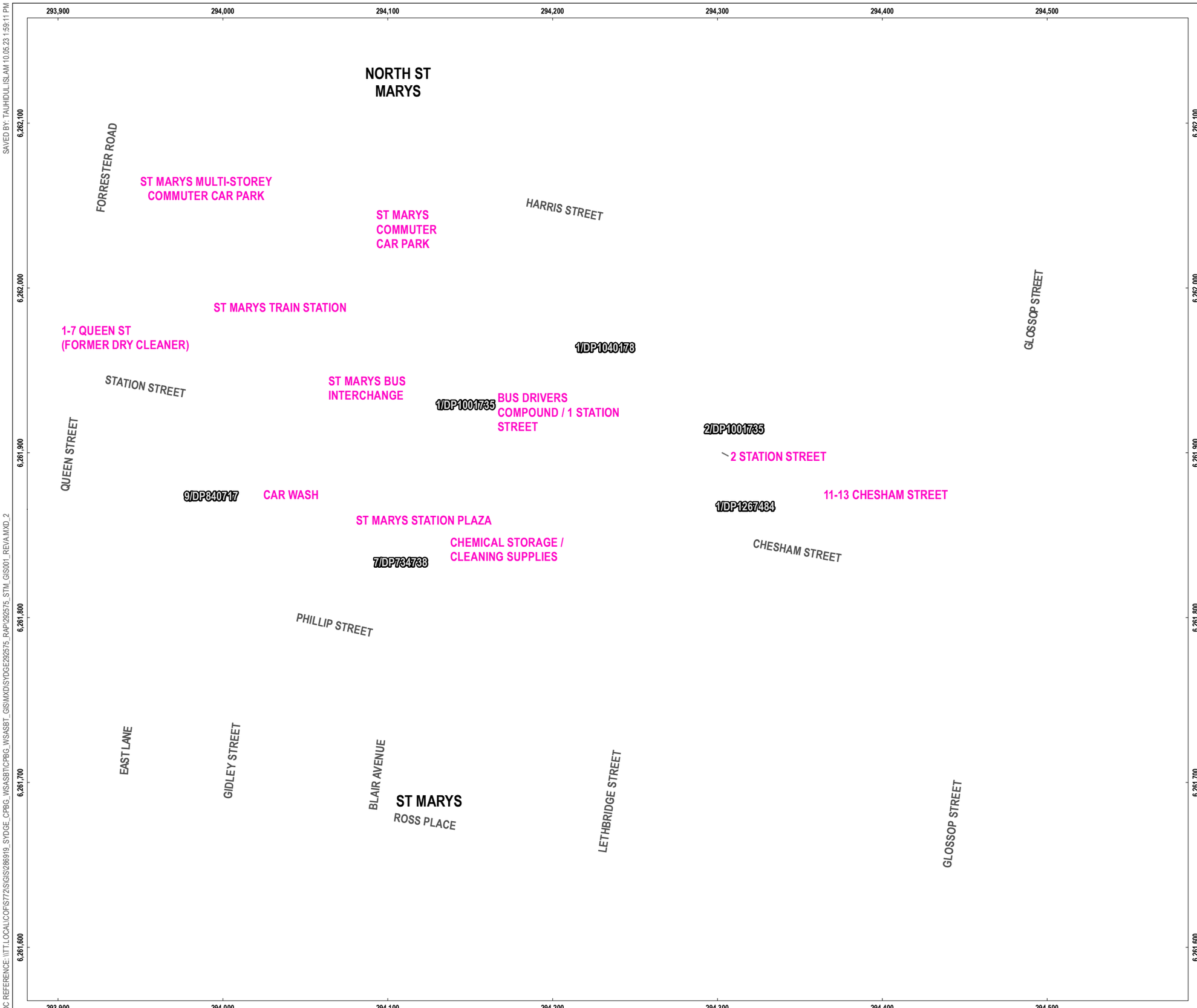
An Addendum to this RAP will need to be prepared as part of the SSTOM works package which describes how potential impacts to future users of the site will be managed as part of the operational phase of the project and incorporated into the design of the metro station.

Notwithstanding based on the implementation of this RAP, TTMP considers that potential risks from chlorinated hydrocarbons can be adequately mitigated to make the site suitable for commercial/industrial use as defined in the NSW EPA Guidelines through water proofing of the station box and the implementation of other engineering controls (if required).

Practical completion of remediation would be considered to have occurred when the following has been completed under the SSTOM work package:

- Waterproofing of the station has been completed such that the flow of groundwater has returned to its pre-construction direction
- A Validation Report and LTEMP (if required) has been prepared and approved by the Site Auditor (refer to Section 12.2).

APPENDIX 1 Figures



LEGEND

- Site Feature
- STM Site Boundary
- Railway
- Cadastral Boundary

SOURCE
Existing site features, site layout and boundary from Tetra Tech Coffey.
Cadastre from DFSI.
Aerial imagery from Nearmap (capture date 14-06-2022).

0 30 60 m

SCALE **1:2,250**
PAGE SIZE: **A3**
PROJECTION: **GDA2020 MGA Zone 56**

CPB - GHELLA

WESTERN SYDNEY AIRPORT
STATION BOXES AND TUNNELLING WORKS

FIGURE 1

Site Location Plan
St Marys Station

DATE: **10.05.23** PROJECT: **754-SYDGE292575** FILE: **292575_STM_F001_GIS**

LEGEND

- Tunnel Alignment
- Tunnel Alignment - Chainage
- Tunnel Alignment - Cross Passage
- St Marys Station Site Layout
- Railway
- Cadastral Boundary
- Surface Works Cut Area
- Surface Works Fill Area
- STM Site Boundary
- St Marys Station Box

SOURCE
Existing site features, site layout and boundary from Tetra Tech Coffey.
Alignment supplied by CPBG.
Cadastre from DFSI.
Aerial imagery from Nearmap (capture date 14-06-2022).

N

0 30 60 m

SCALE **1:2,250**
PAGE SIZE: **A3**
PROJECTION: **GDA2020 MGA Zone 56**

CPB - GHELLA

WESTERN SYDNEY AIRPORT
STATION BOXES AND TUNNELLING WORKS

FIGURE 2

Project Footprint
St Marys Station

TETRA TECH COFFEY

DATE: **10.05.23** PROJECT: **754-SYDGE292575** FILE: **292575_STM_F002_GIS**

SAVED BY: TAUHIDUL.ISLAM 10.05.23 2:02:12 PM
DOC REFERENCE: \\TTLOCALICOFIS772\SIGIS\286919_SYDGE_CPBG_WSASBT\CPBG_WSASBT_GIS\MXD\SYDGE292575_RAP\292575_STM_GIS002_REVA.MXD_2

LEGEND

Additional Contaminated Land Location
- Borehole

Additional Geotechnical/Hydrogeological Location
- Borehole

Existing Investigation Location
- Borehole
- Test Pit
- Tunnel Alignment
- Tunnel Alignment - Chainage
- Tunnel Alignment - Cross Passage
- Railway
- Cadastral Boundary
- STM Site Boundary
- Station Box / Shaft

SOURCE
Contaminated land locations, additional investigations, site boundary, and hand samples from Tetra Tech Coffey.
Existing investigations, site layout, station box and alignment supplied by CPBG.
Cadastre from DFSI.
Aerial imagery from Nearmap (capture date 14-06-2022).

N

0 50 100 m

SCALE **1:2,750**
PAGE SIZE: **A3**
PROJECTION: **GDA2020 MGA Zone 56**

CPB - GHELLA

WESTERN SYDNEY AIRPORT
STATION BOXES AND TUNNELLING WORKS

FIGURE 3

DSI Investigation Locations
St Marys Station

TETRA TECH COFFEY

DATE: **09.09.22** PROJECT: **754-SYDGE292575** FILE: **292575_STM_F003_GIS**

SAVED BY: TAUHIDUL.ISLAM 09.09.22 4:41:51 PM
DOC REFERENCE: \\TT.LOCAL\COFS\772\SIGIS\286919_SYDGE_CPBG_WSASBT\CPBG_WSASBT_GIS\MXD\SYDGE292575_RAP\292575_STM_GIS003_REVA.MXD_3

LEGEND

Additional Contaminated Land Location
- Borehole

Additional Geotechnical/Hydrogeological Location
- Borehole

Existing Investigation Location
- Borehole
- Tunnel Alignment
- Tunnel Alignment - Chainage
- Tunnel Alignment - Cross Passage
- Railway
- Cadastral Boundary
- STM Site Boundary
- Station Box / Shaft

SOURCE
Contaminated land locations, additional investigations, site boundary, and hand samples from Tetra Tech Coffey.
Existing investigations, site layout, station box and alignment supplied by CPBG.
Cadastre from DFSI.
Aerial imagery from Nearmap (capture date 14-06-2022).

N

0 20 40 m

SCALE **1:1,100**
PAGE SIZE: **A3**
PROJECTION: **GDA2020 MGA Zone 56**

CPB - GHELLA

WESTERN SYDNEY AIRPORT
STATION BOXES AND TUNNELLING WORKS

FIGURE 3A

DSI Investigation Locations
St Marys Station

TETRA TECH COFFEY

DATE: **09.09.22** PROJECT: **754-SYDGE292575** FILE: **292575_STM_F003A_GIS**

LEGEND

Additional Contaminated Land Location
- Borehole

Additional Geotechnical/Hydrogeological Location
- Borehole

Existing Investigation Location
- Borehole
- Tunnel Alignment
- Tunnel Alignment - Chainage
- Tunnel Alignment - Cross Passage
- Railway
- Cadastral Boundary
- STM Site Boundary
- Station Box / Shaft

SOURCE
Contaminated land locations, additional investigations, site boundary, and hand samples from Tetra Tech Coffey.
Existing investigations, site layout, station box and alignment supplied by CPBG.
Cadastre from DFSI.
Aerial imagery from Nearmap (capture date 14-06-2022).

N

0 20 40 m

SCALE **1:1,000**
PAGE SIZE: **A3**
PROJECTION: **GDA2020 MGA Zone 56**

CPB - GHELLA

WESTERN SYDNEY AIRPORT
STATION BOXES AND TUNNELLING WORKS

FIGURE 3B

DSI Investigation Locations
St Marys Station

TETRA TECH COFFEY

DATE: **10.05.23** PROJECT: **754-SYDGE292575** FILE: **292575_STM_F003B_GIS**

LEGEND

Additional Contaminated Land Location
- Borehole

Additional Geotechnical/Hydrogeological Location
- Borehole

Existing Investigation Location
- Borehole
- Test Pit
- Tunnel Alignment
- Tunnel Alignment - Chainage
- Railway
- Cadastral Boundary
- Former AEC3A Buffer Area
- STM Site Boundary
- Station Box / Shaft

SOURCE
Contaminated land locations, additional investigations, site boundary, and hand samples from Tetra Tech Coffey.
Existing investigations, site layout, station box and alignment supplied by CPBG.
Cadastre from DFSI.
Aerial imagery from Nearmap (capture date 14-06-2022).

N

0 20 40 m

SCALE **1:1,000**
PAGE SIZE: **A3**
PROJECTION: **GDA2020 MGA Zone 56**

CPB - GHELLA

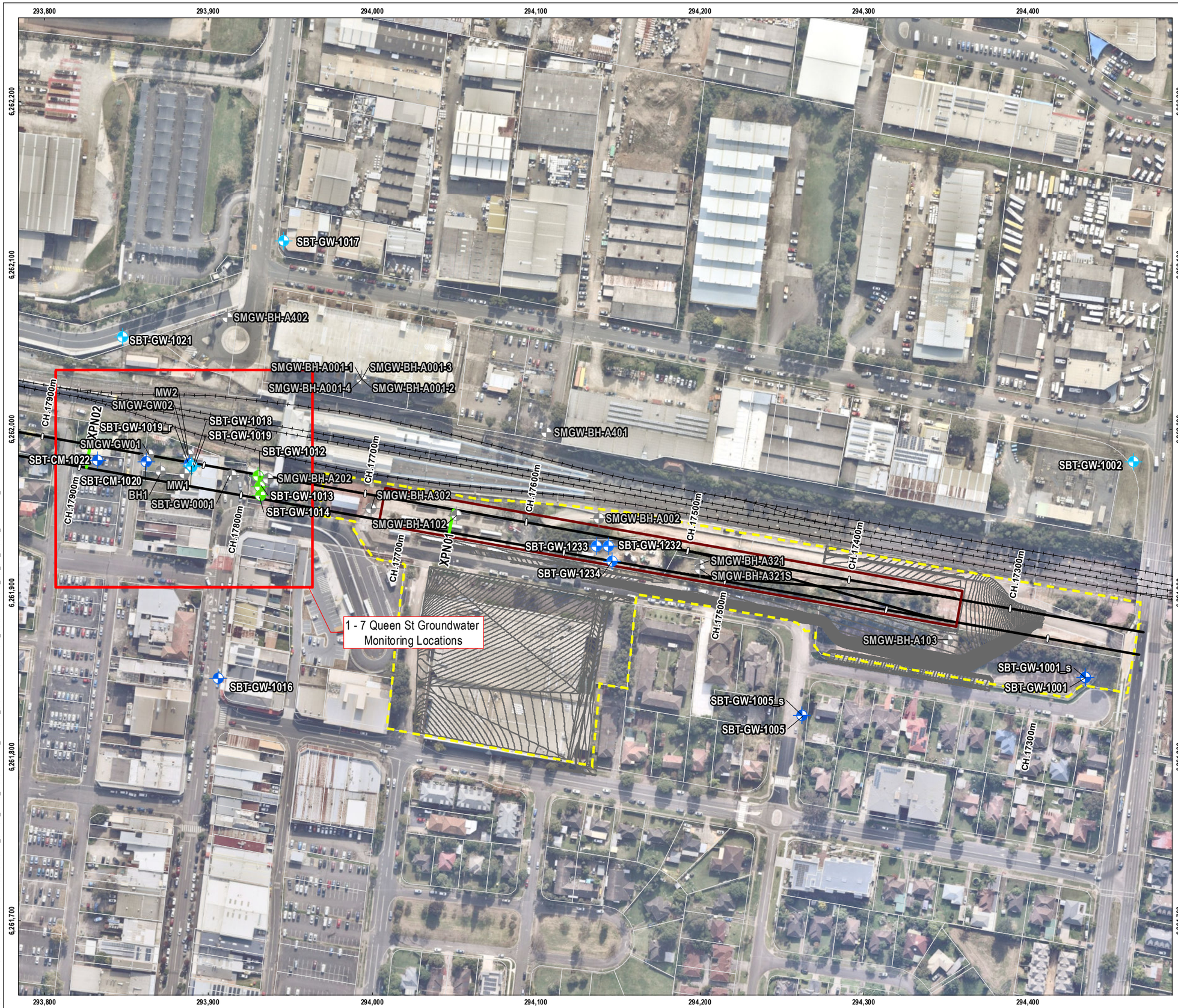
WESTERN SYDNEY AIRPORT
STATION BOXES AND TUNNELLING WORKS

FIGURE 3C

DSI Investigation Locations
St Marys Station

TETRA TECH COFFEY

DATE: **09.09.22** PROJECT: **754-SYDGE292575** FILE: **292575_STM_F003C_GIS**



LEGEND

DSI Investigation Locations

- Groundwater Quality Well
- Monitoring Well
- Sentinel and Contingency Mitigation Well - to be installed

Previous Investigation Locations

- Monitoring Well
- Tunnel Alignment
- Tunnel Alignment - Chainage
- Tunnel Alignment - Cross Passage
- St Marys Station Site Layout
- Railway
- Cadastral Boundary
- STM Site Boundary
- Station Box / Shaft

SOURCE
Investigation locations and boundary from Tetra Tech Coffey. Existing investigations, site layout, station box and alignment supplied by CPBG.
Cadastre from DFSI.
Aerial imagery from Nearmap (capture date 14-06-2022).

0 50 100 m

SCALE **1:2,250**
PAGE SIZE: **A3**
PROJECTION: **GDA2020 MGA Zone 56**

CPB - GHELLA

WESTERN SYDNEY AIRPORT
STATION BOXES AND TUNNELLING WORKS

FIGURE 4

Groundwater Investigation Locations St Marys Station

TETRA TECH COFFEY

DATE: **18.11.22** PROJECT: **754-SYDGE292575** FILE: **292575_DSI_SM_F004_GIS**

CPB CONTRACTORS

Ghella 1894 5 Generations of Tunnelers

LEGEND

DSI Investigation Locations

- Groundwater Quality Well
- Monitoring Well
- Sentinel and Contingency Mitigation Well - to be installed

Previous Investigation Locations

- Monitoring Well
- Tunnel
- Tunnel Alignment - Chainage
- Tunnel Alignment - Cross Passage
- Railway
- Cadastral Boundary

Permeable Reactive Barrier

- Injection Bore

New Monitoring Well

- Monitoring Well

SOURCE
Investigation locations and boundary from Tetra Tech Coffey.
Existing investigations, site layout, station box and alignment supplied by CPBG.
Cadastre from DFSI.
Aerial imagery from Nearmap (capture date 14-06-2022).

N

0 10 20 m

SCALE **1:500**
PAGE SIZE: **A3**
PROJECTION: **GDA2020 MGA Zone 56**

CPB - GHELLA

WESTERN SYDNEY AIRPORT
STATION BOXES AND TUNNELLING WORKS

FIGURE 4A

Groundwater Investigation Locations St Marys Station

TETRA TECH COFFEY

DATE: **18.11.22** PROJECT: **754-SYDGE292575** FILE: **292575_DSI_SM_F004A_GIS**

LEGEND

- Monitoring Well

Previous Investigation Locations

- Monitoring Well
- Tunnel Alignment
- Tunnel Alignment - Chainage
- Tunnel Alignment - Cross Passage
- Railway
- Cadastral Boundary
- STM Site Boundary
- Station Box / Shaft

SOURCE
Investigation locations and boundary from Tetra Tech Coffey.
Existing investigations, site layout, station box and alignment supplied by CPBG.
Cadastre from DFSI.
Aerial imagery from Nearmap (capture date 14-06-2022).

N

0 20 40 m

SCALE **1:1,000**
PAGE SIZE: **A3**
PROJECTION: **GDA2020 MGA Zone 56**

CPB - GHELLA

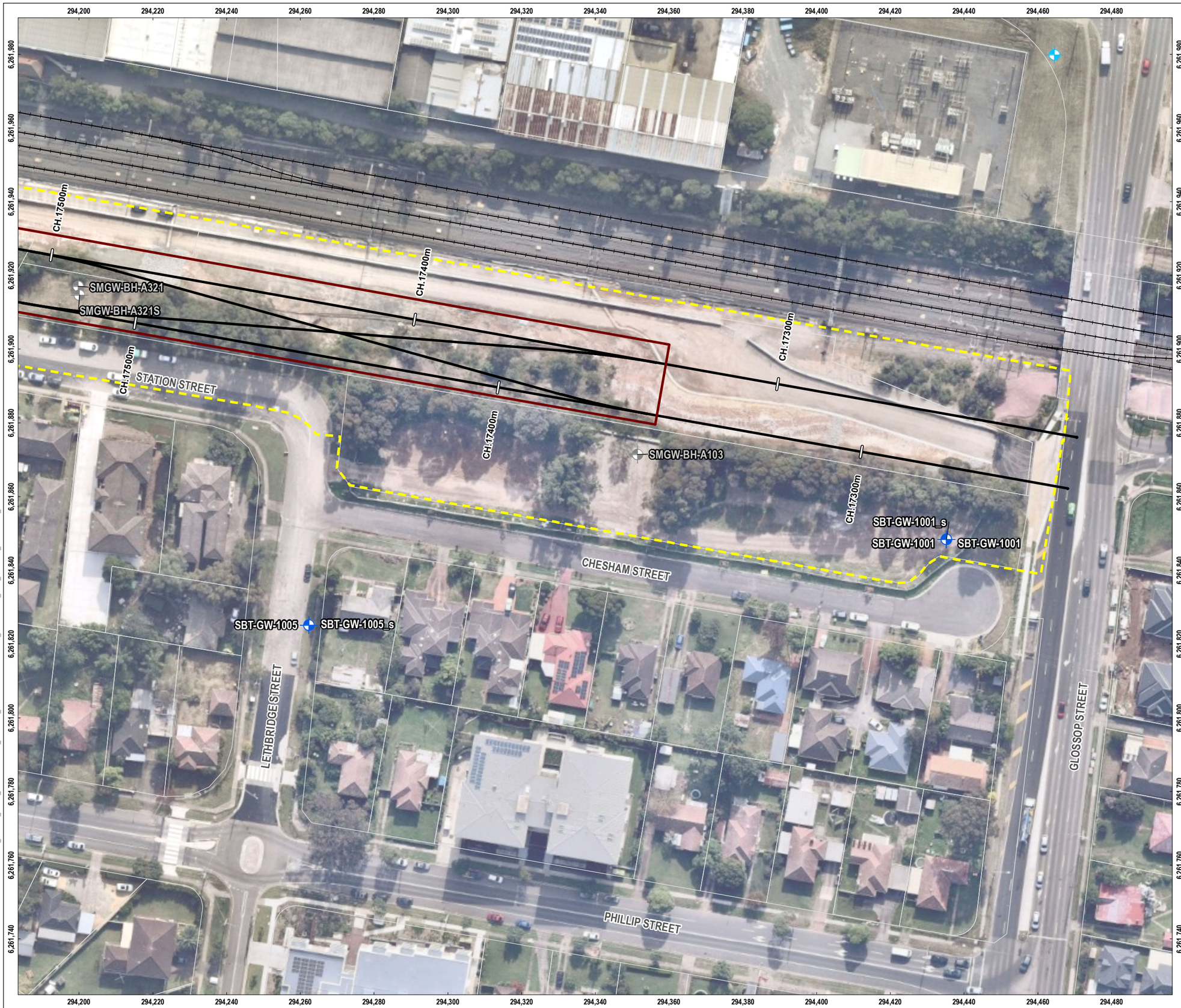
WESTERN SYDNEY AIRPORT
STATION BOXES AND TUNNELLING WORKS

FIGURE 4B

Groundwater Investigation Locations St Marys Station

TETRA TECH COFFEY

DATE: **10.05.23** PROJECT: **754-SYDGE292575** FILE: **292575_DSI_STM_F004B_GIS**



LEGEND

DSI Investigation Locations
- Groundwater Quality Well
- Monitoring Well

Previous Investigation Locations
- Monitoring Well
- Tunnel Alignment
- Tunnel Alignment - Chainage
- Railway
- Cadastral Boundary
- STM Site Boundary
- Station Box / Shaft

SOURCE
Investigation locations and boundary from Tetra Tech Coffey.
Existing investigations, site layout, station box and alignment supplied by CPBG.
Cadastre from DFSI.
Aerial imagery from Nearmap (capture date 14-06-2022).

N

0 20 40 m

SCALE **1:1,000**
PAGE SIZE: **A3**
PROJECTION: **GDA2020 MGA Zone 56**

CPB - GHELLA

WESTERN SYDNEY AIRPORT
STATION BOXES AND TUNNELLING WORKS

FIGURE 4C

Groundwater Investigation Locations St Marys Station

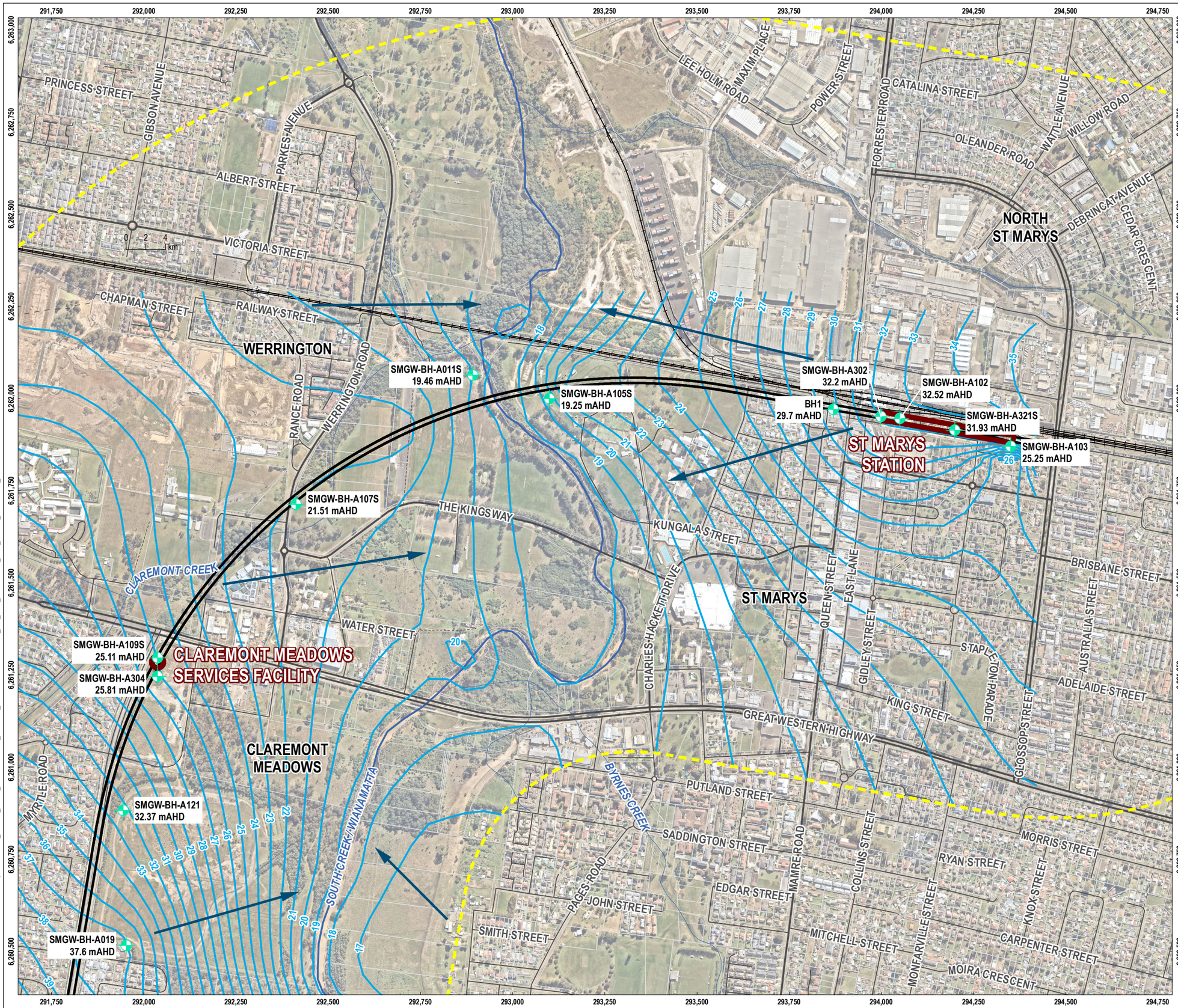
TETRA TECH COFFEY

DATE: **10.05.23** PROJECT: **754-SYDGE292575** FILE: **292575_DSI_STM_F004C_GIS**

SAVED BY: TAUHIDUL.ISLAM 10.05.23 2:26:21 PM
DOC REFERENCE: \\TT-LOCAL\COFS772\SIG\S286919_SYDGE_CPBG_WSASBT\CPBG_WSASBT_GIS\MXD\SYDGE292575_RAP\292575_STM_GIS004C_REVA.MXD_2

SAVED BY: TAUHIDUL.ISLAM 09.09.22 5:12:34 PM

DOC REFERENCE: \\ETTSS772\GISFS1\DATA\GIS\286919_SYDGE_CPBG_WSASBT\CPBG_WSASBT_GIS\MXD\SYDGE292575_DSI_STM_RAP\292575_STM_GIS005_REVA.MXD_1



CPB CONTRACTORS

Ghella 1894 5 Generations of Tunnelers

LEGEND

- Selected Groundwater Monitoring Well
- Project Alignment
- Project Alignment - Structure
- Railway
- Major Road
- Minor Road
- Track
- Path
- Perennial Watercourse
- Non-perennial Watercourse
- Groundwater Elevation Contour (mAHD)
- Groundwater Flow Direction
- Cadastral Boundary
- Project Alignment Buffer (1 km)

SOURCE
Groundwater monitoring wells compiled by Tetra Tech Coffey.
Groundwater contours, groundwater flow direction, and alignment buffer from Tetra Tech Coffey.
Alignment supplied by CPBG.
Cadastre, roads, rail, and watercourses from DFSI.
Aerial imagery from Nearmap (capture date April, 2022).

N

0 200 400 m

SCALE **1:375,000**
PAGE SIZE: **A3**
PROJECTION: **GDA2020 MGA Zone 56**

CPB - GHELLA

WESTERN SYDNEY AIRPORT
STATION BOXES AND TUNNELLING WORKS

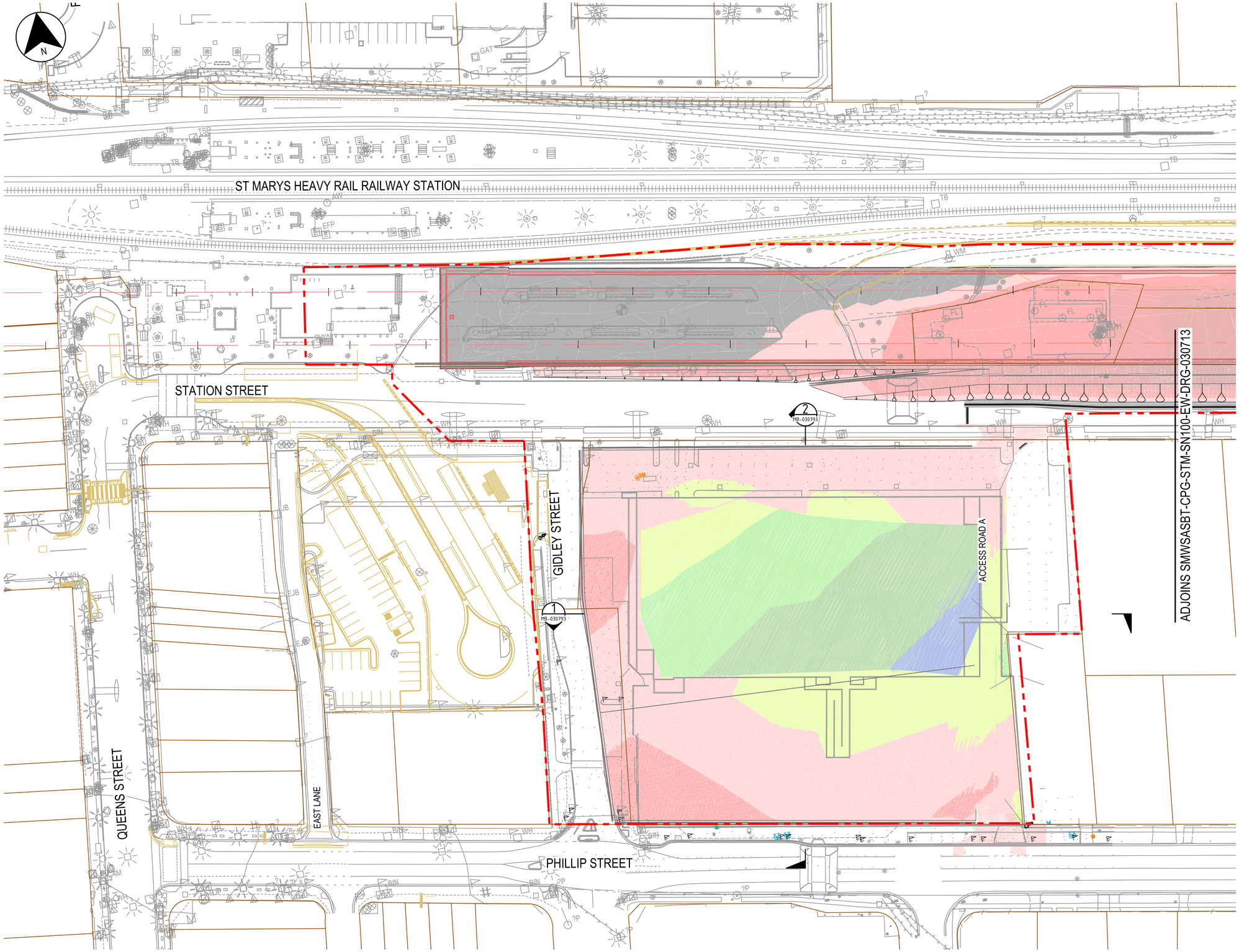
FIGURE 5

DSI Groundwater Level Contours

TETRA TECH COFFEY

DATE: **09.09.22** PROJECT: **754-SYDGE292575** FILE: **292575_STM_F005_GIS_REVA**

APPENDIX 2 Cut to Fill Plan



LEGEND

CONSTRUCTION SITE BOUNDARY

CUT FILL TABLE			
LOWER VALUE		UPPER VALUE	
-10m	to	-9m	
-9m	to	-8m	
-8m	to	-7m	
-7m	to	-6m	
-6m	to	-5m	
-5m	to	-4m	
-4m	to	-3m	
-3m	to	-2m	
-2m	to	-1m	
-1m	to	0m	
0m	to	1m	
1m	to	2m	
2m	to	3m	
3m	to	4m	

NOTE:

HATCHING INDICATE FINISHED
SURFACE LEVEL TO EXISTING LEVEL

FOR CONSTRUCTION

REV.	AMENDMENT DESCRIPTION	Design by	Verified by	Approved by	Date
00	APPROVED FOR CONSTRUCTION	TJ	MS	CL	04.08.22

SCALE: AS SHOWN

1:500@A1 0 5 10 15 20 25 m

A1 Original | Co-ordinate System: GDA2020/MGAZone56 | Height Datum: AHD | This sheet may be prepared using colour and may be incomplete if copied | NOTE: Do not scale from this drawing.

CLIENT: NSW GOVERNMENT | sydney METRO

Engineering Design Solutions
An enterprise partnership of Mott MacDonald and Sydney Metro

SYDNEY METRO

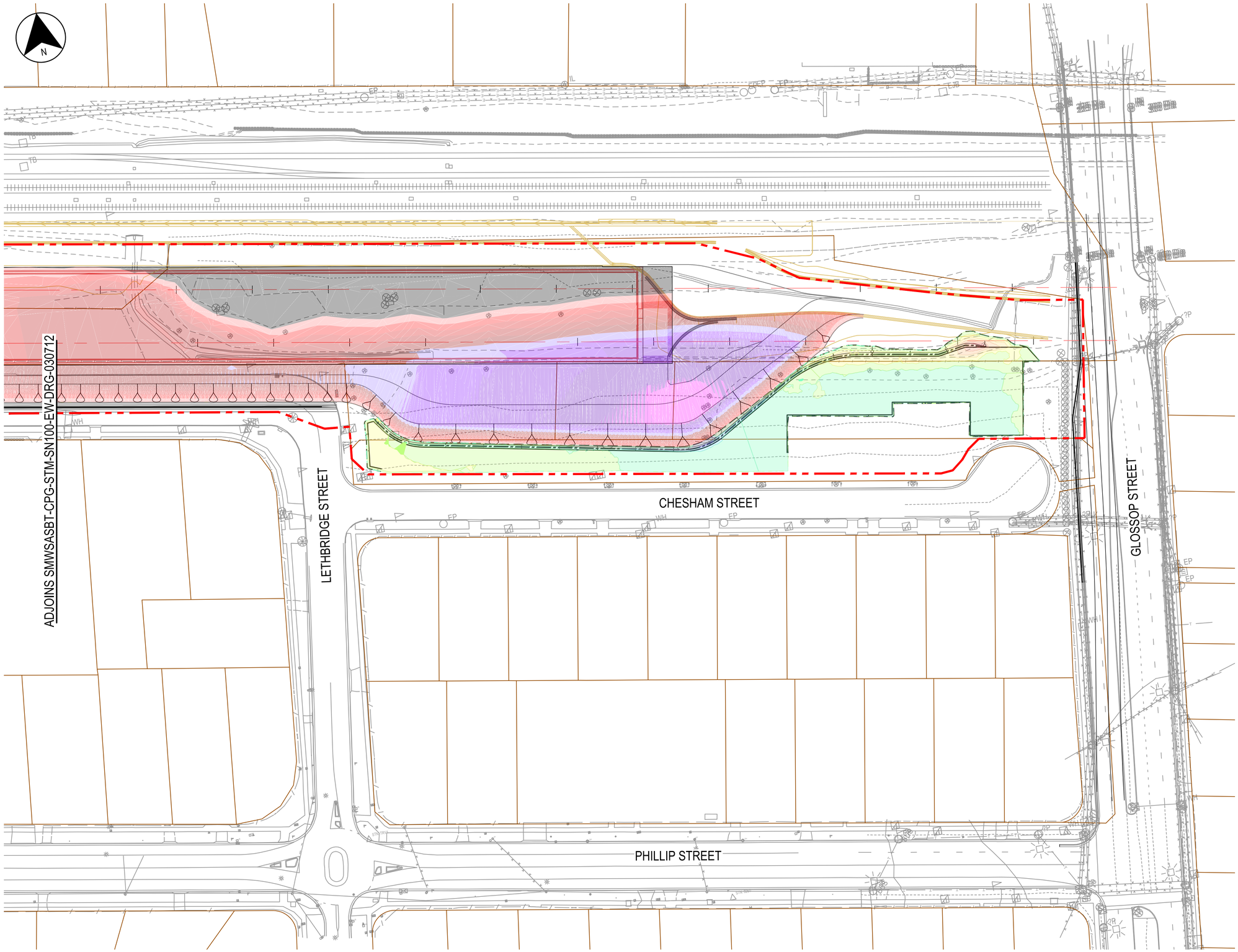
BG&E - bgeeng.com

CIVIL

DRAWN	COLIN BIBLE	13.05.2022
DESIGNED	JOHN KEARNS	13.05.2022
DRG CHECK	GARY VALLANCE	13.05.2022
DESIGN CHECK	TREVOR WOODWARD	13.05.2022
APPROVED	CHRIS LAWTON	13.05.2022

SYDNEY METRO - WESTERN SYDNEY AIRPORT – STATION BOXES AND TUNNELLING WORKS
ST MARYS STATION
EARTHWORKS
CUT AND FILL PLAN
SHEET 1

FILE No: SMWSASBT-CPG-STM-SN100-MB-M3D-030701 | SHEET: 1 OF 2 | ©
STATUS: APPROVED FOR CONSTRUCTION | EDMS No:
DRG No: SMWSASBT-CPG-STM-SN100-EW-DRG-030712 | REV 00 | VER



LEGEND

CONSTRUCTION SITE BOUNDARY

CUT FILL TABLE			
LOWER VALUE		UPPER VALUE	
-10m	to	-9m	
-9m	to	-8m	
-8m	to	-7m	
-7m	to	-6m	
-6m	to	-5m	
-5m	to	-4m	
-4m	to	-3m	
-3m	to	-2m	
-2m	to	-1m	
-1m	to	0m	
0m	to	1m	
1m	to	2m	
2m	to	3m	
3m	to	4m	

NOTE:
HATCHING INDICATE FINISHED
SURFACE LEVEL TO EXISTING LEVEL

FOR CONSTRUCTION

REV.	AMENDMENT DESCRIPTION	Design by	Verified by	Approved by	Date
00	APPROVED FOR CONSTRUCTION	TJ	MS	CL	04.08.22

SCALE: AS SHOWN

1:500@A1 0 5 10 15 20 25 m

A1 Original | Co-ordinate System: GDA2020/MGAZone56 | Height Datum: AHD | This sheet may be prepared using colour and may be incomplete if copied | NOTE: Do not scale from this drawing.

CLIENT:
NSW GOVERNMENT
sydney METRO
Engineering Design Solutions
An enterprise partnership of Mott MacDonald and Sydney Metro
SYDNEY METRO

BG&E - bgeeng.com
CIVIL

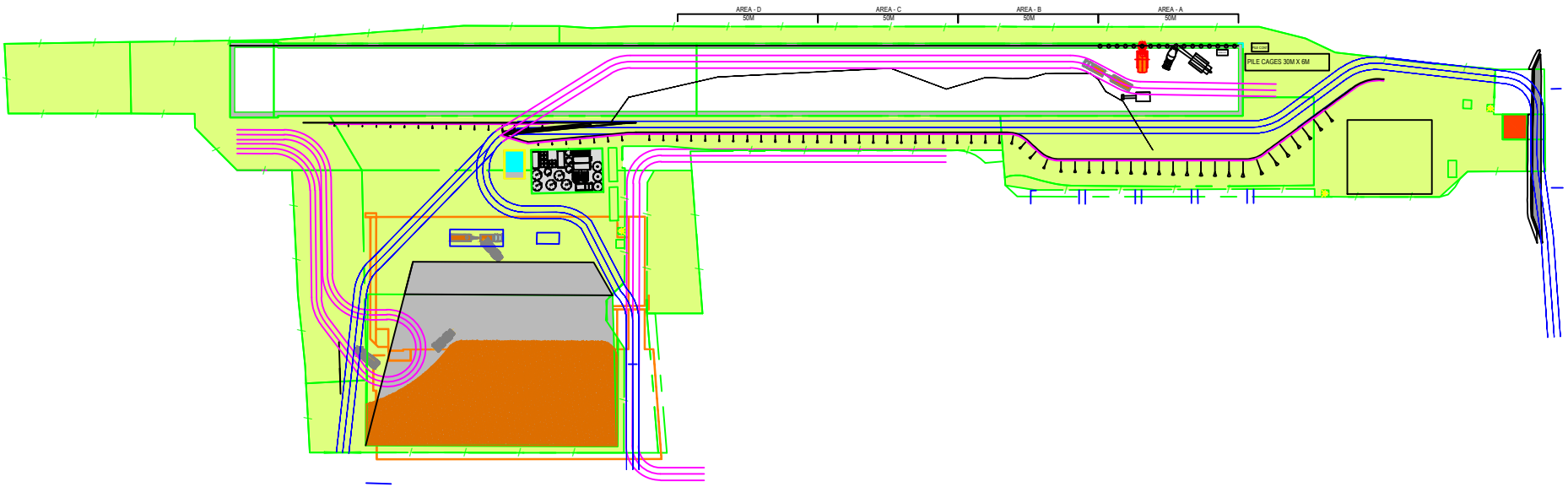
CPB CONTRACTORS
Ghella

DRAWN	COLIN BIBLE	13.05.2022
DESIGNED	JOHN KEARNS	13.05.2022
DRG CHECK	GARY VALLANCE	13.05.2022
DESIGN CHECK	TREVOR WOODWARD	13.05.2022
APPROVED	CHRIS LAWTON	13.05.2022

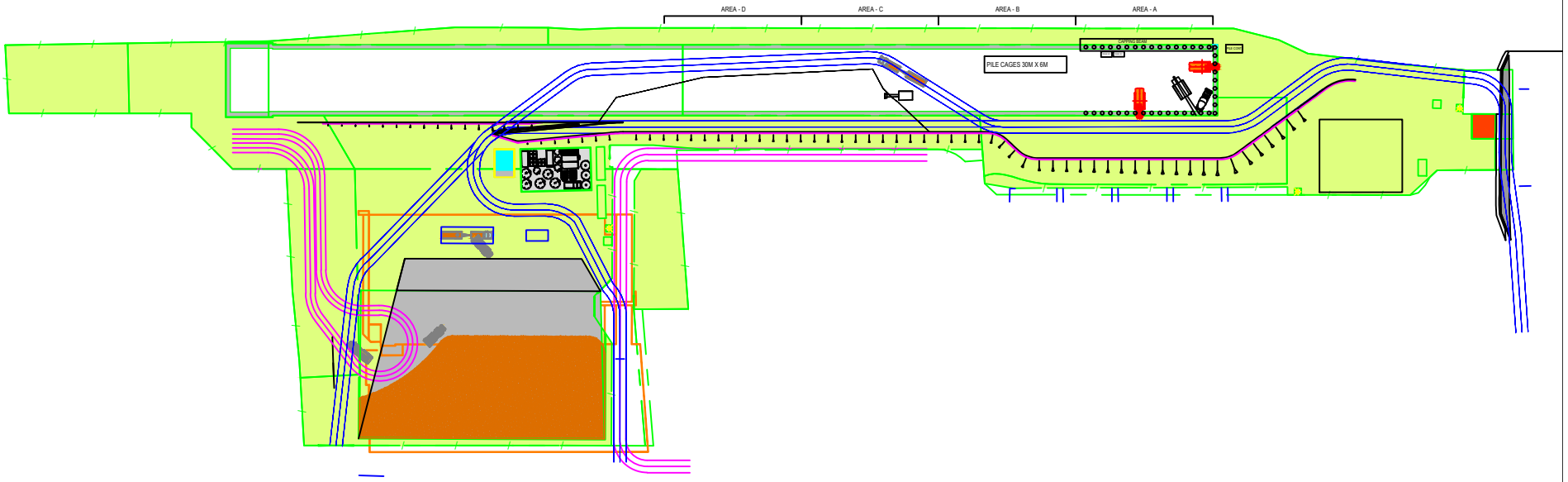
SYDNEY METRO - WESTERN SYDNEY AIRPORT – STATION BOXES AND TUNNELLING WORKS
ST MARYS STATION
EARTHWORKS
CUT AND FILL PLAN
SHEET 2

FILE No: SMWSASBT-CPG-STM-SN100-MB-M3D-030701 | SHEET: 2 OF 2 | ©
STATUS: APPROVED FOR CONSTRUCTION | EDMS No:
DRG No: SMWSASBT-CPG-STM-SN100-EW-DRG-030713 | REV 00 | VER

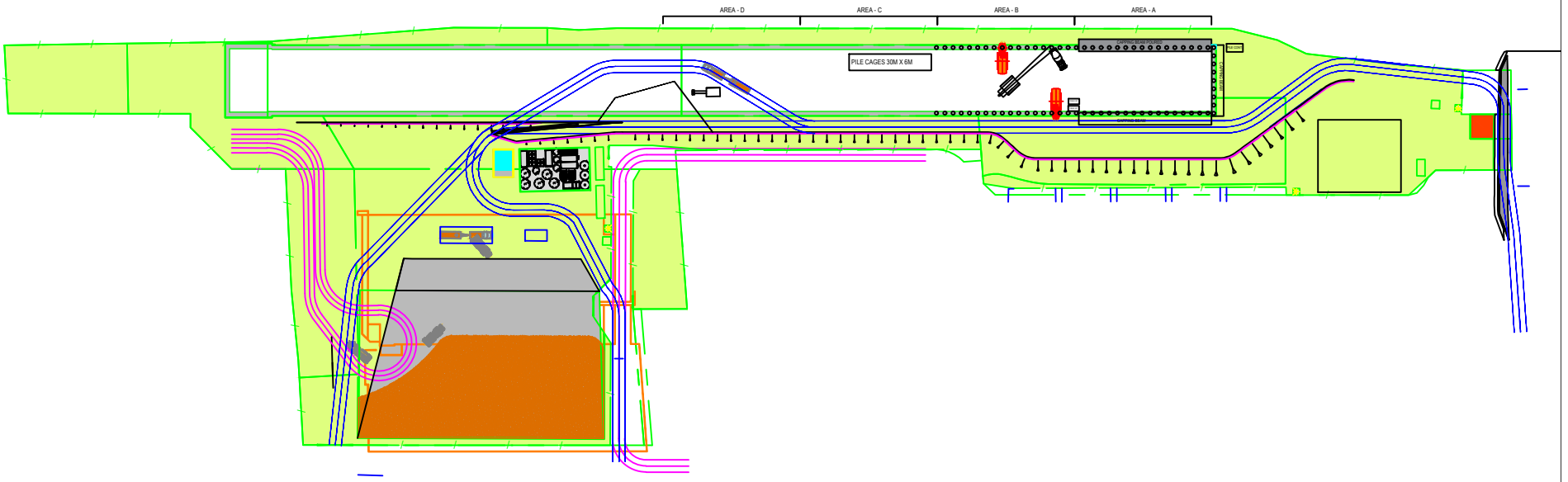
APPENDIX 3 Piling Plan



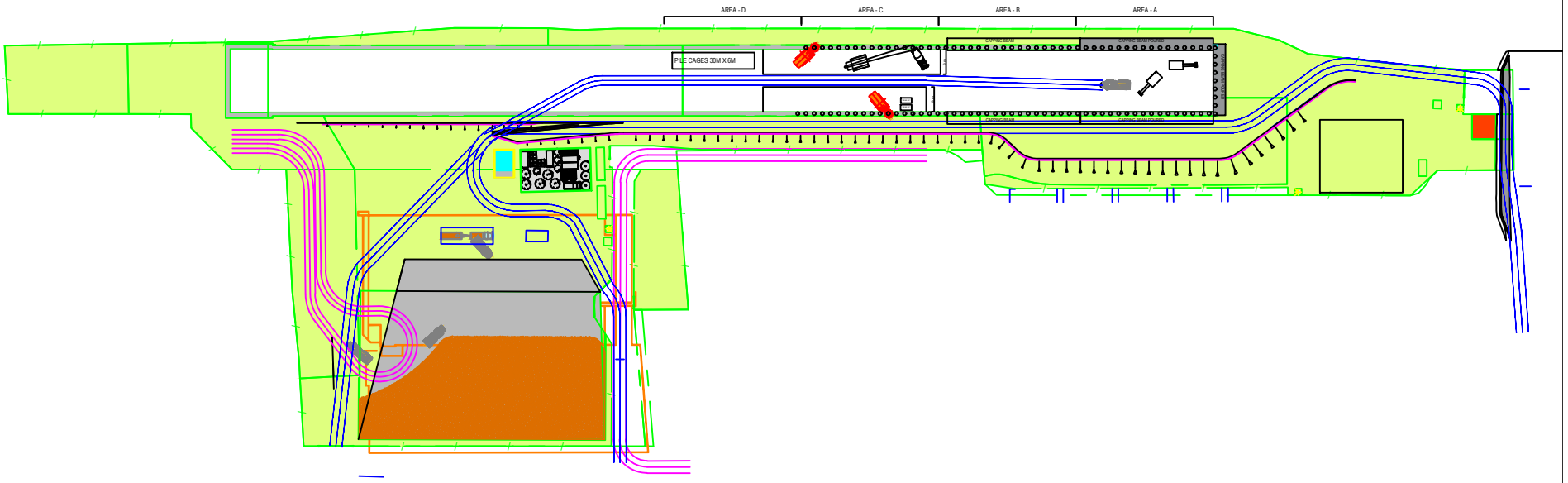
STAGE - 1



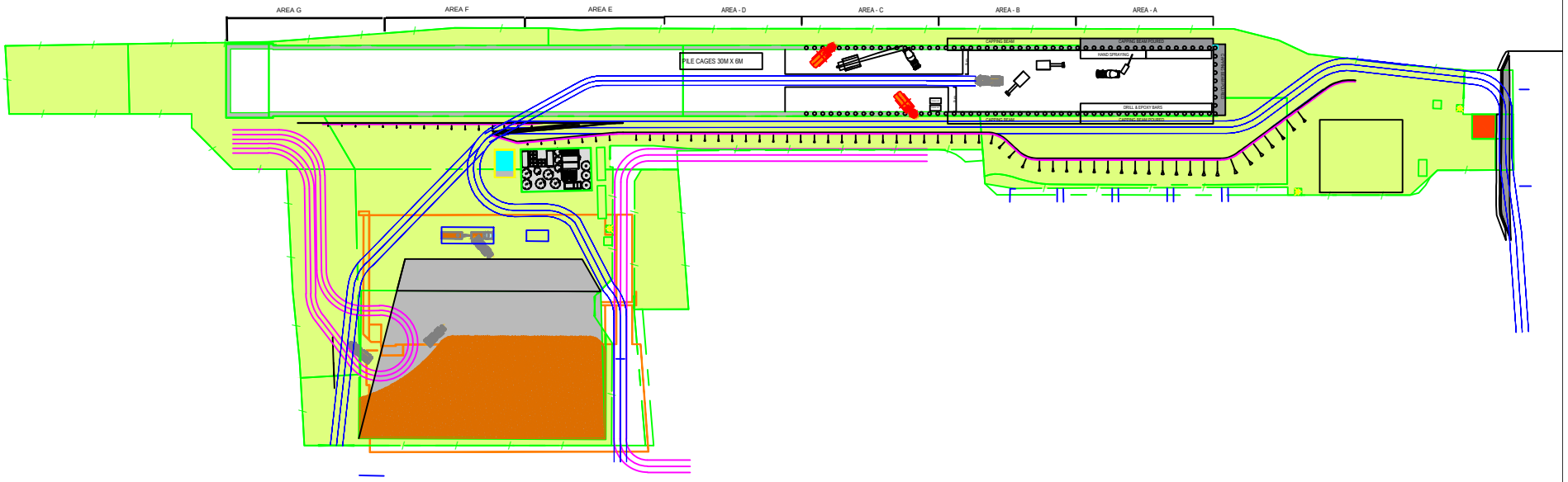
STAGE - 2



STAGE - 3



STAGE - 4


AREA G
AREA F
AREA E
AREA - D
AREA - C
AREA - B
AREA - A
PILE CAGES 30M X 6M

STAGE - 5