St Marys Site Audit Report and Site Audit Statement for RAP

Sydney Metro Western Sydney Airport Station Boxes and Tunnelling Works

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Document approval

Rev	Date	Prepared by	Reviewed by	Approved by
0	16/02/2024	Ramboll	Ramboll	Ramboll

Details of Revision Amendments

Document Control

The Project Director is responsible for ensuring that this Report is reviewed and approved. The Project Director is responsible for updating this plan to reflect changes to construction, legal and other requirements, as required.

Amendments

Any revisions or amendments must be approved by the Project Director and/or client before being distributed/implemented.

Revision Details

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0	Issued for comment

Prepared for

CPB Contractors Pty Ltd and Ghella Pty Ltd

Prepared by

Ramboll Australia Pty Ltd

Date

16 February 2024

Project Number

318001447-001

Audit Number

TO-095-B1R

SITE AUDIT REPORT

REMEDIAL ACTION PLAN, ST MARYS STATION BOX AND TUNNELLING WORKS, SYDNEY METRO WESTERN SYDNEY AIRPORT

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16 February 2024

CPB Contractors Pty Ltd and Ghella Pty Ltd
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Level 2, 177 Pacific Highway
North Sydney NSW 2060

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Dear [redacted]

SITE AUDIT REPORT - REMEDIAL ACTION PLAN, ST MARYS STATION BOX AND TUNNELLING WORKS, SYDNEY METRO WESTERN SYDNEY AIRPORT

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Ref 318001447-001
Audit No. TO-095-B1R

I have pleasure in submitting the Site Audit Report (SAR) for the subject site. The Site Audit Statement (SAS), produced in accordance with the NSW *Contaminated Land Management Act 1997*, is included as Appendix B of the Site Audit Report. The Audit was commissioned by CPB Contractors Pty Ltd and Ghella Pty Ltd (CPBG) to assess the suitability of a remedial action plan (RAP).

The Audit was initiated to comply with requirements of Critical State Significant Infrastructure (CSSI) approval 10051, issued on 23 July 2021 by the Minister for Planning and Public Spaces and is therefore a statutory audit.

The SAR and SAS were initially finalised on 11 May 2023. The RAP was subsequently updated (23 May 2023) to include some minor amendments. CPBG requested that the SAR and SAS be revised to review the updated current version of the RAP.

Thank you for giving me the opportunity to conduct this Audit. Please call me on 9954 8100 if you have any questions.

Yours faithfully,
Ramboll Australia Pty Ltd

[redacted]

[redacted]
EPA Accredited Site Auditor 1505

cc: NSW EPA – Statement only
Penrith City Council

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LIST OF ABBREVIATIONS

Measures

%	per cent
µg/L	Micrograms per Litre
ha	Hectare
km	Kilometres
m	Metre
mAHD	Metres Australian Height Datum
mbgl	Metres below ground level
mg/kg	Milligrams per Kilogram
mg/L	Milligrams per Litre
mg/m^3	Milligrams per Cubic Metre
mm	Millimetre
ppm	Parts Per Million

General

ABC	Ambient Background Concentration
AC	Activated Carbon
ACL	Added Contaminant Limit
ACM	Asbestos Containing Material
ADWG	Australian Drinking Water Guidelines
AEC	Area of Environmental Concern
AF	Asbestos Fines
AHD	Australian Height Datum
ALS	Australian Laboratory Services
ANZG	Australian & New Zealand Guidelines
ASS	Acid Sulphate Soil
BTEX	Benzene, Toluene, Ethylbenzene, Xylenes
CCME	Canadian Council of Ministers of the Environment
CLM Act	NSW Contaminated Land Management Act 1997
COC	Chain of Custody
CoPC	Contaminants of Potential Concern
Council	Penrith City Council
CPBG	CPB Contractors Pty Ltd and Ghella Pty Ltd
CSM	Conceptual Site Model
CSSI	Critical State Significant Infrastructure
Cis-1,2-DCE	cis-1,2-Dichloroethene
DGV	Default Guideline Value
DNAPL	Dense Non-Aqueous Phase Liquids
DP	Deposited Plan
DQI	Data Quality Indicator
DQO	Data Quality Objective
DSI	Detailed Site Investigation
EIL	Ecological Investigation Level
EMP	Environmental Management Plan
ENM	Excavated Natural Material
EPA	Environment Protection Authority (NSW)
EPL	Environment Protection Licence
ES	Environmental Strategies
ESL	Ecological Screening Level
FA	Fibrous Asbestos
GIL	Groundwater Investigation Level
HDPE	High Density Polyethylene
HEPA	Heads of EPAs Australia and New Zealand
HHRA	Human Health Risk Assessment
HI	Hazard Indices
HIL	Health Investigation Level
HQ	Hazard Quotients
HSL	Health Screening Level
IAA	Interim Audit Advice

ILCR	Incremental Lifetime Cancer Risk
LCS	Laboratory Control Sample
LDPE	Low Density Polyethylene
LEP	Local Environment Plan
LNAPL	Light Non-Aqueous Phase Liquids
Metals	As: Arsenic, Cd: Cadmium, Cr: Chromium, Cu: Copper, Ni: Nickel, Pb: Lead, Zn: Zinc, Hg: Mercury
MIP	Membrane-Interface and Hydraulic Profiling Tool
ML	Management Limits
MS	Matrix Spike
NAPL	Non-Aqueous Phase Liquids
NATA	National Association of Testing Authorities
NC	Not Calculated
ND	Not Detected
NEPM	National Environment Protection Measure
NHMRC	National Health and Medical Research Council
NL	Non-Limiting
n	Number of Samples
OCPs	Organochlorine Pesticides
OEH	Office of Environment and Heritage
OH&S	Occupational Health & Safety
OPPs	Organophosphorus Pesticides
PAHs	Polycyclic Aromatic Hydrocarbons
PCBs	Polychlorinated Biphenyls
PCE	Tetrachloroethene
PFAS	Per- and Poly-fluoroalkyl substances
PFHxS	Perfluorohexane sulfonic acid
PFOA	Perfluorooctanoic acid
PFOS	Perfluorooctanesulfonic acid
pH	A measure of acidity, hydrogen ion activity
PID	Photoionisation Detector
PQL	Practical Quantitation Limit
PRB	Permeable Reactive Barrier
QA/QC	Quality Assurance/Quality Control
Ramboll	Ramboll Australia Pty Ltd
RAP	Remediation Action Plan
RL	Relative Level
RPD	Relative Percent Difference
RRE	Resource Recovery Exemption
RRO	Resource Recovery Order
RSL	Regional Screening Level
SAQP	Sampling Analysis and Quality Plan
SAR	Site Audit Report
SAS	Site Audit Statement
SBT	Station Boxes and Tunnelling
SMWSA	Sydney Metro - Western Sydney Airport
SPR	Source, Pathway and Receptor
SQG	Soil Quality Guidelines
SSTOM	Stations Systems Trains and Operations and Maintenance
STEL	Short-Term Exposure Limit
SVOCs	Semi Volatile Organic Compounds
SWL	Standing Water Level
TCE	Trichloroethene
TCLP	Toxicity Characteristic Leaching Procedure
TEQ	Toxic Equivalence Quotient
TPHs	Total Petroleum Hydrocarbons
TRHs	Total Recoverable Hydrocarbons
TTMP	Tetra Tech Major Projects Pty Ltd
TV	Trigger Value
TWA	Time Weighted Average
USEPA	United States Environmental Protection Agency

UST	Underground Storage Tank
VC	Vinyl Chloride
VENM	Virgin Excavated Natural Material
VOCs	Volatile Organic Compounds
WHO	World Health Organisation
XSD	Halogen specific detector
-	On tables is “not calculated”, “no criteria” or “not applicable”

1. INTRODUCTION

1.1 Audit Details

A site contamination audit has been conducted in relation to the proposed St Marys Station, which forms part of the Sydney Metro – Western Sydney Airport (SMWSA) rail project, located at Station Street, St Marys NSW. The site/Audit boundary is defined by the construction site boundary illustrated by the red outline in Attachment 13a and 13b, Appendix A (other attachments to the Site Audit Report (SAR) do not correctly show this boundary).

The Audit was conducted to provide an independent review by an EPA Accredited Auditor of the suitability and appropriateness of a remedial action plan (RAP), i.e. a "Site Audit" as defined in Section 4 (1) (b) (v) of the NSW *Contaminated Land Management Act 1997* (the CLM Act).

The Audit was initiated to comply with requirements of Critical State Significant Infrastructure (CSSI) approval 10051, issued on 23 July 2021 by the Minister for Planning and Public Spaces. Condition E94 of the CSSI relates to the RAP and requires a site audit as follows:

> *"Before commencing remediation, a Section B Site Audit Statement(s) must be prepared by an NSW EPA-accredited Site Auditor that certifies that the Remedial Action Plan(s) is/are appropriate and that the site can be made suitable for the proposed use. The Remedial Action Plan(s) must be implemented and any changes to the Remedial Action Plan(s) must be approved in writing by the NSW EPA-accredited Site Auditor."*

The Audit is therefore a statutory audit.

Details of the Audit are:

Requested by:	Stuart Anstee on behalf of CPB Contractors Pty Limited and Ghella Pty Ltd (CPBG)
Request/Commencement Date:	4 July 2022
Auditor:	Tom Onus
Accreditation No.:	1505

This SAR and Site Audit Statement (SAS) were initially finalised on 11 May 2023. The RAP was subsequently updated (23 May 2023) and included requirements for an Environmental Management Plan (EMP) to be prepared to describe the scope of groundwater monitoring to be undertaken during the later stages of works to demonstrate the Permeable Reactive Barrier (PRB) remains effective until the station box and tunnel is tanked and the groundwater flow direction returns to the pre-construction direction. CPBG requested that the SAR and SAS be revised to review the updated current version of the RAP.

1.2 Project Background

The SMWSA railway project 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.

Sydney Metro has engaged the joint venture of CPB Contractors Pty Limited and Ghella Pty Ltd (CPBG) for the design and construction of the Station Boxes and Tunnelling Works (SBT Works) of the project.

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 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, Orchard Hills, Airport Terminal and Aerotropolis.
- Excavations for two intermediate services facilities, one in each of the tunnel sections at Claremont Meadows and Bringelly.

The St Marys site/Audit area comprises the station box and surrounding areas that are disturbed during construction works, including parts of Station Street, the former bus interchange, Bus Driver Rest Compound, former St Marys Station Plaza and vacant land adjacent to the rail corridor (red outline in Attachment 13a and 13b, Appendix A).

Fit-out of the St Marys Sydney Metro Station is outside the scope of the SBT Works and it is understood 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 St Marys Station site will be analogous with a commercial/industrial land use with hardstand and minimum soft landscaping.

The site and surrounding area have been subject to previous intrusive investigations of soil, groundwater and soil vapour. More recently a detailed site investigation (DSI) and a DSI Addendum were undertaken by Tetra Tech Major Projects Pty Ltd (TTMP). Based on the findings of the DSI, construction activities that did not result in groundwater drawdown were considered by TTMP to be low risk and these works would not be considered as 'remediation'. TTMP noted that remediation was defined as a management measure which is required to make the site suitable for commercial/industrial use. Construction activities which were considered low risk and not 'remediation' by TTMP included: preparatory works (site levelling (cut and fill), importation of fill for a piling platform and piling) and bulk excavation above the groundwater table. An Interim RAP was prepared to document the controls to be implemented during these works.

Chlorinated hydrocarbon contamination was identified in soil and groundwater during previous investigations at a former dry cleaner located at 1-7 Queen Street. Development works are not proposed at the former dry cleaner (located ~100-120 m west, down-gradient of the station box and off-site), however groundwater travel time modelling indicated that dewatering of the station box excavation would reverse the groundwater flow direction, drawing contamination towards the station box excavation. TTMP prepared a site-specific human health risk assessment (HHRA) to assess the risks to human health and develop site-specific trigger values, as well as a RAP to present the remedial strategy for excavation below the groundwater table.

1.3 Interim Audit Advice

The Auditor previously undertook independent reviews of a the DSI and DSI Addendum that were documented in interim audit advice (IAA) letters IAA3 (dated 5 September 2022) and IAA10 (dated 17 October 2022), respectively, along with an Interim RAP as documented in IAA11 (dated 24 October 2022) and the HHRA and RAP as documented in IAA14 (dated 7 February 2023). Preparation of the IAAs was undertaken to satisfy a requirement of the deed between Transport for NSW and CPBG. Relevant information from the IAAs has been include in this Site Audit Report (SAR). The IAAs are attached as Appendix C to this SAR.

1.4 Scope of the Audit

The scope of the Audit included:

- Review of the following reports:
  - *'Sydney Metro – Western Sydney Airport Technical Paper 8 Contamination',* dated October 2020, prepared by M2A (*the Technical Paper*)

- 'Contamination at 1-7 Queen Street, St Marys', dated 8 July 2021, Tetra Tech Major Projects Pty Ltd (TTMP) (*the Contamination Memo*)
- 'Technical Memorandum: Preliminary Soil Results Eastern Portion St Marys', dated 15 July 2022, TTMP (*the Tech Memo*)
- 'St Marys, Sampling Analysis Quality Plan, Sydney Metro Western Sydney Airport Station Boxes and Tunnelling Works', dated 22 July 2022, TTMP (*the SAQP*)
- 'St Marys Station, Detailed Site Investigation, Sydney Metro Western Sydney Airport Station Boxes and Tunnelling Works', dated 27 September 2022, TTMP (*the DSI*)
- 'St Marys Station Remedial Action Plan (Interim) Preparatory Works and Initial Bulk Excavation', dated 21 October 2022, TTMP (*the Interim RAP*)
- 'Detailed Site Investigation Addendum St Marys Station', dated 13 October 2022, TTMP (*the DSI Addendum*)
- 'Detailed Site Investigation Addendum St Marys Groundwater Monitoring Data', dated 23 November 2022, TTMP (*the Groundwater DSI Addendum*)
- 'Hydrogeological Report (Project-wide), Sydney Metro Western Sydney Airport Station Boxes and Tunnelling Works', dated 23 February 2023, TTMP (*the Hydrogeological Report*)
- 'St Marys Station, Former Dry Cleaner, 1-7 Queen St – Assessment of Human Health Risk and Mitigation Options, Sydney Metro Western Sydney Airport Station Boxes and Tunnelling Works', dated 26 April 2023, TTMP (*the HHRA*)
- 'St Marys Station, Remedial Action Plan, Sydney Metro Western Sydney Airport Station Boxes and Tunnelling Works', dated 23 May 2023, TTMP (*the RAP*)

- A site visit by the Auditor on 11 October 2022.
- Discussions with CPBG, and with TTMP who undertook the investigations and prepared the HHRA and RAP.

Draft versions of the above reports were issued for audit review and review comments were issued (by Auditor email) which were incorporated into the final TTMP reports (listed above). The Technical Paper was prepared prior to the Auditor's engagement and was reviewed for factual content, however the Auditor has relied upon summaries provided by TTMP in the above listed reports. Technical Paper 8 is understood to be a supporting document to the Sydney Metro – Western Sydney Airport Environmental Impact Statement (EIS), which was not provided. The Technical Paper included a Preliminary Site Investigation (PSI) of the Project footprint, and a detailed summary of the site history and existing data available when the EIS was prepared.

TTMP reported in the SAQP and DSI that previous investigations had been undertaken at the site including two contamination assessments undertaken by Cardno in 2021 and a factual contamination report prepared by a Golder Associates Pty Ltd and Douglas Partners Pty Ltd joint venture (Golder-Douglas Partners) in 2021. Summaries of these reports were included in the various TTMP reports and the data was included as an appendix to the DSI. The majority of the original reports were not provided for Auditor review, however, where provided, the reports were reviewed for factual information.

The Auditor has relied on the report summaries presented by TTMP for consideration in the site audit where relevant.

Preparation of the SAR included contributions from Ramboll staff Geoff Fletcher (assistant) and Dr Anand Chandra (human health risk assessor).

I have reviewed the key documents against the requirements of guidelines made or approved under Section 105 of the CLM Act, including the following:

- Chapter 4 Remediation of Land in the Resilience and Hazards State Environment Planning Policy (SEPP) 2021 (formerly known as SEPP 55) and NSW Department of Urban Affairs and Planning and NSW EPA (1998) '*Managing Land Contamination, Planning Guidelines SEPP 55 – Remediation of Land*'
- NSW EPA (2017) '*Guidelines for the NSW Site Auditor Scheme (3rd Edition)'*
- NSW EPA (2020) '*Contaminated Land Guidelines, Consultants Reporting on Contaminated Land'*
- NSW EPA (2022) *'Sampling design part 1 – application'* and *'Sampling design part 2 – interpretation'*
- National Environment Protection Council (NEPC) '*National Environment Protection (Assessment of Site Contamination) Measure 1999',* as Amended 2013 (NEPM, 2013)
- Australia and New Zealand Heads of EPAs (HEPA 2020) *'PFAS National Environmental Management Plan, Version 2.0'* (NEMP).

2. SITE DETAILS

2.1 Location

The site locality is shown on Attachment 1, Appendix A (note yellow SBT/site boundary on this attachment is incorrect). The site/Audit boundary is defined by the construction site boundary illustrated by the red outline in Attachment 13a and 13b, Appendix A. It is noted that other attachments to the SAR do not correctly show this boundary.

The site details are as follows:

Street address:	Station Street, St Marys, NSW 2760
Identifier:	Lot 1 DP1001735 (1 Station Street), Lot 2 DP1001735 (2 Station Street), Lot 7 DP734738 (33-43 Phillip Street), Lot 8 DP734738 (8 Station Street), part Lot 9 DP840747 (part 45 Station Street), part Lot 1 DP1040178 (part 63 Station Street), Lot 1 DP1267484 (11-13 Chesham Street) and part of Station Street (no Lot and DP)
Local Government:	Penrith City Council
Owner:	Transport for NSW
Site Area:	Approximately 3.9 ha

Site boundaries were typically defined by temporary fencing/timber hoarding and permanent fencing with the existing rail corridor.

A survey plan of the site has not been provided.

2.2 Zoning

The current zoning of the site is SP2 (Railway), B4 (Mixed Use) and R4 (High Density Residential) under the Penrith Local Environmental Plan 2010.

2.3 Adjacent Uses

The site is located within an area of mixed residential and commercial/industrial land uses (Attachment 1, Appendix A). The surrounding site use includes:

North: St Marys Train Station and Railway corridor. North of the rail corridor is the St Marys Commuter Carpark and various commercial/industrial land uses.

East: Glossop Street. East of Glossop Street is a low-density residential area south of the rail corridor, and a commercial/industrial area north of the rail corridor.

South: Residential land uses (low to medium density) to the southeast and commercial/industrial to the southwest.

West: Commercial (including the former dry cleaner), then car parking and residential land use

2.4 Site Condition

TTMP undertook a limited walkover inspection of the site in March 2022 for the DSI prior to site establishment by CPBG. Observations recorded by TTMP were limited to the St Marys Station Plaza area and areas located north of Station Street and Chesham Street.

<u>St Marys Station Plaza</u>

- St Marys Station Plaza was a vacant, commercial shopping centre comprising one above-ground level and single level basement car park that was accessed from Station Street.

- The below-ground car park was surfaced with hardstand pavement in good condition with some minor oil staining on the hardstand from motor vehicles. A small area used for the storage of cleaning chemicals and a car wash with an oil separator and sub-surface drainage was present in the car park.
- There was 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 site along Station Street.

1 to 2 Station Street and 11-13 Chesham Street

- At the time of the inspection, the area 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 located in this area 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. This portion of the alignment was elevated approximately 10 m above the existing 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.

The following was noted by the Auditor during the site visit on 11 October 2022:

- The site was an existing construction site with excavation/preparatory works underway in the eastern portions of the site.
- A large, excavated batter was observed in the eastern portion of the site with site sheds located to the southeast. Material excavated from this portion was observed to be transported within the site to the former St Marys Station Plaza, which had been cleared prior to material placement.
- Preparatory works appear to have commenced on the eastern portions and were moving towards the west with fill materials and construction debris observed in the central and western portions of the site.

2.5 Proposed Development

The site is to be redeveloped as a future Metro Train Station. TTMP did not specify the details for the future use, however provided an outline of the construction works involved, which include:

- Demolition of existing commercial/industrial premises including St Marys Station Plaza.
- Establishment of temporary offices, amenities, car parking and access roads for construction purposes.
- Bulk excavation up to 6 metres below ground level (mbgl) within land south of the station box and west of St Mary Station Plaza, and the use of excavated material as fill within the St

Marys Station Plaza, where such material is assessed to be suitable from a contamination and geotechnical perspective.

- Piling and station box excavation using rippers and rock hammers. The station box will be excavated to approximately 20 mbgl (i.e., 19 m Australian Height Datum (mAHD)). Excavation of the station box is expected to generate approximately 172,000 m^3 (as an in-situ volume) of spoil.
- Stub tunnel excavation east of the station box using road headers.
- Tunnel boring west of the station box, and retrieval of the Tunnel boring machine (TBM) within the station box.

TTMP noted that fit out of the St Marys Sydney Metro Station is outside the scope of the SBT Works and will be completed under a separate works package. TTMP understood that the final land use for the site will be analogous with a commercial/industrial land use with hardstand and minimum soft landscaping.

For the purposes of this audit, the 'commercial/industrial' land use scenario has been assumed.

3. SITE HISTORY

TTMP reported in the SAQP and DSI that the history of the site was described in *Sydney Metro – Western Sydney Airport Technical Paper 8 Contamination.* The SAQP and DSI included a summary of the site history, which noted the following:

- The 1943 historical aerial imagery noted that the site comprised St Marys Station, a rail line/siding, and low-density residential housing surrounding the station. A rail siding was 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 and appeared to be disturbed and used for the stockpiling of materials. In the 1980s additional buildings were added (now the Bus Driver Rest Compound) with the configuration of these buildings changing between the 1980s through to 2013. A single building and shed used as a rest area for bus drivers remained in this area from 2013 until construction works began.
- 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 information indicates that remediation works were completed, which included excavation and off-site disposal of asbestos impacted soils, and reinstatement of the remedial excavation with clean fill.
- From 1943 to the present-day, units/apartments were constructed and the density of residential housing increased in the area to the 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 cleaners were also located in this area between the 1950s and 1990s. From 2012 the site was cleared vacant land and remained in this configuration until approximately 2015.
- 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 was developed between 2009 and 2010.

TTMP undertook a search of the List of NSW Contaminated Sites Notified to NSW EPA under Section 60 of the CLM Act on 8 March 2022 which identified two nearby properties, comprising: 1-7 Queen Street (former dry cleaner located off-site ~100-120 m west of the station box excavation) and 76 Glossop Street (service station located ~300 m north of the site). TTMP did not specify the EPA management class for these sites however the Auditor observed in January 2023 that 1-7 Queen Street remained on the list and was noted to be “under assessment”.

In April 2022, TTMP undertook a search of the NSW EPA Contaminated Land Public Record for declaration notices and orders made by the EPA under the CLM Act, voluntary management proposals approved under the CLM Act, and site audit statements relating to significantly contaminated land. The search of the database did not identify any listings for the site, or for properties within 250 m of the site.

The SAQP and DSI identified potentially contaminated sites nearby, as illustrated in Attachment 1, Appendix A (note incorrect site boundary), including:

- The Harris Street commuter car park (north of the station) which was previously used as a wreckers and associated workshop, a plastics manufacturing site, and bus depot and associated fuel storage.
- A commercial area around Queen Street and Phillip Street (south of the station) where current and former business activities may have resulted in groundwater contamination. The businesses include a former service station (47 Phillip Street, approximately 100 m south of

station box), a former dry cleaner (51 Phillip Street, approximately 100 m south of station box) and a Waterproofer (43 Queen Street, approximately 125 m southeast of station box).

- St Marys Station Plaza on Station Street (south of the station) included chemical storage areas and a car wash. There was limited information on previous site use before the development of the Plaza in 1994.
- A former depot with the potential for a UST was located within the station box excavation. Previous investigations did not confirm the presence of a UST and contamination associated with a potential UST was not identified.
- A former dry cleaner located at 1-7 Queen Street, which is approximately 100-120 m west of the station box (incorrectly identified as within the site on Attachment 1, Appendix A).

3.1 Auditor's Opinion

The site history provides an adequate indication of past activities. Previous site uses with the most significant potential to cause contamination include potential storage of fuels in USTs, uncontrolled filling of the site, demolition of former buildings and structures which contained hazardous building materials and current/former onsite and offsite commercial/industrial land uses (including dry cleaner). The duration of operation for the dry cleaner is not known, however it was reported that a commercial premisses occupied this area since 1955.

4. CONTAMINANTS OF CONCERN

TTMP noted in the SAQP and DSI that historical activities with the potential for contamination (referred to as Areas of Environmental Concern (AEC)) were identified in the EIS. Fifteen AECs were identified and the location of the AECs are shown in Attachment 2, Appendix A. The summary provided by TTMP for these AECs is provided as Attachment 3, Appendix A.

The DSI provided a list of the contaminants of concern and potentially contaminating activities which have been tabulated in Table 4.1.

Table 4.1: Contaminants of Concern

Activity	Potential Contaminants
Uncontrolled fill material	Total recoverable hydrocarbons (TRH), benzene, toluene, ethylbenzene and total xylenes (BTEX), heavy metals, polycyclic aromatic hydrocarbons (PAH), organophosphorus pesticides (OPP), organochlorine pesticides (OCPs), polychlorinated biphenyls (PCB) and asbestos
Demolition materials from previous buildings and structures	Asbestos and lead (lead-based paint)
Existing commercial/industrial land use onsite and previous commercial/industrial land use businesses in the surrounding area (dry cleaners, service stations, depots containing USTs, wreckers, vehicle workshops, and manufacturing/industrial facilities).	TRH, BTEX, heavy metals, PAH, pesticides (OCP/OPP), PCB, chlorinated hydrocarbons, perfluoroalkyl and polyfluoroalkyl substances (PFAS) and asbestos

4.1 Auditor's Opinion

The Auditor considers that the contaminants of concern identified by TTMP adequately reflect the site history and site condition, and were included in the analyte list in the DSI and DSI Addendum.

5. STRATIGRAPHY AND HYDROGEOLOGY

5.1 Stratigraphy

TTMP reviewed geological maps and reported that the site is underlain by Bringelly Shale of the Wianamatta Group which was deposited in a deep marine environment of the Middle Triassic. Bringelly Shale is described as shale, carbonaceous claystone, laminite, lithic sandstone, with rare coal.

TTMP provided a summary of the previous investigations undertaken at the site and noted that a review of the borehole logs indicated fill material was observed in all previous investigation locations to depths of between 0.2 m and 1.2 mbgl. TTMP undertook a total of 47 boreholes and test pits during the DSI and DSI Addendum (Attachments 4a to 4d, Appendix A). The sub-surface profile of the site is summarised by the Auditor in Table 5.1.

Table 5.1: Stratigraphy

Subsurface Profile	Description and Depths (mbgl)
Pavement/Hardstand	Hardstand pavements including concrete, asphalt and brick at the surface of nine locations (SBT-BH-1007, SBT-CM-1022, SBT-BH-1200, SBT-BH-1202, SBT-BH-1215, SBT-BH-1220 to SBT-BH-1222 and SBT-BH-1232).
Fill	Fill materials, including topsoil, were typically present to depths of between 0.2 m and 1.5 m. Deeper fill was encountered in SBT-BH-1200 (St Marys Bus Interchange) to a depth of 2.5 m. Brick, terracotta tiles and potential asbestos-containing material (ACM) as fibre cement debris was identified in fill at 1-7 Queen Street (SBT-GW-1018 and SBT-GW-1019). Brick fragments were also observed in shallow fill at SBT-BH-1215 (St Marys Bus Interchange)
Natural soils and Bedrock	Residual soils were encountered beneath the fill and were generally described as silty clay with sandy clay, encountered from approximately 6.5 mbgl with increasing sand content from 14 to 16 mbgl. An approximately 3-metre-thick band of weathered siltstone with clay was encountered at approximately 16 mbgl, with bedrock (siltstone) from 19 mbgl.

mbgl – metres below ground level

TTMP reported that the Atlas of Australian Acid Sulfate Soil (ASS) compiled by CSIRO was reviewed during the SAQP and DSI to assess the probability of occurrence of ASS within the site. It was reported by TTMP that the ASS risk plan indicates that the site is located in an area with Extremely Low Probability of Occurrence of ASS.

5.2 Hydrogeology

TTMP undertook a search for registered bores during the SAQP and DSI. Three bores were identified within a 1,000 m radius of the site. The bores were installed to 6 mbgl, registered for monitoring purposes and located approximately 750 m northwest of the site. The Auditor undertook a search in February 2023 and identified the same bores.

Based on the information presented in the DSI, HHRA, the Groundwater DSI Addendum and the Hydrogeological Report, TTMP reported in the RAP that groundwater flows in a westerly direction towards South Creek (Attachment 5, Appendix A). Groundwater elevations were recorded within the Bringelly Shale (siltstone) and ranged between approximately 30 mAHD and 40 mAHD. TTMP noted that perched water may be present at the soil/rock interface.

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

The HHRA reported that the range of hydraulic conductivities reported in the residual soils in the vicinity of the chlorinated hydrocarbon impact (around 1-7 Queen Street) ranged from 1.2×10^{-8} m/s to 3×10^{-6} m/s, which is similar to the range of 7.4×10^{-8} m/s to 2.2×10^{-6} m/s reported in

the EIS. Testing indicated that the highest hydraulic conductivities are in residual soils in the suspected dry cleaner source area (3 x 10^{-6} m/s) and to the east toward the Station box excavation (1.1 x 10^{-6} m/s). Based on groundwater levels and the lithology between the former dry cleaner and the Station box, the testing indicated that impacted groundwater drawn toward the excavation is likely to predominantly flow in the residual soils, which appear to be of high permeability along this flow path.

5.3 Auditor's Opinion

The Auditor considers that the stratigraphy and hydrogeology detailed by TTMP adequately reflect the site conditions and are sufficient for remedial planning.

6. EVALUATION OF QUALITY ASSURANCE AND QUALITY CONTROL

The Auditor has assessed the overall quality of the data by review of the information presented in the referenced reports, supplemented by field observations. The data sources are summarised in Table 6.1.

Table 6.1: Summary of Investigations

Stage of Works	Field Data	Analytical Data
DSI *Fieldwork date: July to August 2022*	40 boreholes (SBT-GW-1001, SBT-BH-1003 to SBT-BH-1011, SBT-GW-1018, SBT-GW-1019, SBT-CM-1020, SBT-CM-1022, SBT-BH-1200 to SBT-BH-1222, SBT-BH-1232, SBT-GW-1233, SBT-GW-1234 and SBT-BH-1345) drilled across the site to between 1 m and 45.18 mbgl for site coverage and targeted to identified AECs. Installation and sampling of six new groundwater wells (SBT-GW-1232 to SBT-GW-1234, SBT-BH-1018, SBT-BH-1019 and SBT-CM-1020), along with sampling from eight existing wells (SMGW-BH-A302, SMGW-BH-A321, SMGW-BH-A321-S, SMGW-BH-A401, SMGW-BH-A402, GW01, GW02 and MW1 (EMW1)). Membrane-Interface and Hydraulic Profiling Tool (MIP) survey in eight locations (MIP01 to MIP08) in the vicinity of the former dry cleaner (off-site) to depths of approximately 4 to 9 mbgl (Attachment 8, Appendix A).	Soil: metals, TRH, BTEX, PAH, OCP, OPP, phenolic compounds (phenols), PCB, PFAS, volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs) and asbestos (500 mL) Groundwater: Metals, TRH, BTEX, PAHs, phenols, OCPs, OPPs, PCBs, VOCs, SVOCs and PFAS
HHRA *Fieldwork date: August 2022*	Installation of replacement well SBT-GW-1019R (replacement well for SBT-GW-1019). Groundwater sampling from SBT-GW-1018 and SBT-GW-1019R.	Groundwater: Metals, TRH, BTEX, PAHs, phenols, OCPs, OPPs, PCBs, VOCs, SVOCs and PFAS
DSI Addendum *Fieldwork date: September 2022*	Seven test pits (SBT-BH-1224 to SBT-BH-1227, SBT-BH-1229, SBT-BH-1230 and SBT-BH-1342) targeting the former St Marys Station Plaza area to depths of approximately 1 mbgl.	Soil: Metals, TRH, BTEX, PAHs, phenols, OCPs, OPPs, PCBs, VOCs, SVOCs, PFAS and asbestos (500 mL)
Groundwater DSI Addendum *Fieldwork date: September 2023*	Installation and sampling of four new groundwater wells (SBT-GW-1002, SBT-GW-1016, SBT-GW-1017 and SBT-GW-1021), along with groundwater sampling from three existing wells (SBT-GW-1232, SBT-GW-1233 and SBT-GW-1234).	Groundwater: Metals, TRH, BTEX, PAHs, phenols, OCPs, OPPs, PCBs, VOCs, SVOCs and PFAS

The Auditor's assessment of data quality follows in Tables 6.2 and 6.3.

Table 6.2: QA/QC – Sampling and Analysis Methodology Assessment

Sampling and Analysis Plan and Sampling Methodology	Auditor's Opinion
Data Quality Objectives (DQO) TTMP defined specific DQOs in accordance with the seven-step process outlined in Schedule B2 of NEPM (2013). The following decisions were identified in the DSI DQOs: • Is soil and groundwater contamination present at the site in consideration of the data gaps / uncertainties identified? • Is groundwater contamination present in the vicinity of the site which may be drawn into the excavation during construction?	The identified DQOs were considered appropriate for the investigations conducted.

Sampling and Analysis Plan and Sampling Methodology	Auditor's Opinion
• Are volatile contaminants present in groundwater which require management during construction? • If contamination is present how likely is it to be disturbed during construction works? • Are potential sources of contamination identified likely to represent a constraint to the project with respect to construction and spoil management in relation to contamination? • Are remediation actions or management measures required to manage risks to human health and the environment related to contamination? • Is asbestos present which requires management during construction? And if asbestos is present, what is the condition of the material (i.e., bonded and/or friable)? If asbestos in soils is identified, is additional investigation required to assess potential risks to human health during construction, or can risks be controlled through implementation of an asbestos management plan and procedures outlined in SafeWork NSW codes of practice for asbestos related works?	
Sampling pattern and locations *Soil:* Investigation locations were spaced to gain coverage of the majority of the site. Further sample locations targeted identified AECs. The various fill and natural materials at the site were also targeted for sampling. *Groundwater:* Monitoring wells were spaced to gain site coverage and within the potential draw down influence radius. Additional monitoring wells were installed targeting identified AECs. Wells were concentrated to the west of the station box in on-site and off-site locations targeting potential impacts from the off-site former dry cleaner.	The investigation locations adequately target the main areas of concern for the purposes of remedial planning in the context of the proposed development.
Sampling density *Soil:* The sampling density of 47 locations over approximately 3.9 ha is marginally below the minimum recommended (50 locations for a 4 ha site) by EPA (2022) *Sampling Design Part 1*. The coverage provides a 95% confidence of detecting a residual hot spot of approximately 33.4 m diameter. Samples analysed for asbestos were not collected according to the density outlined in NEPM (2013) (Schedule B1). *Groundwater*: A total of 10 new groundwater wells were installed at the site with an additional eight existing wells sampled	The sampling density was adequate for the purposes of remedial planning in the context of the proposed development.
Sample depths Soil samples collected from boreholes were generally collected at pre-determined intervals within the soil profile (0-0.2 mbgl, then 0.5 m intervals in fill material, and natural materials at the interface with fill materials, and then 1 m intervals in natural to the target depth) or where changes in the soil profile were noted. The maximum depth of investigation was 45.18 mbgl and the maximum depth of sampling was 39.3 mbgl. Groundwater samples were collected from varying depths within each well depending on depth and screen interval. Sample depths ranged from 2 mbgl to 17.4 mbgl.	The sampling strategy was adequate to characterise the primary material types present on site.
Well construction *Groundwater:* The new groundwater monitoring wells were constructed of class 18 uPVC screen and casing to the target depth of the location with a 3-6 m screen placed in 2 mm graded sand used to create a filter to 0.5 m above the top of the screen section. Above the sand a bentonite clay plug was installed to prevent groundwater from overlying water bearing zones entering the screen, as well as top-down water ingress	The well construction was acceptable for assessment of groundwater conditions. Positioning of the screen interval below the SWL did not allow for identification of light non-aqueous phase liquid (LNAPL) in these wells.

Sampling and Analysis Plan and Sampling Methodology	Auditor's Opinion
through the bore annulus. The bore annulus was then grouted to the surface and finished with a steel gatic cover. Wells of varying depth were installed to target geology and AECs. Nested wells were not installed. The Standing Water Level (SWL) does not intersect the screen interval in wells SBT-GW-1018, SBT-GW-1019, BH1/MW1, GW01, GW02, SMGW-BH-A302, SMGW-BH-A321 and SMGW-BH-A402.	
Sample collection method *Soil*: Sample collection was via a drilling rig using solid flight augers/pushtubes and excavated test pits. Samples collected from drilling rigs were obtained from SPT split spoon or pushtube sampler attachments. Samples from excavated test pits were collected by hand, either directly from the excavation or from the excavator bucket. 500 mL samples were collected for laboratory analysis for asbestos (asbestos fines (AF) and fibrous asbestos (FA)). Samples analysed for ACM were not collected according to the asbestos quantification methodology outlined in NEPM (2013) (Schedule B1). *Groundwater*: Wells were installed by solid flight augers, developed with a bailer and/or pump and sampled by dedicated Hydrasleeve passive sampler. High Density Polyethylene (HDPE) sleeves were used in most monitoring wells, with Low Density Polyethylene (LDPE) sleeves used in the vicinity of the former dry cleaner.	Sample collection from the auger flights is not ideal as it can result in loss of volatiles and sample cross contamination. Similarly, sampling of soil from test pits can result in loss of volatiles. The assessment of asbestos was not undertaken in accordance with NEPM (2013) and it is considered that there is the potential to encounter fill materials containing asbestos during construction. Overall, in consideration of the contamination encountered, the sample collection method was found to be acceptable for remediation planning purposes.
Decontamination procedures *Soil:* Sampling equipment was cleaned with detergent (Liquinox), tap water and then de-ionised water prior to sampling and between sampling events to prevent cross contamination. New gloves were reportedly used for each new sample. Decontamination of augers between locations was not explicitly reported. *Groundwater*: Dedicated sampling equipment was used for each well. New gloves were reportedly used for each new sample.	Acceptable
Sample handling and containers Samples were placed into prepared and preserved sampling containers provided by the laboratory and chilled during storage and subsequent transport to the laboratories. Samples for asbestos analysis were placed in plastic zip-lock bags. Groundwater samples to be analysed for heavy metals were field filtered.	Acceptable
Chain of Custody (COC) Completed COC forms were provided in the reports.	Acceptable
Detailed description of field screening protocols *Soil:* Field screening for volatiles was undertaken using a photoionisation detector (PID). Soil sub-samples were placed in ziplock plastic bags and the headspace measured for VOCs after allowing time for equilibration. *Groundwater:* Field parameters were measured during well sampling and development.	Acceptable
Calibration of field equipment The reports indicated that calibration had been undertaken prior to use. Calibration certificates from the equipment supplier were provided, however field calibration records were not provided.	Acceptable

Sampling and Analysis Plan and Sampling Methodology	Auditor's Opinion
Sampling logs Soil logs are provided within the report, indicating sample depth, PID readings and lithology. With the exception of ACM fragments in two locations, the logs report no indications of contamination were found. Groundwater field sampling records were provided, indicating SWL, field parameters, methodology and observations.	Acceptable

Table 6.3: QA/QC – Field and Lab Quality Assurance and Quality Control

Field and Lab QA/QC	Auditor's Opinion
Field quality control samples Field quality control samples including trip blanks, trip spikes, rinsate blanks, field intra-laboratory and inter-laboratory duplicates were undertaken.	Acceptable
Field quality control results The results of field quality control samples were generally within appropriate limits. The following exceptions were noted: • Relative percent difference calculations (RPDs) for 16 laboratory soil/groundwater duplicate samples obtained during the DSI were outside acceptance criteria. Where a duplicate sample has reported a higher concentration, the highest result has been used. TTMP noted that generally the variance in the results was considered to be due to the nature and heterogeneity of the sampled materials. • Several rinsate samples reported relatively low concentrations of metals, TRH, OCP and chlorinated hydrocarbons. TTMP noted that these detections may reflect minor residue on the soil sampling equipment (auger, hammer and tube) following decontamination.	Overall, in the context of the dataset reported, the elevated RPD results and minor rinsate blank detections are not considered significant and the field quality control results are acceptable.
NATA registered laboratory and NATA endorsed methods Laboratories used included: ALS (Primary) and Eurofins | mgt (Secondary). Laboratory certificates were NATA stamped.	Acceptable
Analytical methods Analytical methods were included in the laboratory test certificates. Both laboratories provided brief method summaries of in-house NATA accredited methods used based on USEPA and/or APHA methods (excluding asbestos) for extraction and analysis in accordance with the NEPM (2013). Asbestos identification was conducted by the laboratories using polarised light microscopy with dispersion staining by method AS4964-2004 *Method for the Qualitative Identification of Asbestos Bulk Samples*. The NEPM (2013) methodology of assessing a 500 mL sample to achieve a lower detection limit is not NATA accredited.	The analytical methods are considered acceptable for the purpose of the site audit, noting that AS4964-2004 is currently the only available method in Australia for analysing asbestos. DOH (2009) and enHealth (2005) state that *"until an alternative analytical technique is developed and validated the AS4964-2004 is recommended for use"*.
Holding times Review of the COCs and laboratory certificates indicate that the holding times had generally been met, however, breaches of holding times were reported by the laboratory in numerous laboratory reports for varying contaminants of concern. TTMP noted that the breaches were minor and did not affect the validity of the data and included supporting discussions.	Acceptable
Practical Quantitation Limits (PQLs) *Soil:* PQLs (except asbestos) were generally less than the threshold criteria for the contaminants of concern. *Asbestos:* The NATA approved limit of detection for asbestos in soil was 0.01% w/w, although NEPM (2013) analyses were reported to 0.001% w/w for AF/FA.	*Soil (except asbestos):* Overall the soil PQLs are acceptable. *Asbestos:* In the absence of any other validated analytical method, the detection limit for asbestos is considered acceptable.

Field and Lab QA / QC	Auditor's Opinion
Groundwater: The following trigger values were less than the PQLs: • Anthracene 0.1 µg/L, trigger value 0.01 µg/L • Benzo(a)pyrene 0.1 µg/L, trigger value 0.01 µg/L	*Groundwater*: The elevated PQLs were only marginally elevated above the trigger values and in the context of the results reported these discrepancies do not materially affect the outcome of the audit.
Laboratory quality control samples Laboratory quality control samples including laboratory control samples, matrix spikes, surrogate spikes, blanks and duplicates were undertaken by the laboratory.	Acceptable
Laboratory quality control results The results of laboratory quality control samples were generally within appropriate limits, with the following exceptions: • Slightly elevated spike recoveries were recorded for metals, PFAS, PAHs, OCPs, ammonia and nutrients. Generally acceptable recoveries were obtained for the laboratory control sample (LCS). • Relative percent difference calculations (RPDs) RPDs for laboratory duplicates were outside control limits for individual metals, OCPs, PFAS and TRH in individual samples from 14 sample batches. • Some phenol and OCP compounds reported recoveries (surrogate and matrix spike) slightly above or below the limits in Eurofins batches. PFAS surrogates were sometimes reported outside the limits of 50 – 150%, however TTMP noted that, as surrogate recoveries are used to correct PFAS, these do not affect interpretation of the data.	The slightly elevated spike recoveries are not considered to affect the usability of the data. In the context of the dataset reported, the elevated RPDs are not considered significant and the laboratory quality control results are acceptable.
Data Quality Indicators (DQI) and Data Evaluation (completeness, comparability, representativeness, precision, accuracy) Predetermined data quality indicators (DQIs) were set for laboratory analyses including blanks, replicates, duplicates, laboratory control samples, matrix spikes and surrogate spikes. These were discussed with regard to the five category areas. A QA/QC narrative referred to as 'data point validation' describing information relevant to the site assessment was included in the DSI and TTMP concluded that *"This assessment concluded that the field and laboratory data collected from this investigation is of suitable quality to assess potential contamination risks from this site"*.	An assessment of the data quality with respect to the five category areas has been undertaken by the Auditor and is summarised below.

6.1 Auditor's Opinion

In considering the data as a whole, the Auditor concludes that:

- While data is likely to be representative of the overall conditions, results for volatile organics in soil samples collected from solid stem auger and open test pits may underestimate actual concentrations. Sampling and analysis for ACM was not undertaken in accordance with the current guidelines (NEPM 2013) and results may not be representative of fill conditions.
- The data is considered to be adequately complete.
- There is a high degree of confidence that data is comparable for each sampling and analytical event.
- The primary laboratory provided sufficient information to conclude that data is of sufficient precision.
- There is a high degree of confidence that the data is accurate.

7. ENVIRONMENTAL QUALITY CRITERIA

The Auditor has assessed the results against Tier 1 criteria from NEPM (2013). Other guidance has been adopted where NEPM (2013) is not applicable or criteria are not provided. Based on the proposed development (Section 2.5), criteria for a 'commercial/industrial' land use scenario were adopted.

7.1 Soil Assessment Criteria

7.1.1 Human Health Assessment Criteria

The Auditor has adopted human health assessment criteria from the following sources:

- NEPM (2013) Health Investigation Levels (HILs) for 'Commercial/Industrial' (HIL D) land use.
- NEPM (2013) Health Screening Levels (HSLs) for 'Commercial/Industrial' (HSL D) land use. The HSLs assumed a clay soil type. Depth to source adopted was <1 m as an initial screen.
- NEPM (2013) Management Limits (MLs) for petroleum hydrocarbons for 'Commercial/Industrial' land use and assuming fine soil texture. Criteria are relevant for operating sites where significant sub-surface leakage of petroleum hydrocarbons has occurred and when decommissioning industrial and commercial sites.
- NEPM (2013) HSLs for Asbestos Contamination in Soil for 'Commercial/Industrial' (HSL D) land use and the presence/absence of asbestos.
- Friebel & Nadebaum (2011) HSLs for direct contact for all land use categories, and vapour inhalation/direct contact pathways for intrusive maintenance workers.
- HEPA (2020) PFAS National Environmental Management Plan Version 2.0. Perfluorooctanesulfonic acid (PFOS)/ Perfluorohexanesulfonic acid (PFHxS) and Perfluorooctanoic acid (PFOA) soil criteria developed for 'Commercial/Industrial' land use. These criteria assumed 80% background exposure, i.e. 20% of the tolerable daily intake recommended by Food Standards Australia New Zealand (2017). The PFOS/PFHxS criteria is compared to the sum of the PFOS and PFHxS concentrations.
- USEPA Regional Screening Levels (RSLs) 'Composite Worker Soil' criteria. Online database of assessment criteria that are current as of November 2022. Soil assessment criteria derived for carcinogenic compounds were multiplied by a factor of 10 to adjust the target cancer risk level from 1:1,000,000 to 1:100,000 to be consistent with Australia's recommended target cancer risk level. For most chemicals, where a criterion was derived using both non-cancer and cancer toxicity data, the lower criteria was adopted.

7.1.2 Ecological Assessment Criteria

The Auditor has adopted ecological soil assessment criteria from the following sources:

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

- HEPA (2020) PFOS/PFHxS 'soil ecological indirect exposure' criteria and PFOA 'soil ecological direct exposure' criteria developed for all land uses.

7.1.3 Soil Aesthetic Considerations

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

7.2 Groundwater Assessment Criteria

7.2.1 Human Health Assessment Criteria

NEPM (2013) HSLs are not appropriate for assessing risks from groundwater to human health at the site due to the potential for direct contact. The Auditor has adopted human health assessment criteria from the following sources to assess risk from direct contact, inhalation and incidental ingestion:

- NHMRC (2011) *National Water Quality Management Strategy, Australian Drinking-Water Guidelines* (ADWG), Version 3.8 Updated September 2022. These criteria were multiplied by a factor of 10 to assess potential risks associated with incidental/recreational-type exposure to groundwater, however the adjustment was not applied to volatile compounds where inhalation is the primary pathway of concern.
- HEPA (2020) *PFAS National Environmental Management Plan* Version 2 for drinking water and recreational water criteria for PFOS/PFHxS and PFOA.
- USEPA RSLs Residential Tap Water Criteria. Online database of assessment criteria that are current as of November 2022. Tap water assessment criteria derived for carcinogenic compounds were multiplied by a factor of 10 to adjust the target cancer risk level from 1:1,000,000 to 1:100,000 to be consistent with Australia's recommended target cancer risk level. For some chemicals, where a criteria has been derived using both non-cancer and cancer toxicity data, the lower criteria was adopted.
- WHO (2017) *Guidelines for Drinking-water Quality, Fourth Edition, incorporating the 1st addendum*.
- WHO (2008) *Petroleum Products in Drinking-water. Background document of WHO Guidelines for Drinking-water Quality* (adopted in absence of health-based criteria in WHO (2017) because the taste and odour of petroleum products will in most cases be detectable at concentrations below those of health concern).

Site specific trigger values were developed in the HHRA for tetrachloroethene (PCE), trichloroethene (TCE), cis-1,2-dichloroethene (cis-1,2-DCE) and vinyl chloride (VC) (discussed in Section 11.8 of the SAR). The trigger values are to be applied at sentinel wells during implementation of remedial measures to ensure unacceptable exposures do not occur. These were therefore not adopted during review of site investigation analytical data.

7.2.2 Ecological Assessment Criteria

The Auditor has adopted ecological groundwater assessment criteria from the following sources:

- ANZG (2018) *Australian and New Zealand Guidelines for Fresh and Marine Water Quality.* Australian and New Zealand Governments and Australian state and territory governments, Canberra ACT, Australia (www.waterquality.gov.au/anz-guidelines). Criteria for freshwater and 95% level of protection were adopted. Where the chemical is considered to bioaccumulate, the 99% level of protection was adopted. Low and moderate reliability trigger values were also adopted for some contaminants where high-reliability trigger values don't exist.

- HEPA (2020) PFOS/PFHxS and PFOA 'freshwater' criteria developed for the protection of 99% species protection due to bioaccumulation and biomagnification in wildlife. The criteria for 95% species protection were also adopted for context.

7.3 Auditor's Opinion

The environmental quality criteria referenced by the Auditor are consistent with those adopted by TTMP with the exception of the following:

- TTMP derived site-specific EILs using the Interactive (Excel) Calculation Spreadsheet provided in the NEPM (2013) Toolbox assuming the contamination is "aged" and using site-specific pH and CEC values.
- TTMP assessed the soil data against criteria specified in Airport Environmental Protection Regulations 1997 (AEPR) and those for a future commercial/industrial land use for potential re-use within the larger Western Sydney Airport Site (FS01). These criteria were not considered by the Auditor to be relevant to the future site use.

Given the results obtained, the Auditor considers that these discrepancies do not affect the overall conclusions reached by TTMP and the Auditor.

8. EVALUATION OF SOIL RESULTS

As noted in Section 1.4, TTMP reported that previous investigations had been undertaken at the site including two contamination assessments undertaken by Cardno in 2021 and a factual contamination report prepared by a Golder-Douglas Partners joint venture in 2021. Summaries of these reports were included in the various TTMP reports and the data was tabulated and included as an appendix to the DSI. The majority of the additional reports were not provided for Auditor review and summaries by TTMP were relied on (Section 8.1). An evaluation of the soil results obtained by TTMP during the DSI and DSI Addendum have been summarised/discussed in Section 8.2.

8.1 Previous Investigations

The scope of work completed in the previous investigations was summarised by TTMP as outlined in Figure 8.1 below. The sample locations are shown in Attachments 4a to 4d, Appendix A.

Figure 8.1: Summary of the Scope of Work for Previous Investigations (Source: the DSI)

Report	Scope of Investigation Relevant to the site
Factual Contamination Report (Golder & Douglas Partners, Feb 2021)	• Thirteen boreholes (SMGW-BH-A001, SMGW-BH-A002, SMGW-BH-A002S, SMGW-BH-A004, SMGW-BH-A100 - SMGW-BH-A102, SMGW-BH-A102L, SMGW-BH-A201, SMGW-BH-A202, SMGW-BH-A251, SMGW-BH-A252 and SMGW-BH-A300) were drilled and sampled.
Contamination Assessment Report (Cardno, May 2021)	• Three boreholes (SMGW-BH-A302, SMGW-BH-A321 and SMGW-BH-A321S) were drilled and sampled. • One test pit (SMGW-TP-A302) was excavated and sampled.
Contamination Assessment Report – Phase D/E (Cardno, Nov 2021)	• Three boreholes (SMGW-BH-A360, SMGW-BH-A361 and SMGW-BH-A362) were drilled and sampled.

Fill and natural soil samples were analysed for a range of potential contaminants including:

- Fill samples - metals (27 samples), TRH, BTEX and PAHs, PFAS (22), asbestos (presence/absence) (16), PCBs (15) and phenols (6).
- Natural samples – metals (40), PFAS, TRH and BTEX (35), PAHs (34), phenols (8), PCBs (5) and asbestos (presence/absence) (2).

A tabulated summary of these results was provided by TTMP and is presented in Attachment 6a, Appendix A, for fill materials and Attachment 6b, Appendix A, for natural materials.

TTMP noted that fill materials were observed in all previous investigation intrusive locations and the depth of fill ranged between 0.2 m and 1.2 m. Fill was largely described as a brown, low plasticity sandy clay fill with roots. ACM fragments were reported in the log for BH-A321S. No other visual/olfactory signs of contamination, such as soil staining and hydrocarbon odours, were reported.

In reviewing the analytical results tabulated by TTMP, the Auditor notes the following:

- Reported concentrations of analytes (potential contaminants) in both the fill and natural materials were below the adopted commercial/industrial human health guidelines.
- Although ACM was identified in fill material at one location (BH-A321S), the presence of asbestos was not detected in the soil samples analysed.

- Trace concentrations of PFAS were reported in both fill and natural materials. Maximum concentrations of PFOS (0.0032 mg/kg) and PFOA (0.009 mg/kg) were below the adopted human health and ecological criteria.
- Elevated concentrations of metals (copper, nickel and zinc) were identified in both fill and natural soils above the most conservative ACL outlined in NEPM (2013). Elevated concentrations of arsenic were identified in two fill samples above the generic EIL for ecological receptors. TTMP did not identify these ecological exceedances as the data review did not appear to consider ecological receptors.

In addition to the above previous investigations, the Contamination Memo reported that investigations were undertaken by others at the former dry cleaner (1-7 Queen Street) including a detailed site assessment in November 2015 by Environmental Strategies (ES), a remediation action plan in June 2016 by ES and a supplementary site investigation in July 2019 by Golder-Douglas Partners. These reports were not provided to the Auditor for review, however, a summary of the chlorinated ethene concentrations in soil was tabulated in the Contamination Memo. Based on the tabulated information, TCE was detected by ES in BH1/MW1 in 2015 at depths of 0.5, 1.5 and 3 mbgl with concentrations of 37 mg/kg, 94 mg/kg and 120 mg/kg, respectively. Sample locations and concentrations of chlorinated hydrocarbons in soil and groundwater are illustrated in Attachment 7, Appendix A.

8.2 DSI and DSI Addendum Results

TTMP undertook a total of 47 boreholes and test pits during the DSI and DSI Addendum as described in Table 6.1 (shown on Attachment 4a to 4d, Appendix A). The following subsections provide a summary of the field and analytical results obtained by TTMP during the DSI and DSI Addendum. In addition, a MIP survey was completed at eight locations (MIP01 to MIP08) in the vicinity of the former dry cleaner (off-site) to depths of approximately 4 to 9 mbgl (Attachment 8, Appendix A).

8.2.1 Field Results

Investigation locations generally encountered a thin layer of fill overlying residual soils and bedrock. Minor amounts of anthropogenic material (brick and terracotta tiles) were identified in fill at three sample locations (SBT-GW-1018, SBT-GW-1019 and SBT-BH-1215). The brick fragments observed in fill at SBT-BH-1215 were considered by TTMP to be attributed to the brick pavers at the surface. Suspected ACM was noted in samples of fill collected from SBT-GW-1018 and SBT-GW-1019 directly adjacent to the former dry cleaner (off-site). No other visual/olfactory indicators of contamination (staining or odours) were noted by TTMP.

Soil headspace PID readings were typically below 3 parts of per million (ppm), indicating a low likelihood for significant VOC contamination in the sampled soils.

Key findings of the MIP survey included strong PID and halogen specific detector (XSD) signals, which indicate the presence of chlorinated hydrocarbon impact, at two locations close to the rear wall of the dry cleaner building (MIP05 and MIP06), with signal strength decreasing with distance from the building. The highest reading was reported at MIP06 at 0.95 mbgl. The survey did not identify signs of non-aqueous phase liquids (NAPL) within the strata investigated and also confirmed that there are thin lenses of higher permeability within the residual soils.

8.2.2 Analytical Results

Fill and natural soil samples were analysed for a variety of contaminants. The Auditor has assessed the results against the environmental quality criteria outlined in Section 7 as summarised in Table 8.1. Soil sampling locations are shown as Attachment 4a to 4d, Appendix A.

Table 8.1: Evaluation of Soil Analytical Results – Summary Table

Analyte	n	Detections	Maximum (mg/kg)	n > Human Health Screening Criteria	n > Terrestrial Ecological Screening Criteria
AF/FA (500 mL samples)	17	0	<PQL	0 above HSL 0.001%	-
Asbestos in soil	17	0	Not detected	0 above 0.1 g/kg	-
Asbestos trace analysis	17	0	Not Detected	-	-
Benzene	256	0	<PQL	0 above HSL D 0-1 m, clay 4 mg/kg	0 above ESL (commercial/industrial) (fine) 95 mg/kg
Toluene	256	0	<PQL	0 above HSL D 0-1 m, clay NL	0 above ESL (commercial/industrial) (fine) 135 mg/kg
Ethylbenzene	256	1	0.2	0 above HSL D 0-1 m, clay NL	0 above ESL (commercial/industrial) (fine) 185 mg/kg
Total Xylenes	256	3	1.5	0 above HSL D 0-1 m, clay NL	0 above ESL (commercial/industrial) (fine) 95 mg/kg
F1 (TRH C_6–C_{10} minus BTEX)	261	4	**413**	**1 above HSL D 0-1 m, clay 310 mg/kg**	**1 above ESL (commercial/industrial) 215 mg/kg**
F2 (TRH >C_{10}–C_{16} minus naphthalene)	261	1	100	0 above HSL D 0-1 m, clay NL	-
TRH C_6–C_{10}	261	4	413	0 above ML (commercial/industrial) 800 mg/kg	-
TRH >C_{10}–C_{16}	261	1	100	0 above ML (commercial/industrial) 1000 mg/kg	0 above ESL (commercial/industrial) 170 mg/kg
TRH >C_{16}-C_{34}	261	16	1,030	0 above ML (commercial/industrial) 5000 mg/kg	0 above ESL (commercial/industrial) 2500 mg/kg
TRH >C_{34}-C_{40}	261	11	1,510	0 above ML (commercial/industrial) 10,000 mg/kg	0 above ESL (commercial/industrial) 6600 mg/kg
Naphthalene	243	0	<PQL	0 above HSL D 0-1 m, clay NL	0 above EIL (commercial/industrial) 370 mg/kg
Benzo(a)pyrene	224	0	<PQL	-	0 above CCME 72 mg/kg
Benzo(a)pyrene TEQ	224	0	<PQL	0 above HIL D 40 mg/kg	-
Total PAHs	224	8	2.5	0 above HIL D 4000 mg/kg	-
Total Phenols	218	0	<PQL	0 above HIL D 240,000 mg/kg	-
Arsenic	301	196	102	0 above HIL D 3000 mg/kg	0 above EIL (commercial/industrial) of 160 mg/kg
Cadmium	301	13	14	0 above HIL D 900 mg/kg	-

Analyte	n	Detections	Maximum (mg/kg)	n > Human Health Screening Criteria	n > Terrestrial Ecological Screening Criteria
Chromium	301	293	110	0 above HIL D 3600 mg/kg	0 above most conservative ACL (commercial/industrial) 310 mg/kg
Copper	301	289	**228**	0 above HIL D 240,000 mg/kg	**4 above most conservative ACL (commercial/industrial) 85 mg/kg**
Lead	301	285	379	0 above HIL D 1500 mg/kg	0 above generic ACL (commercial/industrial) 1800 mg/kg
Mercury	301	29	2	0 above HIL D 730 mg/kg	-
Nickel	301	241	**160**	0 above HIL D 6000 mg/kg	**10 above most conservative ACL (commercial/industrial) 55 mg/kg**
Zinc	301	284	**1,800**	0 above HIL D 400,000 mg/kg	**28 above most conservative ACL (commercial/industrial) 110 mg/kg**
PCB	16	0	<PQL	0 above HIL D 7 mg/kg	-
OCP	121	1	0.06	0 above HIL D	0 above EIL
OPP	111	0	<PQL	0 above HIL D	-
Tetrachloroethene (PCE)	65	9	**333**	**1 above USEPA RSL 100 mg/kg**	-
Trichloroethene (TCE)	65	4	1.8	0 above USEPA RSL 6 mg/kg	-
Perfluorooctanesulfonic acid (PFOS)	288	44	**0.0197**	0 above NEMP HIL D 20 mg/kg	0 above NEMP direct exposure 1 mg/kg, **2 above NEMP indirect exposure 0.01 mg/kg**
Perfluorooctanoic acid (PFOA)	288	19	0.0008	0 above NEMP HIL D 50 mg/kg	0 above NEMP direct exposure 10 mg/kg
Perfluorohexane sulfonic acid (PFHxS)	288	3	0.0016	0 above NEMP HIL D 20 mg/kg	0 above NEMP direct exposure 1 mg/kg, 0 above NEMP indirect exposure 0.01 mg/kg

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

In reviewing the analytical results, the Auditor notes the following:

- An elevated concentration of TRH F1 was identified above the initial screening criteria adopted for human health and the adopted ecological criteria in one natural sample obtained from location SBT-GW-1019 at a depth of 2-2.1 m (adjacent the former dry cleaner). The TRH F1 concentration is below the HSL for the most applicable sample depth (NL at >2 m to <4 m) and ecological criteria are only applicable for depth <2 m.
- Elevated concentrations of metals (copper, nickel and zinc) were identified in numerous fill and natural soils samples, which were above the most conservative ACL adopted by the Auditor for ecological receptors. Following application of the TTMP site specific EILs, only zinc

exceeded the site-specific EIL (1,100 mg/kg) in the shallow fill sample SBT-GW-1019 (0.1-0.2 m) and associated duplicate sample (QC45). TTMP noted that SBT-GW-1019 was located adjacent to the former dry cleaner and likely that this off-site area will remain undisturbed and likely paved which will restrict terrestrial ecology interacting with impacted soil. As such, TTMP considered that these ecological exceedance does not require further consideration.

- Concentrations of chlorinated hydrocarbons (PCE and TCE) were detected in both fill and natural samples at two sample locations adjacent to the former dry cleaner (SBT-GW-1019 and SBT-GW-1019). Concentrations appeared to be increasing with depth with the deepest sample analysed from 2-2.1 m. TTMP noted that the depth of impact was not delineated. PCE concentrations exceeded the USPEA RSL in the SBT-GW-1019 (2-2.1 m) natural sample.
- Asbestos was not detected in the soil samples analysed, however, asbestos was assumed to be present in the fragments observed in fill at SBT-GW-1018 and SBT-GW-1019 directly adjacent to the former dry cleaner (off-site). As the material was observed from a borehole and boreholes are less conducive to identifying ACM in soil, TTMP noted that there remains some uncertainty regarding the extent of potential asbestos impacts. However, the project does not propose to disturb fill materials in this off-site area, therefore the risk associated with ACM in fill at this location was assessed by TTMP to be low.
- Trace concentrations of PFAS were reported in both fill and natural materials. Maximum concentrations of PFOS (0.0197 mg/kg) and PFOA (0.0008 mg/kg) were below the adopted human health and direct exposure ecological criteria. Concentrations of PFOS in SBT-GW-1018 (0.1-0.2 m) and duplicate sample QC46 (duplicate of primary sample SBT-GW-1019 (0.1-0.2m)) were reported above the adopted indirect ecological criteria. Concentrations reported for the underlying samples analysed were below the indirect criteria indicating that impacts may be limited to the upper fill profiles in the vicinity of the former dry cleaner.

8.3 Auditor's Opinion

The soil analytical results are consistent with the site history and field observations. The results indicate that contamination is present outside the proposed areas of excavation in the vicinity of the former dry cleaner located off-site ~100-120 m west of the station box. Contamination comprises surficial impact by metals, PFAS and asbestos, and deeper impact by TRH and chlorinated hydrocarbons. Development works are not proposed at the former dry cleaner, therefore further assessment or management of surficial contamination is not required.

Elevated concentrations of TRH and chlorinated hydrocarbons identified in deeper soil at the former dry cleaners (outside the proposed area of excavation) may pose unacceptable risks to future site users and subsurface construction workers as a result of migration of contamination in groundwater during dewatering of excavations. A HHRA (discussed in Section 11) was prepared to assess the potential health risk to workers in the tunnel and station. The RAP (discussed in Section 12) was prepared to mitigate potentially unacceptable risks.

The assessment of asbestos was not undertaken in accordance with NEPM (2013) and there is potential to encounter fill materials containing asbestos during construction. The RAP includes measures/management actions to ensure any contamination identified (including asbestos) during the works are dealt with appropriately to minimise risks to human health and the environment. A competent person should also be present during disturbance of topsoil/fill materials to visually monitor for signs of potential contamination and potential asbestos.

9. EVALUATION OF GROUNDWATER RESULTS

As noted in Section 1.4, TTMP reported that previous investigations had been undertaken at the site including two contamination assessments undertaken by Cardno in 2021 and a factual contamination report prepared by a Golder-Douglas Partners joint venture in 2021. Summaries of these reports were included in the various TTMP reports and the data was tabulated and included as an appendix to the DSI. The majority of the additional reports were not provided for Auditor review and summaries of the previous investigation data have been relied on (Section 9.1). An evaluation of the groundwater results obtained by TTMP during the DSI and Groundwater DSI Addendum is discussed in Section 9.2.

9.1 Previous Investigations

TTMP reported that the previous groundwater monitoring well network comprised eight monitoring wells and six vibrating wire piezometers. Groundwater sampling was undertaken at select wells during the previous investigations and included sampling from SMGW-BH-A202, SMGW-BH-A302, SMGW-BH-A102, SMGW-BH-A002, SMGW-BH-A321, SMGW-BH-A321S and SMGW-BH-A103. The previous groundwater sample locations are shown in Attachment 4d, Appendix A.

Groundwater samples were analysed for a range of contaminants and a tabulated summary of these results was provided by TTMP in the DSI, reproduced as Attachment 9, Appendix A.

In reviewing the analytical results tabulated by TTMP, the Auditor notes the following:

- Elevated concentrations of heavy metals and ammonia were detected in numerous wells above the adopted freshwater ecological criteria.
- Minor concentrations of petroleum hydrocarbons, PAHs, OCPs and PFAS were detected, however at concentrations generally below the adopted criteria. Elevated concentrations of PFOS were detected at four well locations (A321S, A321, A002 and A102) above the HEPA (2020) 99% species protection freshwater criteria.

In addition to the above previous investigations, the Contamination Memo reported that additional investigations have been undertaken by others at the former dry cleaner (1-7 Queen Street), including a detailed site assessment in November 2015 by ES, a remediation action plan in June 2016 by ES and a supplementary site investigation in July 2019 by Golder-Douglas Partners. These reports were not provided to the Auditor for review, however, a summary of these findings was provided in the Contamination Memo and DSI. Sample locations along with concentrations of chlorinated data for soil and groundwater is illustrated in Attachment 7, Appendix A.

In reviewing the additional data summarised in the Contamination Memo and the DSI, the Auditor notes the following:

- Chlorinated hydrocarbons were detected in MW1/BH1, MW2/BH2 and EW1 during monitoring in 2015 and 2019. The PCE concentrations reported at MW1 (13,000 µg/L in 2015 and 3,290 µg/L in 2019) and MW2 (3,100 µg/L in 2015 and 1,960 µg/L in 2019) exceeded the adopted freshwater ecosystems and human health criteria. TCE was also detected in these wells.
- The reported concentrations indicate that PCE may be present as a dense non-aqueous phase liquid (DNAPL) as well as dissolved phase.

In addition to groundwater results, the DSI summary noted that the presence of PCE was confirmed in both soil and soil vapour samples. One or more soil vapour samples also exceeded the health investigation levels for commercial/industrial land use (HIL-D, NEPM (2013)) for PCE breakdown products TCE, cis-1,2-DCE and VC.

9.2 DSI and Groundwater DSI Addendum Results

TTMP undertook groundwater sampling from 15 new and four existing monitoring wells between July 2022 and October 2022 as described in Table 6.1. The following sub-sections provide a summary of the field and analytical results obtained by TTMP during the DSI and Groundwater DSI Addendum, including data which was collected from the former dry cleaner area (1-7 Queen Street) located off-site.

9.2.1 Field Results

TTMP reported that groundwater levels ranged between approximately 1.54 and 8.43 mbgl and reported the water level range between approximately 30 mAHD and 40 mAHD.

Groundwater field parameters were recorded as follows:

- Dissolved oxygen (DO): 0.5 mg/L and 4.99 mg/L;
- Electrical conductivity (EC): 580 µS/cm and 49,241 µS/cm;
- pH: 4.54 pH units and 8.29 pH units;
- Redox potential (eH): -242.1 and 284.77 (Ag/AgCL 3.5M); and
- Temperature: 13.4°C and 22.8°C.

TTMP noted that EC ranged from fresh to brackish/saline water and that variations were potentially attributed to freshwater recharge (i.e. in response to rain) and/or leakage from water pipes.

The DSI reported groundwater samples collected from GW01, SBT-GW-1232, SMGW-BH-A302 and A321S had a mild sulfur odour and hydrocarbon odours were observed in BH1/MW1 and SBT-GW-1018. NAPL was not reported in the monitoring wells. No odours and/or NAPL were reported in the Groundwater DSI Addendum.

9.2.2 Analytical Results

Groundwater was sampled over numerous sampling events and analysed for a variety of contaminants. The Auditor has assessed the results against the environmental quality criteria outlined in Section 7 as summarised in Table 9.1. Groundwater sampling locations are shown as Attachment 4d, Appendix A.

Table 9.1: Summary of DSI and Groundwater DSI Addendum Analytical Results (µg/L)

Analyte	n	Detections	Maximum	n > Health Screening Criteria	n > ANZG (2018) Freshwater DGV
TRH C_6-C_{10} less BTEX (F1)	51	15	**26,400**	**4 above WHO (2017) of 15,000[a]**	-
TRH >C_{10}-C_{16} less naphthalene (F2)	51	14	**720**	**3 above WHO (2017) of 300[a]**	-
TRH >C_{16}-C_{34}	51	8	620	0 above WHO (2017) of 3,000	-
TRH >C_{34}-C_{40}	51	0	<PQL	-	-
Benzene	51	4	**2**	**3 above ADWG of 1**	0 above DGV of 950
Toluene	51	2	7	0 above ADWG of 800	0 above DGV of 180
Ethylbenzene	51	0	<PQL	0 above ADWG of 300	0 above DGV of 80

Analyte	n	Detections	Maximum	n > Health Screening Criteria	n > ANZG (2018) Freshwater DGV
Xylenes	51	2	6	0 above ADWG of 600	0 above DGV of 75
Naphthalene	51	1	3	0 above USEPA RSL of 6.1	0 above DGV of 16
Benzo(a)pyrene	51	0	<PQL	-	0 above DGV of 0.01
Anthracene	51	0	<PQL	-	0 above DGV of 0.01
Fluoranthene	51	0	<PQL	-	0 above DGV of 1
Phenanthrene	51	0	<PQL	-	0 above DGV of 0.6
Pentachlorophenol	51	0	<PQL	0 above ADWG of 10	-
Arsenic	51	27	**26**	0 above ADWG of 100	**2 above DGV of 24**
Cadmium	51	17	**2.2**	0 above ADWG of 20	**13 above DGV of 0.2**
Chromium	51	15	**24**	0 above ADWG of 500	**15 above DGV of 1.0**
Copper	51	22	**3,080**	0 above ADWG of 20,000	**19 above DGV of 1.4**
Lead	51	15	**45**	0 above ADWG of 100	**8 above DGV of 3.4**
Mercury	51	0	<PQL	0 above ADWG of 10	0 above DGV of 0.06*
Nickel	51	50	**139**	0 above ADWG of 200	**39 above DGV of 11**
Zinc	51	39	**236**	0 above ADWG of 30,000	**34 above DGV of 8**
Ammonia	42	31	**42,500**	-	**10 above DGV of 900**
OCP	51	0	<PQL	0 above ADWG	0 above DGV
OPP	51	0	<PQL	0 above ADWG	0 above DGV
Tetrachloroethene (PCE)	51	8	**24,500**	**8 above ADWG of 50**	-
Trichloroethene (TCE)	51	13	**102**	**10 above WHO (2017) of 20**	-
cis-1,2-dichloroethene	51	11	**4,220**	**11 above ADWG of 60**	-
1,1-dichloroethene	51	3	11	0 above ADWG of 30	-
1,1,2-trichloroethane	51	0	<PQL	0 above USEPA RSL of 0.28	0 above DGV of 6500
Vinyl chloride	51	8	**300**	**8 above ADWG of 0.3**	-
Chloroform	51	1	6	0 above ADWG of 250	0 above DGV of 370*
Bromodichloromethane	51	0	<PQL	0 above ADWG of 250	-

Analyte	n	Detections	Maximum	n > Health Screening Criteria	n > ANZG (2018) Freshwater DGV
Perfluorooctanesulfonic acid (PFOS)	52	41	**1.07**	-	**41 above HEPA (2020) 99% of 0.00023*** 0 above HEPA (2020) 95% of 0.13
Perfluorooctanoic acid (PFOA)	52	42	0.362	0 above HEPA (2020) of 0.56	0 above HEPA (2020) 99% of 19 or 95% of 220
Sum of PFOS and PFHxS	52	43	**1.07**	**11 above HEPA (2020) of 0.07**	-

n number of samples
- No criteria available/used
<PQL Less than the practical quantitation limit
NL non limiting
* 99% Species protection to account for bioaccumulation
a WHO (2017) assessment criteria for TPH aliphatic fraction

In assessing the analytical results, the Auditor makes the following observations:

- Metals were generally reported at background levels with the exception of arsenic, nickel and zinc. Significant metal contamination was not identified in the soils sampled and TTMP attributed the concentrations detected in groundwater to a combination of natural and/or diffuse urban/industrial area sources.
- Elevated concentrations of TRH F1 were identified above the WHO (2017) human health criteria during two monitoring events (July and August) at SBT-GW-1018 (vicinity of former dry cleaner). Elevated concentrations of TRH F2 were also identified above the WHO (2017) human health criteria during the 17 August 2022 at SBT-GW-1019 (vicinity of former dry cleaner), the 4 August 2022 sampling event at SBT-GW-1232 and 21 October 2022 sampling event at SBT-GW-1017. Subsequent sampling events also detected concentrations of TRH F2 below the adopted criteria. Detections of hydrocarbons were reported in other sample locations in the vicinity of SBT-GW-1232 in the vicinity of a potential former UST. TMP noted that review of the chromatograms by the laboratory advised that the source of detections in SBT-GW-1232 was carbocyclic acid which can be naturally occurring or anthropogenic in origin. A low concentration of toluene was also reported in SBT-GW-1232. SBT-GW-1017 is located offsite near a former garage and potential service station with low concentrations marginally above the ADWG criteria reported during the two sampling events in October 2022. Concentrations of benzene were reported as <PQL in the vicinity of the former dry cleaner, however, it is noted that the PQL was raised and greater than the adopted human health criteria (ADWG).
- Elevated concentrations of chlorinated hydrocarbons (mainly TCE and PCE) were reported above the adopted human health criteria in the majority of wells located in the vicinity of the former dry cleaner (1-7 Queen Street). The highest concentration of PCE was reported at SBT-GW-1018 while the highest concentration of TCE was reported at BH1/MW1.
- Elevated concentrations of PFHxS + PFOS were identified above the adopted human health criteria at SBT-GW-1021 during three sampling events. Elevated concentrations were also identified in the vicinity of the former dry cleaner at locations BH1/MW1 (between 2 and 6 mbgl), GW02 (2 mbgl) and SBT-BH-1019 (15.4 and 17.4 mbgl). Elevated concentrations of PFOS were also identified in the majority of the wells above the HEPA (2020) 99% species protection freshwater criteria. The highest concentration of PFOS was identified at GW02 at a depth of 2 mbgl, located in the vicinity of the former dry cleaner.

- Elevated concentrations of ammonia above the 95% freshwater DGV for ecological receptors were identified at SBT-GW-1021 and SBT-GW-1234. TTMP noted sulfurous odours in several wells and that ammonia could be derived from biological process and leakage from a sewer. Ammonia may have also been used historically at the dry cleaners but was considered by TTMP unlikely to be the cause of ammonia reported in groundwater. Elevated concentrations of ammonia were reported in the vicinity of the former dry cleaner at SBT-GW-1019.

9.3 Auditor's Opinion

In the Auditor's opinion, the groundwater analytical results indicate that groundwater at the site has been impacted from historical onsite and off-site land uses. Groundwater in off-site areas (former dry cleaner) is impacted by hydrocarbons, volatile chlorinated hydrocarbons and PFAS. Dewatering activities have the potential to alter groundwater flow and there is potential for the identified offsite impacts to migrate towards the station box excavation and present potential risks to construction workers during station box excavation. Remediation/mitigation measures to be implemented during dewatering to prevent the migration of contaminants to the station box excavation are presented in the RAP (discussed in Section 12).

10. EVALUATION OF CONCEPTUAL SITE MODEL

A conceptual site model (CSM) is a representation of the contaminant source, pathway and receptor (SPR) linkages at a site. TTMP developed a CSM and used it iteratively throughout the site assessment to inform decisions around investigation and management requirements. The CSM was initially developed following the preliminary investigations and has been updated as new information became available. Table 10.1 provides the Auditor's review of the CSM used by TTMP in the DSI to inform the Groundwater DSI Addendum investigations and remediation/ management requirements.

Table 10.1: Review of the Conceptual Site Model

Element of CSM	Consultant	Auditor Opinion
Contaminant source and mechanism	The following sources of contamination were identified for further consideration: • Suspected ACM in fill material at sampling locations SBT-GW-1018 and SBT-GW-1019, located off-site. • Former dry cleaning activities located off-site at 1-7 Queen Street. Elevated concentrations of PCE recorded in soil and groundwater. Elevated concentrations of ammonia and PFAS have also been identified • PFAS detected in groundwater samples above human health and ecological criteria. • Potential sources of hydrocarbons near SBT-GW-1232, SBT-GW-1234 and SMGW-BH-A321 which is to be further investigated through supplementary groundwater sampling and analysis	The identified potential sources of contamination and mechanism(s) of contamination are considered appropriate. The Auditor notes that other chlorinated hydrocarbons (TCE, cis-1,2-DCE and VC) were identified in soil and groundwater at the former dry cleaner. The Auditor notes that further investigation of the potential hydrocarbon sources near SBT-GW-1232, SBT-GW-1234, and SMGW-BH-A321 was undertaken during the Groundwater DSI Addendum. The DSI concluded there is a potential minor source of hydrocarbons in groundwater (and potentially soil) which may require management during construction and the additional data obtained for the Groundwater DSI Addendum supports this conclusion. TTMP considered that any potential minor source of hydrocarbon contamination in soil (if present) can be managed by the RAP.
Affected media	Soil, groundwater and vapour	The affected and potentially affected media have been adequately identified.
Receptor identification	The following receptors were considered relevant to the sources of contamination identified: • Workers involved with the site construction work and maintenance of the rail infrastructure • General public including persons who could be subject to contaminated media generated during/following redevelopment, including those accessing the station • Ecological receptors including terrestrial flora and fauna • Groundwater and surface water receptors.	The receptors have been adequately identified.
Exposure pathways	The asbestos impacted fill currently remains beneath ground surface materials which will limit the potential for exposure.	Exposure pathways were not specified for asbestos, however, the area is off-site and will remain undisturbed therefore exposure to asbestos by inhalation of fibres/dust is not

Element of CSM	Consultant	Auditor Opinion
	Occupants of existing structures on 1-7 Queen Street: Vapour ingress/indoor inhalation pathway. Impacted groundwater has the potential to be drawn into the station box during construction. Vertical migration of impacted groundwater and DNAPL has the potential to enter the tunnel dive immediately west of the station box. Both contaminant transport mechanisms have the potential to introduce impacted water within an enclosed environment, potentially posing health risks to subsurface construction workers via the vapour inhalation pathway.	considered relevant to the site. Remaining exposure pathways outlined in the CSM were adequately identified.
Presence of preferential pathways for contaminant movement	Not explicitly discussed, however, impacted groundwater has the potential to be drawn into the station box and tunnel during construction. Preferential pathways for migration were not identified.	Although not explicitly discussed the identified potential pathways are adequate.
Potentially complete SPR linkages requiring remediation or management	TTMP considered that there is a potentially complete exposure pathway in relation to chlorinated hydrocarbons in soil and in groundwater at the former dry cleaner. Elevated concentrations of PFAS and ammonia have also been reported at this site. The contamination requires management during dewatering of the station box.	The identified potential complete SPR linkages requiring remediation/ management are adequate. The Auditor notes that a site-specific risk assessment was conducted for the former dry cleaner.
Evaluation of data gaps	Due to the method adopted for the assessment of asbestos in soils, the DSI recommended that a competent person be present during disturbance of topsoil/fill materials to visually monitor for signs of potential contamination and potential ACM. The DSI also recommended a site-specific risk assessment for the former dry cleaner and an additional groundwater assessment for wells which were not captured in the DSI and for further assessment of the hydrocarbons detected at the site.	Additional groundwater assessment has been undertaken with results presented in the Groundwater DSI Addendum. The site-specific risk assessment has been undertaken and is reviewed in Section 11.

10.1 Auditor's Opinion

The CSM developed is considered an adequate basis for assessing remedial requirements.

11. ASSESSMENT OF RISK

The HHRA assessed potential health risks to workers in the tunnel and station associated with exposure to chlorinated hydrocarbon impacts in soil and groundwater from the former dry cleaner located off-site at 1-7 Queen Street. The HHRA also considered community impact through odorous vapours associated with the identified impacts.

The site was previously used for dry cleaning purposes and is currently not operational. The site is listed in the register of NSW Contaminated Sites Notified to NSW EPA. Previous investigations confirmed chlorinated hydrocarbon impacts in soil and groundwater, with the suspected source area located directly on the tunnel alignment and approximately 100-120 m west of the station box excavation.

11.1 Objective of HHRA

The HHRA was used to inform the site RAP prepared for the SBT works at St Marys. The purpose of the HHRA was to assess whether the contamination could pose a potentially unacceptable risk to worker health. Objectives of the overall assessment were to:

- *"Laterally and vertically assess the extent of chlorinated hydrocarbon impact in soil and groundwater at the rear of 5 Queen St, St Marys;*
- *Refine the range of hydraulic conductivity in residual soils in the vicinity of the source area, and between the source and the future station excavation;*
- *Review the preliminary analytical groundwater model developed in tender based on site-specific hydraulic conductivity data and a reasonable estimate of aquifer porosity;*
- *Assess potential vapour intrusion risk to the station and worker health during tunnel construction; and*
- *Outline mitigation options to reduce potential adverse risk associated with mobilisation of chlorinated hydrocarbon impact in groundwater due to construction activities."*

The scope of works relating to the HHRA included:

- HHRA to consider potential vapour intrusion risk to station workers (based on modelled groundwater concentrations) and worker health during tunnel construction.
- Preparation of a report on the above including a refined CSM, model results, HHRA, and options for mitigation (if required).

11.2 Issue Identification and Data Assessment

11.2.1 MIP Investigations

MIP results were used as a line of evidence that significant chlorinated hydrocarbon impact was present, and impact is greatest close to the building in the vicinity of existing shallow well MW1. Additional soil and groundwater investigations were carried out based on MIP results.

11.2.2 Soil

Previously available soil data indicated there was the potential for pure PCE (DNAPL) to be present beneath the dry cleaner (based on soil results from MW1 and MW2). The report further stated that groundwater well SBT-GW-1019R (replacement well for SBT-GW-1019) was not installed in the optimum location due to access constraints; including existing monitoring wells, and therefore soil chlorinated hydrocarbon concentrations may not represent the maximum present at tunnel depth.

The report provides a summary of soil chlorinated ethene concentrations reported in the vicinity of the dry cleaner, in Table 2 of the HHRA report.

11.2.3 Groundwater

Groundwater flow is expected to be west to north-westerly and any existing groundwater impact from the former dry cleaner was inferred to currently migrate to the west or northwest.

Groundwater at 1-7 Queen Street was historically reported between 2 to 4 mbgl, although fresher shallow groundwater (<1 mbgl) was reported in MW1 during sampling in July and August 2022.

11.2.4 Groundwater Contamination

Section 4.3.2 of the HHRA report provides a summary of chlorinated ethene concentrations in monitoring wells in the vicinity of the former dry cleaner.

In the suspected source area, vertical delineation sampling results indicate PCE groundwater concentrations in the order of 9 mg/L to 24 mg/L present at the top of the tunnel. However, at tunnel depth PCE concentrations in groundwater may be one or two orders of magnitude less, although this area may not represent location of maximum impact.

The composition of chlorinated hydrocarbons in shallow groundwater in the source area (MW1) has changed since 2019 from predominantly PCE to breakdown products cis-1,2-DCE and vinyl chloride. Shallow groundwater is likely to be impacted by sewer leakage as it contains high concentrations of ammonia and organics.

Hydraulic conductivity testing showed that residual soils in the vicinity of the chlorinated hydrocarbon impact ranged from 1.2×10^{-8} m/s to 3×10^{-6} m/s. The testing indicates that impacted groundwater drawn toward the excavation as a result of dewatering is likely to predominantly flow in the residual soils, which appear to be of high permeability along this flow path.

The report also includes findings of a groundwater travel model. The travel time model indicates that groundwater from the source area may reach the station box in less than six months based on the upper case, and approximately seven months based on the reasonable case from commencement of dewatering of the station box excavation.

Auditor's opinion

The Auditor's view is that soil and groundwater contamination was adequately characterised for the assessment of human health risks.

11.3 Conceptual Site Model

The main source of chlorinated hydrocarbon contamination was identified as the former dry-cleaning operations. The contaminants of potential concern (CoPCs) identified were PCE, TCE, cis-1,2-DCE and VC.

The primary transport mechanisms for CoPCs were identified as:

- Downward migration of impact through soil profile;
- Leaching of soil impact (where present) into groundwater;
- Groundwater transport of dissolved phase contaminants with regional groundwater flow or driven by dewatering;
- Vapour migration from soil and/or groundwater for volatile contamination;
- Seepage of groundwater into the tunnel and station box excavation; and
- Volatilisation into the tunnel and station box air space.

The scope of the HHRA was limited to workers involved in the construction of the tunnel and station boxes, and included:

- Workers within the tunnel either in the TBM or cross passages;
- Workers within the station box excavation; and
- Workers managing spoil stockpiles from the tunnelling works at the surface.

The report also identifies additional receptors not within the scope of the HHRA.

The main exposure routes identified were:

- Inhalation of volatile contaminants emitted into indoor air, outdoor air and enclosed spaces (such as the tunnel and station box air spaces);
- Dermal contact with impacted water as a result of groundwater seepage into an unlined tunnel or station box structure; or
- Dermal contact with impacted slurry / spoil during construction activities.

The exposure pathways considered for specific workers were:

- TBM Workers – workers may be exposed to vapours emitted from spoil paste that exits the TBM screw conveyor and travels along the conveyor to the surface. This includes workers within the shield tail or further up the tunnel.
- Workers managing spoil – vapour inhalation and/or direct contact with spoil stockpile.
- Station box excavation workers – if contamination reaches excavation, then construction workers may get directly exposed and/or inhale volatile contaminants from groundwater.

Auditor's opinion

The Auditor's view is that the CSM presented in the HHRA was well defined and included relevant contaminant transport pathways and routes of exposure.

11.4 Exposure Assessment

The exposure scenarios assessed in the report are shown in Table 11.1.

Table 11.1: Exposure scenarios assessed in the HHRA report

Receptor	Point of Exposure	Impact Media	Exposure Pathway			
			Vapour inhalation	Dermal contact	Dust inhalation	Accidental ingestion
Tunnel workers	TBM and cross passage	Spoil paste	√	X	X	X
Spoil workers	Spoil stockpiles	Spoil pastes	√	√	√	√
Station box workers	Station box excavation	Groundwater	√	√	X	X

Auditor's opinion

The Auditor agrees with the exposure scenario presented in the HHRA and notes the following:

- Dermal and ingestion were not relevant exposure pathways for tunnel workers due to the TBM eliminating these pathways. Dust inhalation for spoil paste is expected to be minimal.
- Accidental ingestion of groundwater by station box workers was not considered to be a complete exposure pathway given that dewatering will be occurring during construction. Dust inhalation is not relevant for groundwater impact.

11.4.1 Soil Concentrations

As the TBM progresses through the plume area, impacted soil and water from across the entire cutterhead will be mixed with bentonite in the excavation chamber before being drawn through the screw conveyor and the open conveyor. Sufficient bentonite is expected to be added to ensure the mixture is a paste and not a mix of paste/water.

Given the limited sampling of soil and water within the tunnel alignment, the following assumptions were made:

- Approximately 30% of the cross section of the tunnel may contain impacted material;
- DNAPL may be present within soil at the upper portion of the tunnel alignment;
- The maximum concentrations identified in soil were used to represent the impacted material:
  - PCE: 333 mg/kg
  - TCE: 1.8 mg/kg
- No allowance was made for dilution with bentonite;
- cis-1,2-DCE and VC are not indicated to be present at the depth of the tunnel and have only been reported within shallower groundwater where it is suspected sewer is providing a carbon source that is stimulating breakdown of PCE and TCE.

11.4.2 Groundwater Concentrations

Dewatering of groundwater is expected to occur for the station box excavation and based on groundwater modelling, impacts could reach the edge of the excavation within 6-10 months.

Groundwater source concentrations were adopted based on maximum measured concentrations:

- PCE – 25 mg/L
- TCE – 0.10 mg/L
- Cis-1,2-DCE – 4.2 mg/L
- VC – 0.32 mg/L

11.4.3 Exposure point concentrations

Tunnel

Exposure concentrations in the tunnel were modelled by assuming complete volatilisation from a limited source. The assumed complete volatilisation of impact from a concentration above C_{sat} was considered to be highly conservative and protective of vapour risk from both soil and groundwater sources. The following tunnel air concentrations were calculated (Appendix 8 of the HHRA report):

- PCE – 54 mg/m^3
- TCE – 0.29 mg/m^3

Station box excavation

- For direct contact exposure, the source concentrations for groundwater were adopted as the exposure point concentrations.
- Vapour emissions from impacted groundwater into deep excavation was determined using Guo & Roache (2003) approach, as provided in Appendix 9 of the HHRA report. The following air concentrations were calculated:
  - PCE – 0.26 mg/m^3
  - TCE – 0.001 mg/m^3

- Cis-1,2-DCE – 0.045 mg/m^3
- VC – 0.004 mg/m^3

Spoil Workers

- Direct contact soil exposure concentration was determined by multiplying source soil concentrations by a factor of 0.3, based on an assumption of 30% of the cross section of the tunnel containing impacted material.
- Vapour emissions from the stockpile was estimated using Johnson and Ettinger (1991) model, as provided in Appendix 10 of the HHRA report:
  - PCE – 6.4 mg/m^3
  - TCE – 0.034 mg/m^3

Auditor's opinion

The Auditor considers that the approaches used to determine exposure point concentrations are appropriate and sufficiently conservative to assess potential exposure risks. Maximum available concentrations were used for modelling and input parameters to the model are considered relevant.

11.4.4 Exposure Parameters

The exposure parameters adopted in the HHRA report are presented in Table 11.2.

Table 11.2: Exposure parameters adopted in the HHRA Report

Exposure Parameters [units]	Value	Auditor's Opinion
Tunnel Workers		
Exposure duration [years]	1	Acceptable based on tunnelling time
Exposure frequency [days/year]	2	EF of 2 days is acceptable based on time to tunnel through plume at an assumed speed of 120 m/week and a plume length of 35 m. It is noted that no safety factor has been allowed for delays, but a conservative plume length has been used for calculation
Exposure time [hours/day]	10.5	Acceptable based on a 12-hour day with 1.5 hours of break
Averaging time [days and hours]	365 25,550	Acceptable
Station Box Worker		
Exposure duration [years]	3	Acceptable based on time to completion of station
Vapour Exposure frequency [days/year]	240	Acceptable – standard work days/hours
Dermal Exposure frequency [days/year]	40	Acceptable based on potential time workers may be in contact with exposed walls and sumps.
Vapour Exposure time [hours/day]	8	Acceptable – standard workday

Exposure Parameters [units]	Value	Auditor's Opinion
Dermal Exposure time [hours/day]	4	Acceptable based on reasonable assumption of half a day working in wet areas
Exposed skin area [cm^2]	6,300	Acceptable as per NEPM (NEPC, 2013)
Averaging time [days and hours]	1,095 25,550	Acceptable
Spoil Worker		
Exposure duration [years]	1	Acceptable based on tunnelling time
Exposure frequency [days/year]	10	Acceptable based on an assumption of 5 day/week for 2 weeks working around stockpile
Exposure time [hours/day]	8	Acceptable – standard workday
Exposed skin area [cm^2]	6,300	Acceptable as per NEPM (NEPC, 2013)
Soil ingestion rate [mg/day]	330	Acceptable based on typical soil intake considered for construction Workers (USEPA, 2002)
Particle Emission [m^3/kg]	4.4×10^8	Acceptable based on USEPA, 2002
Particulate retention [unitless]	0.375	Acceptable as per NEPM (NEPC, 2013)
Soil Adherence [mg/cm^2]	0.9	Acceptable, 95th percentile value for utility workers as per enHealth (2012)
Averaging time [days and hours]	365 25,550	Acceptable

11.5 Toxicological Information

A summary of the toxicity values is provided in Table 6 and 7 of the HHRA. The contaminants of concerns were assessed under threshold assumptions, while TCE and VC were also assessed under non-threshold assumptions (potential carcinogens).

Auditor's opinion

The Auditor considered that the toxicity values adopted from various sources was acceptable and consistent with values normally adopted for these CoPCs in Australia. Non-threshold assumptions for TCE and VC were also considered acceptable.

11.5.1 Background for threshold risks

The HHRA considered the following background exposure:

- TCE – 10% of the RfC for inhalation exposure and 10% of the oral/dermal tolerable intake for direct contact
- PCE – 10% of the RfC for inhalation exposure and none for direct contact
- Cis-1,2-DCE – none for inhalation and direct contact exposure
- VC – none for direct contact exposures
- Background intake for remaining COPCs were not considered to be present.

Auditor's opinion

The background exposure contributions are considered reasonable.

11.6 Acceptable Levels of Risk

The HHRA considered the following risk targets:

- For threshold effects:
  - Hazard quotient – HQ > 1 indicates potentially unacceptable chemical intakes for individual COPCs
  - Hazard index – the HHRA states that "*Where HI is less than 1, there is unlikely to be any adverse health effects associated with exposure to the chemicals of concern. However, a HI exceeding 1 does not necessarily indicate an actual risk but rather a potential adverse health outcome requiring additional assessment"*.
- For non-threshold (carcinogenic) effects – 1 x 10^{-5} was considered to be an *"acceptable"* non-threshold risk in this assessment.

Auditor's opinion

The Auditor considers that the acceptable levels of risk defined in the HHRA are reasonable and consistent with Australian guidance for risk assessment.

11.7 Risk Characterisation

11.7.1 Occupational Exposure Risks

The HHRA compared modelled air concentrations against Safe Work Australia Workplace Exposure Standards for Airborne Contaminants. Modelled air concentrations in contaminated zone tunnel air, station excavation air and contaminated zone spoil stockpile air were compared against the time weighted average (TWA). No exceedances of the TWA values were found.

Auditor's opinion

The Auditor notes that section 6.5.1 of the HHRA is for assessment of Acute Risks, although the TWA values are used for this assessment. The TWA values are for an eight-hour period and are generally designed to provide long term protection. For example, the TWA value for TCE of 54 mg/m^3 is designed to protect for effects on the central nervous system (CNS), renal (kidney) toxicity and cancer (chronic effects), while the short-term exposure limit (STEL) of 216 mg/m^3 is designed to protect against acute effects on the CNS (Safe Work Australia 2020). Hence, the STEL values would have provided better approximation for protection of acute effects. The Auditor notes that STEL values are normally higher than TWA values, therefore any conclusions relating to acute effects is conservative.

11.7.2 Non-Carcinogenic Health Risk

Non-carcinogenic health risks were assessed by calculating hazard quotients (HQ) and hazard indices (HI) for different CoPCs and exposure pathways against a target of 1. A summary of total HI values for different receptors and exposure pathways are provided in Table 11.3.

Table 11.3: Summary of HI for different receptors

Receptors	Vapour Inhalation	Direct Contact	Total HI
Tunnel worker	1.1	-	1
Station box worker	1.8	1.8	4
Spoil worker	0.5	6.7 x 10^{-4}	0.5

Auditor's opinion

The Auditor agrees with the findings of the non-carcinogenic risk assessment.

11.7.3 Carcinogenic Health Risks

Carcinogenic health risks were assessed for carcinogenic CoPCs by calculating the incremental lifetime cancer risk (ILCR) against a target of 1 in 100,000. A summary of the ILCR is provided in Table 11.4.

Table 11.4: Summary of ILCR for different receptors

Receptors	Vapour Inhalation	Direct Contact	Total ILCR
Tunnel worker	4×10^{-8}	-	4×10^{-8}
Station box worker	2×10^{-7}	2.5×10^{-6}	3×10^{-6}
Spoil worker	1.8×10^{-8}	6.9×10^{-11}	2×10^{-8}

Auditor's opinion

The Auditor agrees with the findings of the carcinogenic risk assessment. The Auditor notes that the total ILCR value may not be accurate based on check calculations, however the minor differences do not change the risk conclusions.

11.8 Trigger Values

The HHRA derives trigger values to be applied at sentinel wells during implementation of remedial measures to ensure unacceptable exposures do not take place (shown in Table 11.5). The trigger values are either based on health-based risk calculations (presented in Appendix 13 of the HHRA) or odour threshold, whichever is lower. Trigger values based on health-based approach were divided by 4 to proportion risks between the four CoPCs, in case all of the four CoPCs were present.

Table 11.5: Trigger Values Adopted for Application to Sentinel Wells

CoPC	Units	Health-based Criteria	Odour Threshold	Adopted Trigger Value
PCE	mg/L	12	0.3	0.3
TCE	mg/L	0.22	0.31	0.055
Cis-1,2-DCE	mg/L	1	0.26	0.25
VC	mg/L	0.8	3.4	0.2

Auditor's opinion

The Auditor has reviewed the approach taken to derive the trigger values and is generally in agreement with the approach. While the risks could be proportioned based on existing source concentrations or contribution by each CoPC to overall risk, division by an arbitrary value is considered acceptable given that source proportions may not reflect proportions reaching sentinel wells and the station box. Continued degradation may also alter concentrations and hence change proportions overtime. The Auditor also considered that the trigger values are designed as an early warning prior to contaminants reaching the station box excavation.

11.9 Overall Assessment

The HHRA concludes that there may potentially be some exposure risks to tunnel workers and station box workers, while no exposure risks are predicted for spoil workers. The HHRA report did not assess risks to public but expects inhalation exposure risks to be low and acceptable, based on assessment of risks to workers. For receptors potentially at risk, the HHRA notes the following:

- Tunnel workers:
  - there may be unacceptable inhalation risks either working within the TBM or cross-passage behind the TBM
  - there may be odour issues due to PCE air concentrations
- Station box workers:
  - Chlorinated hydrocarbon impacted groundwater may be drawn towards the station excavation in approximately 5.5 to 9 months after commencement of dewatering
  - there may be unacceptable inhalation and direct contact risks

For tunnel workers, the HHRA recommends having an air monitoring program during the time that the TBM passes through the impacted areas to assess CoPC concentrations against pre-determined trigger levels. The program would identify the need for implementation of required protective measures should unacceptable concentrations be detected. A similar program of monitoring is also recommended for protection of station box workers. The program will be designed to provide early warning and allow for mitigation to be implemented to prevent high concentrations reaching the station box.

Overall, the conclusions of the updated HHRA are supported. The conclusions are dependent on soil and groundwater concentration data collected so far and a number of site and receptor specific assumptions. The report has discussed uncertainties associated with adopted parameters including associated sensitivities towards risk determinations. Where data or information was lacking, conservative assumptions have been adopted. Where unacceptable risks were identified, the HHRA report recommended mitigation and monitoring measures to prevent unacceptable exposures. Details of the measures are provided in the RAP, which is reviewed in Section 12.

11.10 References

Guo Z and Roache NF, 2003. Overall Mass Transfer Coefficient for Pollutant Emissions from Small Water Pools under Simulated Indoor Environmental Conditions. Annuals of Occupational Hygiene 47(4): 279-286

NEPM (2013) National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended on 16 May 2013 (NEPM (2013))

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NEPC (2013b) Assessment of Site Contamination: Schedule B1 – Investigation Levels for Soil and Groundwater. National Environment Protection Council, Adelaide

enHealth (2012) Australian Exposure Factor Guide. Department of Health and Ageing and enHealth Council, Commonwealth of Australia

Safe Work Australia 2020. Trichloroethylene. https://ehq-production-australia.s3.ap-southeast-2.amazonaws.com/2094d3e9e21cc4277baa21099e0e5b6d0ab1f0e0/original/1611805534/draft-evaluation-report-wes-trichloroethylene-pdf.pdf_985fe5ef9fec8b658f10d00e6ca719fc?X-Amz-Algorithm=AWS4-HMAC-SHA256&X-Amz-Credential=AKIA4KKNQAKIOR7VAOP4%2F20230222%2Fap-southeast-2%2Fs3%2Faws4_request&X-Amz-Date=20230222T035807Z&X-Amz-Expires=300&X-Amz-SignedHeaders=host&X-Amz-Signature=8afabf851d9f0e5c53c3b6ef58252edbfd64430b731299779d23d2cfd061ff16

12. EVALUATION OF REMEDIATION

12.1 Remediation Required

TTMP determined that significant contamination was not identified in the materials to be excavated as part of the SBT works and therefore remediation was not required during excavation of the soil/rock materials above the groundwater table. The Interim RAP (reviewed for IAA11) was prepared for construction activities and includes controls/management options to be implemented during bulk excavation within the station box above the groundwater table.

Remediation of the site is required for bulk excavation works beneath the groundwater table due to the potential unacceptable risk to human health as a result of drawdown of groundwater contaminated with volatile chlorinated hydrocarbons, PFAS and ammonia from the former dry cleaner located off-site at 1-7 Queen Street, west of the station box. TTMP noted that a remediation strategy to manage potential risks from chlorinated hydrocarbons is required for both construction and operational phases of the project.

The HHRA 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 monitoring indicate that concentrations have, or will likely, become unacceptable.

Section 7.2 of the HHRA presented four contingency mitigation options which included:

- 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 the project boundary, adjacent to the excavation, to reduce the hydraulic gradient and therefore the groundwater flow rate towards the Station.
- Source remediation.

The RAP reported that TTMP and CPBG had considered the contingency mitigation options and advised that the preferred mitigation option during the construction phase of the project is the implementation of the PRB based on its technical feasibility, ease of deployment, cost and program requirements. If a potential risk to the future users of the site (station staff and public) is identified as a result of ongoing dewatering or breakthrough of contamination after completion of SBT works, an addendum to the RAP will be required as part of later works packages to describe measures that may be incorporated into the design of the station or implemented as part of the operational phase of the project.

The PRB is to be installed in Queen Street within 6 to 8 weeks of commencement of bulk excavation below the groundwater table to abate the migration of contaminated groundwater from 1-7 Queen Street to the station box. The PRB will be installed through the injection of a colloidal activated carbon (AC) product at three 50 mm diameters bores (orange bores shown on Attachment 10, Appendix A) installed in Queen Street to approximately 20 mAHD, to be spaced 5 m apart (centre to centre).

The product is mixed with water ex-situ and injected to the target formation using specialized injection equipment. TTMP included an example of a product which is readily available and suitable to adsorb chlorinated hydrocarbons 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 the station box.

In-conjunction with the installation of the PRB, a monitoring and contingency plan will be implemented which is discussed in Section 12.2 below.

The RAP noted potential management measures which could be considered for the operational stage of the site (if required), including:

- Continued groundwater monitoring and management/maintenance of the PRB 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 the station ventilation system such that sufficient air exchange occurs to mitigate potential risks associated with vapour ingress.

These would need to be documented in an addendum to the RAP and considered in a future Audit.

The RAP notes that 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.

12.2 Groundwater Monitoring and Contingency Plan

The RAP included a groundwater monitoring program to be implemented at the commencement of excavation works beneath the groundwater table, as summarised in Figure 12.1 below. Monitoring well locations are illustrated in Attachment 10, Appendix A.

Figure 12.1: Summary of Construction Groundwater Monitoring (Source: the RAP)

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.

VHC – volatile chlorinated compounds

Groundwater samples from all monitoring wells are to be collected using a HDPE Hydrasleeve. Field parameters (pH, EC, Eh, DO and temperature) are to be recorded using a calibrated water quality meter. Prior to retrieval of the Hydrasleeve, the wells are to be dipped with a dual-phase interface probe to record the SWL and presence/absence of NAPL.

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 and the assessment undertaken is to be reported monthly. Where contaminant(s) are predicted to reach the station box at concentration(s) exceeding the Trigger Values in Figure 12.2, the result is to be reported to Sydney Metro and the Site Auditor within 7 days of receipt of the laboratory result.

Figure 12.2: Construction Groundwater Monitoring Trigger Values (Source: the RAP)

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

The RAP includes a contingency plan which will be initiated if predicted concentrations, based on concentrations reported and travel time to the key sentinel monitoring wells, indicates groundwater concentrations exceeding the risk-based trigger values in Figure 12.2 may reach the station box. The RAP included a flow chart (provided in Attachment 11, Appendix A) illustrating how groundwater data from the monitoring wells will be assessed during construction to determine if implementation of the contingency plan is required.

The contingency plan included in the RAP comprised:

- Evaluate the need to re-inject colloidal AC product into the injection bores installed on Queen Street and/or inject the product into the sentinel monitoring wells SBT-GW-1012, SBT-GW-1013 and SBT-GW-1014 (Attachment 10, Appendix A).
- Consider if an active capture system based on extraction from SBT-GW-1012, SBT-GW-1013 and SBT-GW-1014 is required.
- Collect groundwater samples from sentinel monitoring wells and groundwater pumped from the western end of station box on a weekly basis or at another frequency agreed with the Site Auditor.
- Completion of a report which summarises work completed.
- Fortnightly reporting of groundwater data to Sydney Metro and the Auditor.

If following implementation of the contingency plan chlorinated hydrocarbons are predicted to reach the station box at concentrations exceeding the trigger values in Figure 12.2, 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.

The RAP notes that if the contingency plan is triggered, a supplementary risk assessment will be required 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.

12.3 Evaluation of RAP

The Auditor has assessed the RAP by comparison with the checklist included in NSW EPA (2020) *Contaminated Land Guidelines, Consultants Reporting on Contaminated Land*. The RAP was found to address the required information, as detailed in Table 12.1, below.

Table 12.1: Evaluation of RAP

Remedial Action Plan	Auditor Comments
Remedial Goal/Objective A remedial goal was not clearly specified in the RAP, however the primary objective for the remediation of the site is to make it suitable for construction of an underground station. The RAP applies to the construction phase only.	In the Auditor's opinion, this objective is considered appropriate for the construction phase of the project. An addendum to the RAP would be required for the operational phase if ongoing dewatering of the structure is required or migration of contamination presents a risk to future site users.
Remedial DQOs DQOs were not specified in the RAP.	The Auditor notes that remedial DQOs were not stated however it is noted that validation sampling is not proposed. The groundwater monitoring plan outlined in the RAP included DQIs.
Discussion of the Extent of Remediation Required Remediation of the site is required for bulk excavation works beneath the groundwater table due to the potential unacceptable risk to human health (construction workers and future users of the site) as a result of drawdown of groundwater contaminated with volatile chlorinated hydrocarbons from the former dry cleaner at 1-7 Queen Street located off-site to the west of the station box. TTMP noted that a remediation strategy to manage potential risks from chlorinated hydrocarbons is required for both construction and operational phases of the project.	Acceptable. The extent of remediation required for the construction phase will be determined during implementation of the groundwater monitoring plan based on the concentrations recorded. If chlorinated hydrocarbons exceed trigger values, additional subsequent re-injection events may be required along with appropriate monitoring and mitigation measures for construction workers in the station box. A supplementary risk assessment will also be required 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

Remedial Action Plan	Auditor Comments
The initial extent of remediation proposed is installation of a PRB in Queen Street within 6 to 8 weeks of commencement of bulk excavation with an accompanying groundwater monitoring program.	ecological receptors, and potential risk to building services and sub-surface infrastructure. An addendum to the RAP will be required for any remedial works required for the operational phase of the development, such as if ongoing dewatering of the structure is required or migration of contamination presents a risk to future site users.
Remedial Options Remedial/mitigation options during construction phases were assessed in Table 6 of the RAP (including pros and cons) and included: • Establishment of a 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. The RAP also noted potential management measures which could be considered for the operational stage of the site, including: • Water proofing of the metro station such that 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 the station ventilation system such that sufficient air exchange occurs to mitigate risks associated with vapour ingress.	The Auditor considers that an appropriate range of options were considered. The Auditor notes that engineering controls/construction elements may be required for the operational phases of the site.
Selected Preferred Option and Rationale The preferred option for the construction phase was discussed in Section 8.1 of the RAP (refer sections above). The RAP noted that "*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.*".	The Auditor considers the preferred option to be appropriate. The other options are not preferred due to higher cost, construction program constraints and site access limitations.
Description of Remediation to be Undertaken As discussed in Section 12.2, the PRB will be installed in Queen Street within 6 to 8 weeks of commencement of bulk excavation below the groundwater table to abate the migration of contaminated groundwater from 1-7 Queen Street to the station box. The PRB will be installed through the injection of a colloidal AC product at three 50 mm diameters bores (orange bores shown on Attachment 10, Appendix A) installed to approximately 20 mAHD in Queen Street, to be spaced 5 m apart (centre to centre).	The Auditor considers the description of remediation to be appropriate. An addendum to the RAP will be required for any remedial works required for the operational phases of the development.
Proposed Validation Criteria The RAP included trigger values which will be adopted for the groundwater monitoring program, as discussed in Section 11.8 and shown in Figure 12.2.	The Auditor considers the proposed validation criteria to be acceptable.

Remedial Action Plan	Auditor Comments
Imported soil/aggregate will be required to be classified as either virgin excavated natural material (VENM), excavated natural material (ENM), or supplied in accordance with a suitable resource recovery order/exemption (RRO/RRE) published by the NSW EPA. The suitability of imported material will be assessed against the following criteria presented in NEPM (2013) for commercial/industrial land uses: • HIL D • HSL D (direct contact and vapour intrusion) • Management limits for total petroleum hydrocarbons (TPH) fractions • No asbestos detected at the reporting limit (0.1 g/kg) or via trace analysis	
Proposed Validation Testing <u>Groundwater:</u> As discussed in Section 12.2, groundwater sampling for the construction phase will be weekly from the nominated wells. <u>Imported Materials:</u> Imported material shall be assessed in accordance with the Materials Reuse and Importation Procedure which was included in Appendix 6 of the RAP. TTMP recommended 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. To be considered suitable for use, the chemical results presented in the supplied documentation shall meet the criteria specified in the appropriate RRO and be less than the assessment criteria discussed above. Imported soil/aggregate including quarried VENM shall be inspected during import to confirm the material is consistent with the source documentation. Imported soil/aggregate shall be sampled and analysed during importation to confirm that the material is suitable for use as outlined in Attachment 12, Appendix A. Quarried VENM is exempt from sampling and analysis if adequate information is provided regarding the source and environmental protection licence (EPL). <u>Re-use of Excavated Material:</u> TTMP concluded in the DSI that soils sampled would be suitable (from a contamination perspective) for reuse at the SMWSA FS01 site, however checks would need to be undertaken to confirm such material does not contain asbestos. The RAP noted that, in the event additional investigation is carried out to assess the suitability of spoil for reuse at the site or within the FS01 site, then the report shall be reviewed/endorsed by the 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 at the site or in the FS01 site shall be assessed in accordance with the	The validation requirements documented in the RAP are considered acceptable. The Auditor notes that imported material must either be VENM, ENM or be classified under a RRO. The density of testing would need to be commensurate with the documentation provided and the consistency of the results.

Remedial Action Plan	Auditor Comments
Materials Reused and Importation Procedure included in Appendix 6 of the RAP. If materials are not suitable for reuse, they shall be classified to enable disposal as waste to a licensed landfill.	
Contingency Plan if Selected Remedial Strategy Fails A contingency plan was outlined in Section 11.6 of the RAP. The contingency plan includes: • Evaluate the need to re-inject colloidal AC product into the injection bores installed on Queen Street and/or inject the product into the sentinel monitoring wells SBT-GW-1012, SBT-GW-1013 and SBT-GW-1014. • Consider if an active capture system based on extraction from SBT-GW-1012, SBT-GW-1013 and SBT-GW-1014 is required. • Collect groundwater samples from sentinel monitoring wells and groundwater pumped from the western end of station box on a weekly basis or at another frequency agreed with the Site Auditor. • Completion of a report which summarises work completed. • Fortnightly reporting of groundwater data to Sydney Metro and the Auditor. Contingency procedures prepared by CPBG for unexpected finds of contamination including asbestos were included in Appendix 6 and 8 of the RAP. The RAP notes that "*If observations indicate the presence of potential contamination, the unexpected finds procedures included in Appendix 6 and Appendix 8 shall be implemented.*".	In the Auditor's opinion, the contingency plan is practical and appropriate. It is noted that additional contingencies may need to be considered for the operational phase of the site. The procedures for handling unexpected finds, which includes stopping work and identification of materials is appropriate and practical and can be implemented within the proposed remediation strategy.
Interim Site Management Plan (before remediation) Interim site management measures were not discussed in the RAP.	The auditor notes that the site is currently a construction site and secured by fencing, and management controls are specified in an Interim RAP.
Site Management Plan (operation phase) including stormwater, soil, noise, dust, odour and OH&S A specific site management plan was not discussed in the RAP however Section 9 noted that spoil management shall be carried out in accordance with the project construction EMP and applicable sub-plans 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. Copies of these plans were provided in Appendix 6 of the RAP. The RAP also included a draft erosion and sediment control plan prepared by CPBG.	The Auditor considers the project plans to be adequate.
Remediation Schedule and Hours of Operation Indicative project duration or hours of operation were not specified in the RAP.	The Auditor notes that hours of operation were included in the planning approval consent conditions for construction: 7 am to 6 pm on Monday to Fridays and 8 am to 1 pm on Saturday. No works are to occur on Sundays or public holidays.
Contingency Plans to Respond to Site Incidents Contingency plans to respond to site incidents were not discussed in the RAP.	The RAP includes a spill management procedure and unexpected finds procedure.
Licence and Approvals Regulatory requirements, approvals and licences were not specified in the RAP.	The planning approval consent conditions note that the RAP must be implemented and that any changes must be approved in writing by the Auditor. Approval for injection of AC may be required from the Department of Planning Industry and

Remedial Action Plan	Auditor Comments
An appropriately licensed landfill should be selected and the material tracked from the site to the landfill.	Environment under the NSW *Water Management Act 2000*.
Contacts/Community Relations Contacts and community relations were not specified in the RAP.	The Auditor noted during the site visit that relevant contacts were displayed on signs adjacent to site access. The Auditor notes that the Sydney Metro website provides monthly construction updates and contact details for the community.
Staged Progress Reporting The RAP notes that 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. The RAP does not specify whether staged reporting will be required, however, notes that at completion of the SBT works a validation report shall be prepared and will be accompanied by an EMP. A validation report may also be required at the completion of the SSTOM works.	Adequate. It is assumed the remediation will be undertaken in two stages: construction phase and operational phase, noting the RAP describes remediation for the construction phase only.
Long Term Environmental Management Plan TTMP reported that an EMP will accompany the Validation Report prepared for SBT works. 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. TTMP have noted that on completion of the SSTOM works an EMP may also be required and the validation completed following SSTOM works is to confirm this requirement. The RAP notes that, where an EMP 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 program 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 EMP is to be provided to the Auditor for approval prior to the operational use of the site. The EMP will be required to be recorded on the planning certificate issued under section 10.7 of the NSW *Environmental Planning and Assessment Act 1979*, and noted on the Site Audit Statement. Where a EMP is required, it is to be made legally enforceable.	Implementation of an EMP will require approval by the site owner. The mechanism for enforcement and notification of the EMP is understood to be the deed between Transport for NSW and SBT/SSTOM contractors.
Waste Management Where offsite disposal of spoil is required, such spoil shall be assessed and managed in accordance with the Waste and Recycling Management Procedure (Appendix 6 of RAP), which includes classification in	Adequate

Remedial Action Plan	Auditor Comments
accordance with the NSW EPA (2014) *Waste Classification Guidelines* 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 NEPM (2013) and the NSW EPA (2022) *Sampling design part 1 - application*.	

12.4 Auditor's Opinion

In the Auditor's opinion, the proposed remediation works are appropriate. If adequately implemented, the RAP should be able to ensure that the site is suitable for subsequent construction of the station at the completion of SBT works (construction phase works). Successful validation will be required to confirm this. An Addendum RAP and further site audit may be required if remediation is required to confirm suitability for the SSTOM (operational phase) works.

13. COMPLIANCE WITH REGULATORY GUIDELINES AND DIRECTIONS

13.1 General

The Auditor has used guidelines currently made and approved by the EPA under section 105 of the NSW *Contaminated Land Management Act 1997*. The investigations were generally conducted in accordance with SEPP 55 Planning Guidelines and reported in accordance with the NSW EPA (2020) *Contaminated Land Guidelines, Consultants Reporting on Contaminated Land*.

13.2 Development Approvals

The Audit was initiated to comply with requirements of Critical State Significant Infrastructure (CSSI) approval 10051, issued on 23 July 2021 by the Minister for Planning and Public Spaces.

Condition

Condition E94 of the CSSI relates to the RAP and requires a site audit as follows:

> *"Before commencing remediation, a Section B Site Audit Statement(s) must be prepared by an NSW EPA-accredited Site Auditor that certifies that the Remedial Action Plan(s) is/are appropriate and that the site can be made suitable for the proposed use. The Remedial Action Plan(s) must be implemented and any changes to the Remedial Action Plan(s) must be approved in writing by the NSW EPA-accredited Site Auditor".*

The SAR and accompanying site audit statement (SAS, provided in Appendix B) has been prepared to comply with this condition.

Table 13.1: Evaluation of CSSI Conditions

Condition	Auditor Comments
Condition E92 Before commencement of any construction that would result in the disturbance of moderate to high risk contaminated sites as identified in the documents identified in **Condition A1, Detailed Site Investigations** (for contamination) must be conducted to determine the full nature and extent of the contamination. The **Detailed Site Investigation Report(s)** and the subsequent report(s), must be prepared, or reviewed and approved, by consultants certified under either the Environment Institute of Australia and New Zealand's Certified Environmental Practitioner (Site Contamination) scheme (CEnvP(SC)) or the Soil Science Australia Certified Professional Soil Scientist Contaminated Site Assessment and Management (CPSS CSAM) scheme. The **Detailed Site Investigations** must be undertaken in accordance with guidelines made or approved under section 105 of *Contaminated Land Management Act 1997* (NSW).	The DSI, DSI Addendum and Groundwater DSI Addendum were undertaken to determine the nature and extent of contamination. The reports were reviewed by Matthew Locke CEnvP-SC and adequately met the requirements of guidelines made or approved under the CLM Act.
Condition E93 Should remediation be required to make land suitable for the final intended land use, a **Remedial Action Plan** must be prepared, or reviewed and approved, by consultants certified under either the Environment Institute of Australia and New Zealand's Certified Environmental Practitioner (Site Contamination) scheme (CEnvP(SC)) or the Soil Science Australia Certified Professional Soil Scientist Contaminated Site Assessment and Management (CPSS CSAM) scheme. The **Remedial Action Plan** must be prepared in accordance with relevant	The RAP was prepared to address this condition. The RAP was reviewed by Matthew Locke CEnvP-SC and was adequately met the requirements of guidelines made or approved under the CLM Act.

Condition	Auditor Comments
guidelines made or approved by the EPA under section 105 of the *Contaminated Land Management Act 1997* (NSW) and must include measures to remediate the contamination at the site to ensure the site will be suitable for the proposed use when the **Remedial Action Plan** is implemented.	
Condition E94 Before commencing remediation, a **Section B Site Audit Statement(s)** must be prepared by an NSW EPA-accredited Site Auditor that certifies that the **Remedial Action Plan(s)** is/are appropriate and that the site can be made suitable for the proposed use. The **Remedial Action Plan(s)** must be implemented and any changes to the **Remedial Action Plan(s)** must be approved in writing by the NSW EPA-accredited Site Auditor.	The SAR and accompanying site audit statement (SAS, provided in Appendix B) has been prepared to comply with this condition. If an addendum to the RAP is required, it must be provided for Auditor review and approval.
Condition E95 **Validation Report(s)** must be prepared in accordance with *Consultants Reporting on Contaminated Land: Contaminated Land Guidelines* (EPA, 2020) and relevant guidelines made or approved under section 105 of the *Contaminated Land Management Act 1997* (NSW).	Will be prepared by TTMP at completion of remedial works
Condition E96 A **Section A1 or Section A2 Site Audit Statement** (accompanied by an **Environmental Management Plan**) and its accompanying **Site Audit Report**, which state that the contaminated land disturbed by the work has been made suitable for the intended land use, must be submitted to the Planning Secretary and the Relevant Council(s) after remediation and before the commencement of operation of the CSSI.	Will be prepared by the Auditor at completion of remedial works and review of
Condition E97 A copy of **Detailed Site Investigation Report(s)**, **Remedial Action Plan(s)**, **Validation Report(s)**, **Site Audit Report(s)** and **Site Audit Statement(s)** must be submitted to the Planning Secretary and the Relevant Council(s) for information.	To be undertaken by others
Condition E98 An **Unexpected Contaminated Land and Asbestos Finds Procedure** must be prepared before the commencement of construction and must be followed should unexpected contaminated land or asbestos (or suspected contaminated land or asbestos) be excavated or otherwise discovered during construction.	Provided in the Interim RAP (Appendix 6) and RAP (Appendix 8).
Condition E99 The **Unexpected Contaminated Land and Asbestos Finds Procedure** must be implemented throughout construction.	Provided in the Interim RAP (Appendix 6) and RAP (Appendix 8). Implementation is to be undertaken by CPBG and subcontractors during SBT works.

13.3 Duty to Report

Consideration has been given to the requirements of the EPA (2015) *Guidelines on the Duty to Report Contamination under the Contaminated Land Management Act 1997*. TTMP noted in the

DSI that *"given the known contamination status of the groundwater quality within the Project corridor and the proposed dewatering, CBPG should give consideration on whether these conditions trigger the need to notify the NSW EPA, under the Duty to Report requirements set out under section 60 of the Contaminated land Management Act 1997*".

Based on the findings in this SAR, the Auditor considers that the site is not required to be notified under the Duty to Report requirements. Consideration may be warranted should contamination migrate to the site as a result of dewatering activities.

1-7 Queen Street (former dry cleaner located off-site ~100-120 m west of the station box excavation) has been notified to the EPA and is identified (January 2023) to be "under assessment".

13.4 Asbestos Management Plan

If suspected ACM is observed during construction works, then the Project Asbestos Management Plan (AMP) will be implemented. A copy of the Unexpected ACM Find Procedure from the AMP was included in an Appendix of the RAP.

13.5 Conflict of Interest

The Auditor has considered the potential for a conflict of interest in accordance with the requirements of Section 3.2.3 of the NSW EPA (2017) *Guidelines for the NSW Site Auditor Scheme (3rd Edition)*.

The Auditor considers that there are no conflicts of interest, given that:

1. The Auditor is not related to a person by whom any part of the land is owned or occupied.
2. The Auditor does not have a pecuniary interest in any part of the land or any activity carried out on any part of the land.
3. The Auditor has not reviewed any aspect of work carried out by, or a report written by, the site auditor or a person to whom the site auditor is related.

14. CONCLUSIONS AND RECOMMENDATIONS

TTMP conclude the following in the RAP:

> "*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…*".

Based on the information presented in TTMP reports and observations made on site, and following the Decision-making process for assessing urban redevelopment sites in NSW EPA (2017) *Guidelines for the NSW Site Auditor Scheme (3rd Edition)*, the Auditor concludes that the site can be made suitable for construction of the proposed underground train station, subject to compliance with the following remedial action plan:

- 'St Marys Station, Remedial Action Plan, Sydney Metro Western Sydney Airport Station Boxes and Tunnelling Works', dated 23 May 2023, TTMP.

and subject to compliance with the following conditions:

- Validation of the remediation works undertaken during excavation of the station box and tunnelling works is required to be documented in a final site validation report prepared by a qualified environmental consultant confirming that the works have been undertaken in accordance with the RAP and certifying the suitability of the site for the construction of a future underground train station.
- If an EMP is required at completion of the Station Box and Tunnelling Works, preparation of a Section B Site Audit Statement (SAS) by a NSW EPA Accredited Site Auditor reviewing the validation of remediation works and the EMP.
- Preparation of an addendum to the RAP and further site audit if ongoing dewatering of the structure is required or migration of contamination presents a risk to future site users after completion of Station Box and Tunnelling Works. The addendum to the RAP would be implemented as part of later works packages by incorporation into the design of the station or implemented as part of the operational phase of the project.

- Validation of the remediation works undertaken during construction of the station is required to be documented in a final site validation report prepared by a qualified environmental consultant confirming that the works have been undertaken in accordance with any addendum to the RAP and certifying the suitability of the site for the underground train station.
- Preparation of a Section A Site Audit Statement by a NSW EPA Accredited Site Auditor reviewing the above information and confirming the suitability of the site for the underground train station.

15. OTHER RELEVANT INFORMATION

This Audit was conducted on the behalf of CPBG for the purpose of assessing the suitability and appropriateness of a remedial action plan (RAP), i.e. a “Site Audit” as defined in Section 4 (definition of a ‘site audit’ (b)(v)) of the CLM Act.

This summary report may not be suitable for other uses. TTMP included limitations in their reports. The Audit must also be subject to those limitations. The Auditor has prepared this document in good faith, but is unable to provide certification outside of areas over which the Auditor had some control or is reasonably able to check.

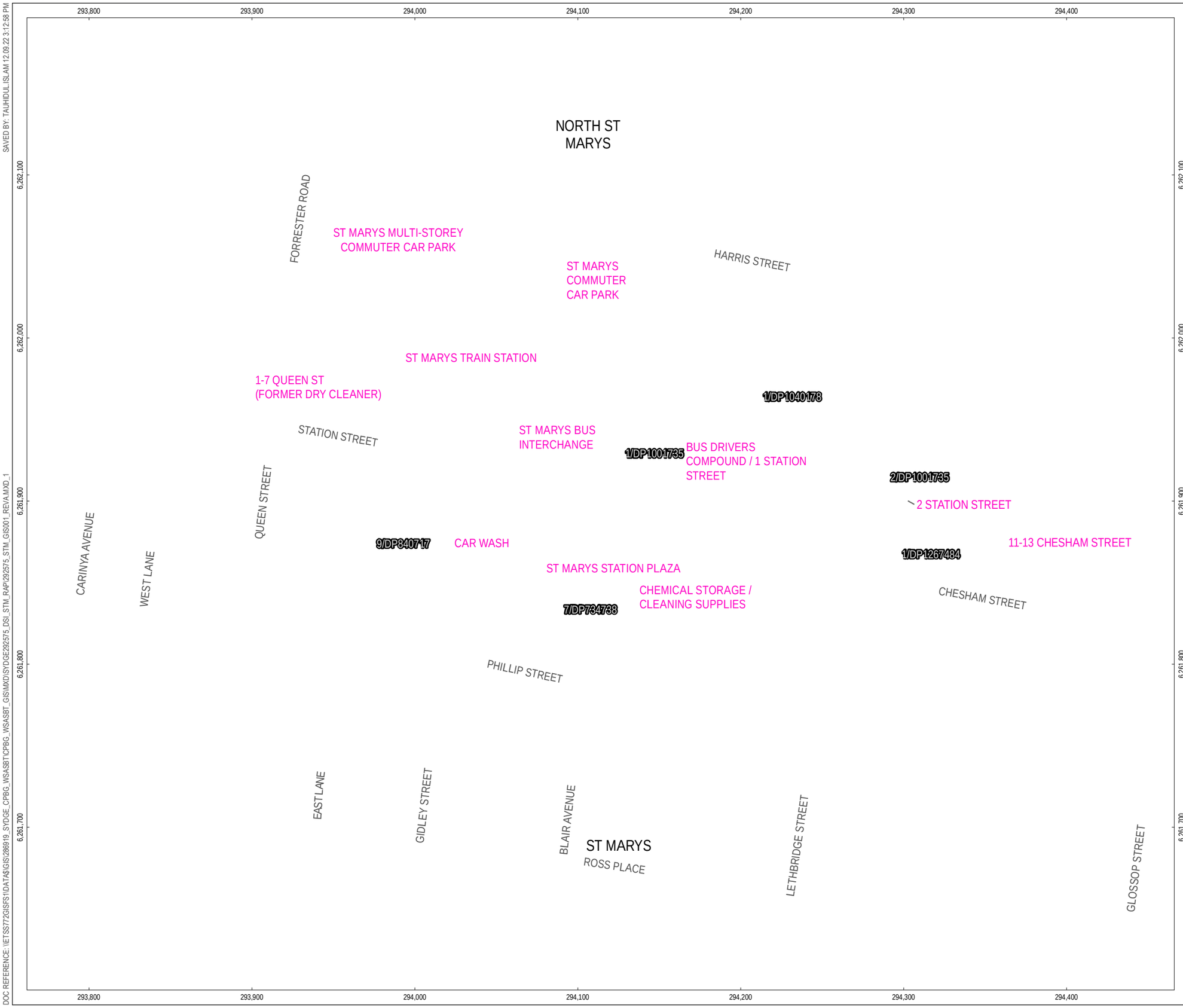
The Auditor has relied on the documents referenced in Section 1 of the Site Audit Report in preparing the Auditor’s opinion. If the Auditor is unable to rely on any of those documents, the conclusions of the audit could change.

It is not possible in a Site Audit Report to present all data which could be of interest to all readers of this report. Readers are referred to the referenced reports for further data. Users of this document should satisfy themselves concerning its application to, and where necessary seek expert advice in respect to, their situation.

APPENDIX A
ATTACHMENTS

Attachment 1: Site Location
Attachment 2: EIS AECs
Attachment 3: Summary of EIS AECs
Attachment 4a to 4d: DSI and DSI Sample Locations
Attachment 5: Inferred Groundwater Flow
Attachment 6a: TTMP Summary of Previous Fill Results
Attachment 6b: TTMP Summary of Previous Natural Results
Attachment 7: Previous Soil and Groundwater Chlorinated Data Former Dry Cleaner
Attachment 8: MIP Locations at Former Dry Cleaner
Attachment 9: TTMP Summary of Previous Groundwater Results
Attachment 10: Groundwater Investigation and Remediation Locations
Attachment 11: Assessment of Trigger Values and Contingency Plan
Attachment 12: Imported Material Sample Rates
Attachment 13a: Construction Site Boundary – West
Attachment 13b: Construction Site Boundary – East

Attachment 1: Site Location



CPB CONTRACTORS

Ghella 1894 5 Generations of Tunnelers

LEGEND

- Site Feature
- Railway
- Cadastral Boundary
- STM Site 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

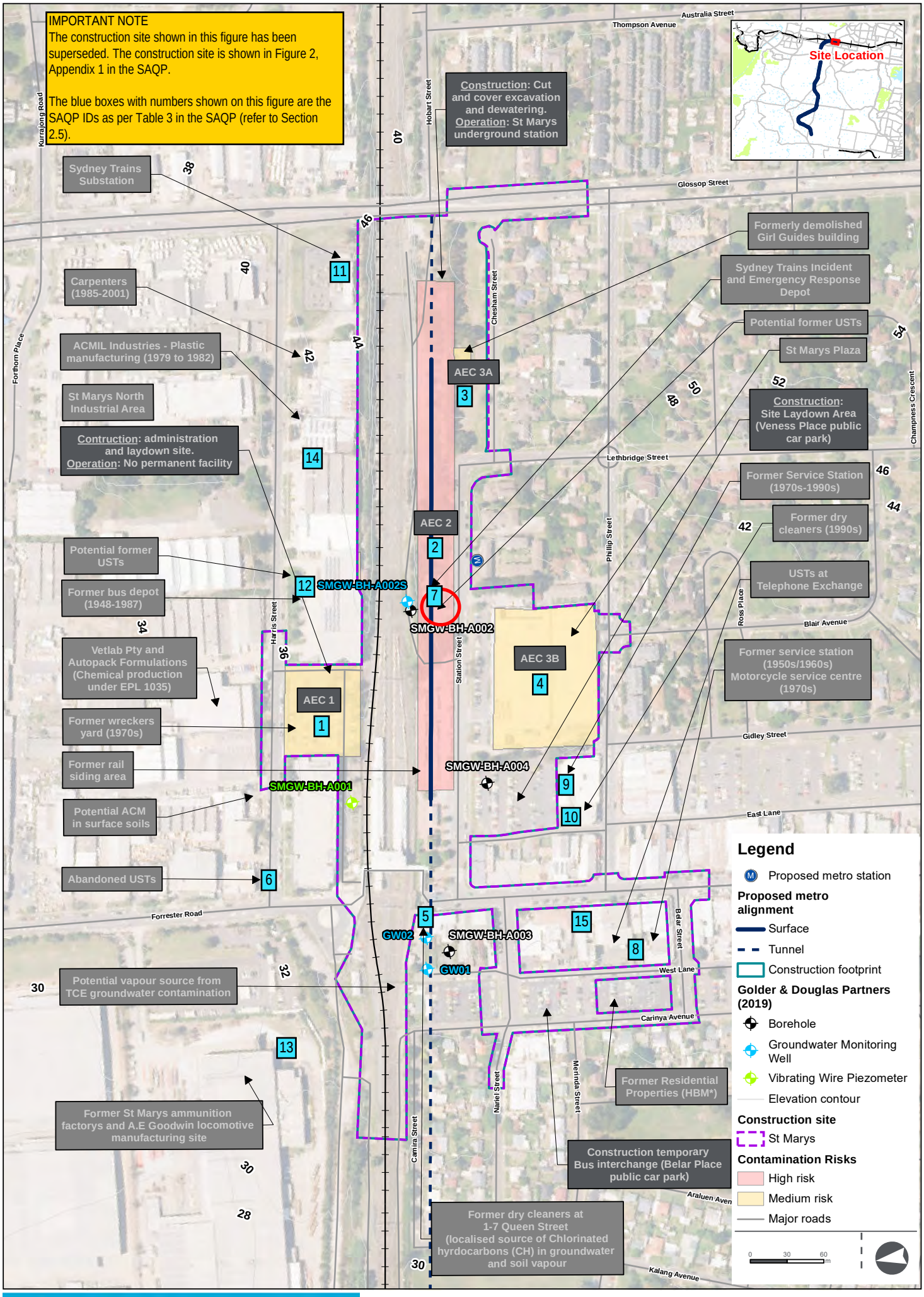
FIGURE 1

Site Location Plan
St Marys Station

TETRA TECH COFFEY

DATE: 12.09.22 PROJECT: 754-SYDGE292575 FILE: 292575_STM_F001_GIS

Attachment 2: EIS AECs



St Marys contamination sources and risk ranking

*HBM - Potential hazardous building materials
Indicative only, subject to design development

Figure A1

Attachment 3: Summary of EIS AECs

DSI ID	EIS Reference	Activity Description
01	AEC1	Site Summary • AEC1 is located at the St Marys Station Commuter Car Park. This area includes the potential for former fuel, oil and chemical storage and use associated with historical industrial land use including wreckers' yard within the 1970s and adjacent former bus depot. Previous Investigation Summary • No previous investigation data is available.
02	AEC2	Site Summary • AEC 2 includes the St Marys rail corridor and bus interchange area. • Potential former fuel storage within Sydney Trains Emergency Response Depot (now bus driver rest compound), former railway siding activities (spills, stockpiling, and filling) and up-gradient sources of groundwater contamination (dry cleaners and service station). Previous Investigation Summary • AEC2 is within the footprint of the station box which have been subject to previous investigations (refer to section 4). Potential UST located in the area.
03	AEC3A	Site Summary • Former Girl Guides Hall with potential for contamination (asbestos and lead) associated with the demolition of this building. Previous Investigation Summary • No previous investigation data is available.
04	AEC3B	Site Summary • The EIS Technical Report that the St Marys Station Plaza may contain chemical storage for back-up generators and air conditioning units. Back up generators were not observed during site walkover however a chemical storage area and car wash facility was observed. There is also potential for contamination in association Historical demolition of former buildings containing hazardous building materials. Previous Investigation Summary • No previous investigation data available

Attachment 3: Summary of EIS AECs

DSI ID	EIS Reference	Activity Description
05	1-7 Queen St (Dry Cleaner)	Site Summary • Environmental Strategies (2015) reported that Argus undertook a preliminary site investigation (PSI) of the site in 2015. The PSI found that there were vent pipes and vent stacks above the tailoring shop. There was no other evidence that dry cleaning had occurred based on historical titles, dangerous goods records, anecdotal information, and observations from the site. Previous Investigation Summary • This site has been subject to previous investigations which are summarised in **Section 4.3**.
06	Corner of Harris Street and Forrester Road	Site Summary • The EIS Technical reports former UST are present on the corner of Harris Street and Forrester Road. The subject land appears to be located topographically down-gradient and therefore unlikely to be a potential contamination source to the St Marys construction footprint Previous Investigation Summary • No previous investigation data is available.
07	1 Station Street (Bus Driver Compound)	Site Summary • Former Sydney Trains Incident and Emergency Response Depot. The EIS Technical reports notes that this site formally had hazmat signage for petroleum hydrocarbon storage, and the site may had either USTs or Aboveground Storage Tanks (AST). Previous Investigation Summary • No previous investigation data is available.
08	59 Queen St (corner of Belar St and Queen Street)	Site Summary • The site was potentially used as a workshop/service station from the 1950s to the 1970s. Previous Investigation Summary • No previous investigation data is available.
09	47 Phillip St	Site Summary • The site was potentially used as a service station in the 1980s. Previous Investigation Summary • No previous investigation data is available.
10	51 Phillip St	Site Summary • The site was potentially used as a dry cleaners in the 1990s. Previous Investigation Summary • No previous investigation data is available.
11	Sydney Trains Substation	Site Summary • The site is an existing substation. Previous Investigation Summary • No previous investigation data is available.

Attachment 3: Summary of EIS AECs

DSI ID	EIS Reference	Activity Description
12	Former Bus Depot	Site Summary • The site is a former bus depot (1940s to 1980s) with the potential for USTs. Previous Investigation Summary • No previous investigation data is available.
13	Former Ammunition and Locomotive Factory	Site Summary • The EIS reports the site was formerly used for the manufacturing of munitions, and then locomotives. Previous Investigation Summary • No previous investigation data is available.
14	Industrial Area North of railway	Site summary • The EIS reports hundreds of historical businesses associated with industrial activities north of the rail line such as chemical and industrial manufacturing, mechanical repairs, textile manufacturing, depots, and yards. Previous Investigation Summary • No previous investigation data is available.
15	43 Queen Street	Site summary • The EIS reports this site was previously used for waterproofing. Previous Investigation Summary • No previous investigation data is available.

Attachment 4a: DSI and DSI Addendum Sample Locations

LEGEND

Additional Contaminated Land Location
- Borehole

Additional Geotechnical/Hydrogeological Location
- Borehole

Existing Investigation Location
- Borehole
- Tunnel Alignment
- Tunnel Alignment - Chainage
- Tunnel Alignment - Cross Passage
- St Marys Station Site Layout
- Railway
- Cadastral Boundary
- SMS 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

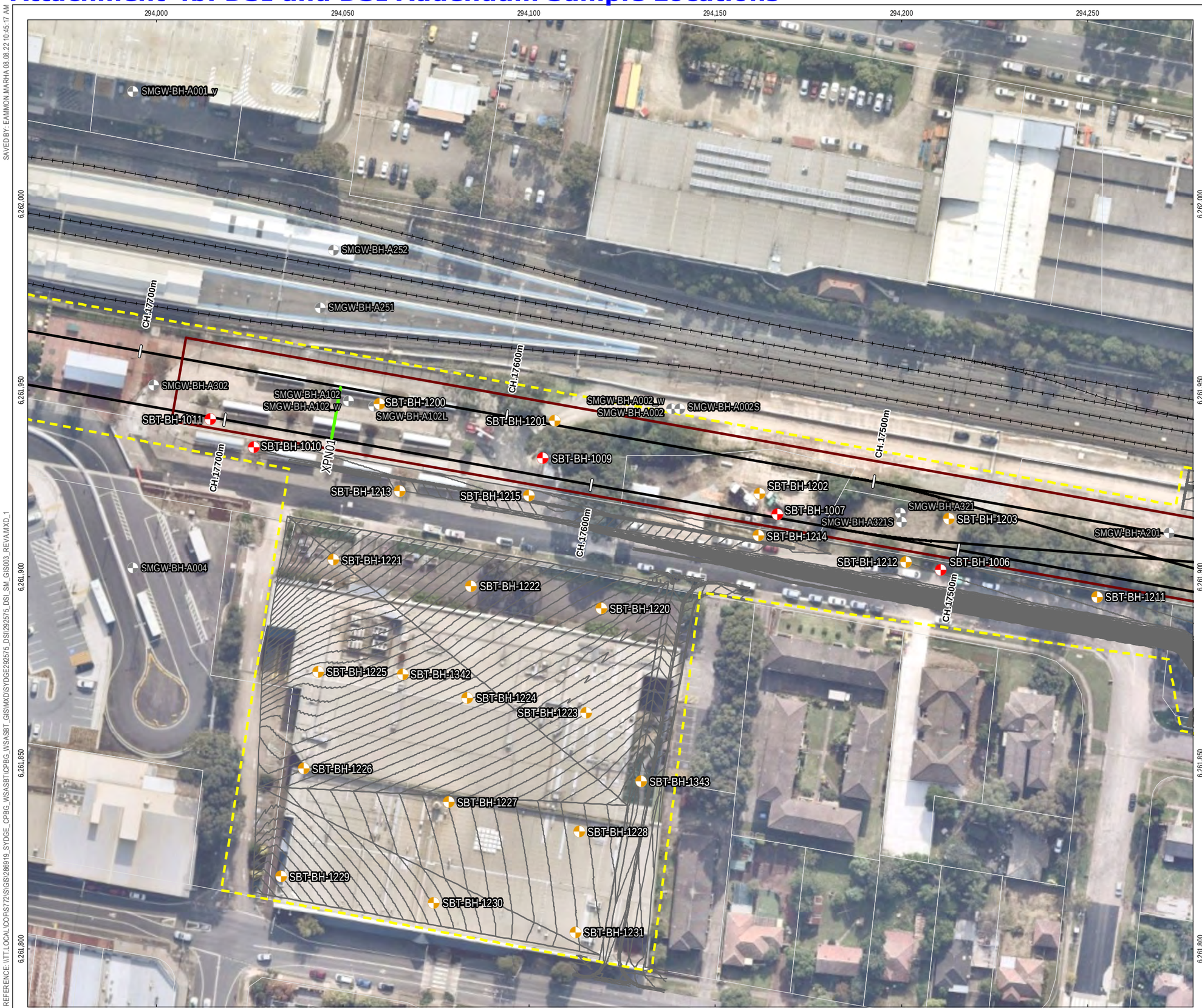
Investigation Locations
St Marys Station

TETRA TECH COFFEY

DATE: 10.08.22 PROJECT: 754-SYDGE292575 FILE: 292575_DSI_SM_F003A_GIS

SAVED BY: EAMMON.MARHA 10.08.22 10:55:25 AM
DOC REFERENCE: \\TT.LOCAL\COPIS\772\SIG\286919_SYDGE_CPBG_WSASBT\CPBG_WSASBT_GIS\MXD\SYDGE292575_DSI\292575_DSI_SM_GIS002_REVA.MXD_1

Attachment 4b: DSI and DSI Addendum Sample Locations



CPB CONTRACTORS

Ghella 1894 5 Generations of Tunnelers

LEGEND

Additional Contaminated Land Location
- Borehole

Additional Geotechnical/Hydrogeological Location
- Borehole

Existing Investigation Location
- Borehole
- Tunnel Alignment
- Tunnel Alignment - Chainage
- Tunnel Alignment - Cross Passage
- St Marys Station Site Layout
- Railway
- Cadastral Boundary
- SMS 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

Contaminated Land Locations
St Marys Station

TETRA TECH COFFEY

DATE: 08.08.22 PROJECT: 754-SYDGE292575 FILE: 292575_DSI_SM_F003B_GIS

SAVED BY: EAMMON.MARHA 08.08.22 10:45:17 AM
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Attachment 4c: DSI and DSI Addendum Sample Locations

CPB CONTRACTORS

Ghella 1894 5 Generations of Tunnelers

LEGEND

Additional Contaminated Land Location
- Borehole

Additional Geotechnical/Hydrogeological Location
- Borehole

Existing Investigation Location
- Borehole
- Test Pit
- Tunnel Alignment
- Tunnel Alignment - Chainage
- St Marys Station Site Layout
- Railway
- Cadastral Boundary
- SMS 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

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WESTERN SYDNEY AIRPORT
STATION BOXES AND TUNNELLING WORKS

FIGURE 3C

Contaminated Land Locations
St Marys Station

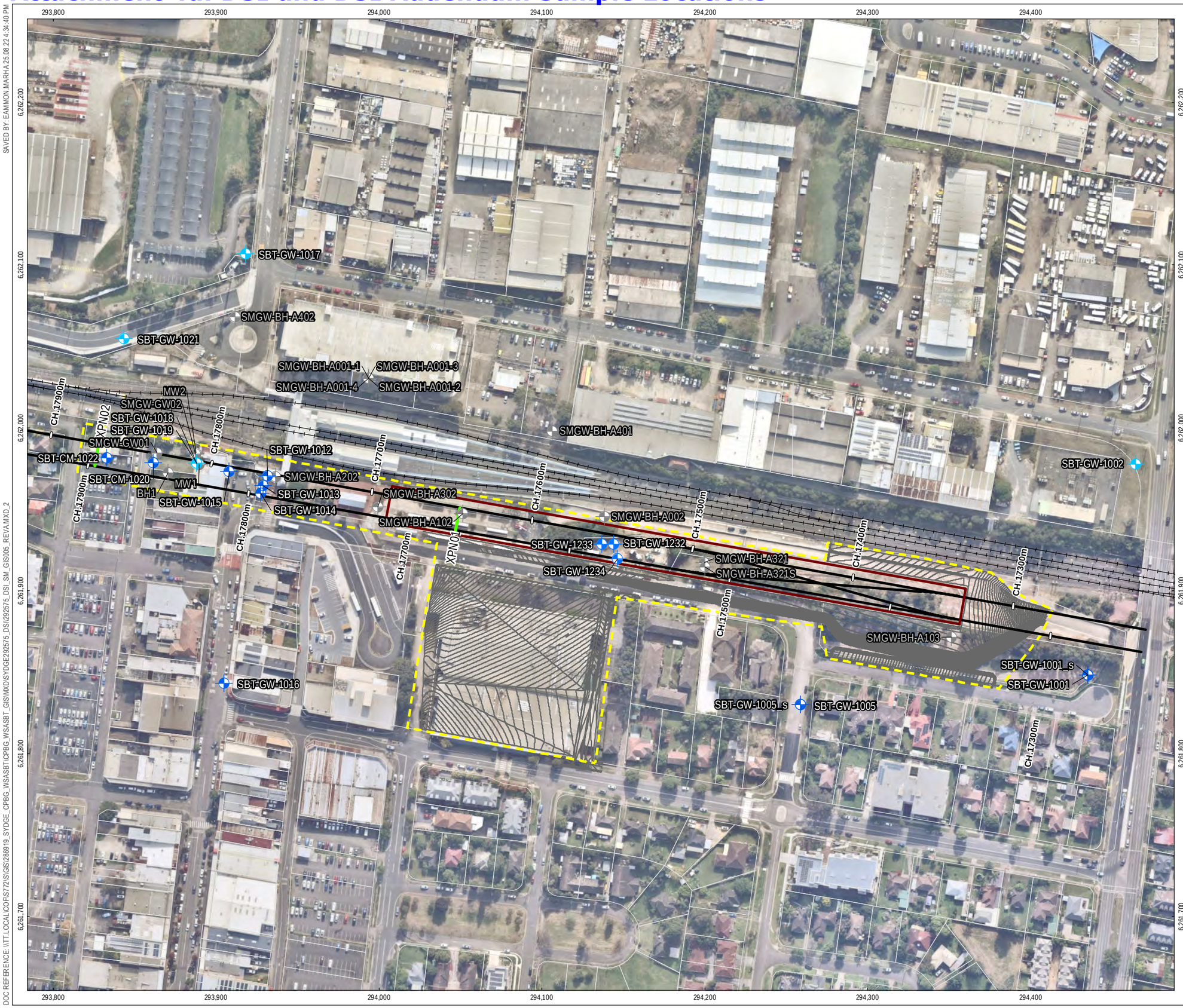
TETRA TECH COFFEY

DATE: 08.08.22 PROJECT: 754-SYDGE292575 FILE: 292575_DSI_SM_F003C_GIS

SAVED BY: EAMMON.MARHA 08.08.22 10:44:13 AM

DOC REFERENCE: \\TT.LOCAL\COFS772\SIG\286919_SYDGE_CPBG_WSASBT\CPBG_WSASBT_GIS\MXD\SYDGE292575_DSI292575_DSI_SM_GIS004_REVA.MXD_1

Attachment 4d: DSI and DSI Addendum Sample Locations



SAVED BY: EAMMON.MARHA 25.08.22 4:34:40 PM

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CPB CONTRACTORS

Ghella 1894 5 Generations of Tunnelers

LEGEND

DSI Investigation Locations
- Groundwater Quality Well
- Monitoring Well

Previous Investigation Locations
- Monitoring Well
- Tunnel Alignment
- Tunnel Alignment - Chainage
- Tunnel Alignment - Cross Passage
- St Marys Station Site Layout
- Railway
- Cadastral Boundary
- SMS 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 50 100 m

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

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WESTERN SYDNEY AIRPORT
STATION BOXES AND TUNNELLING WORKS

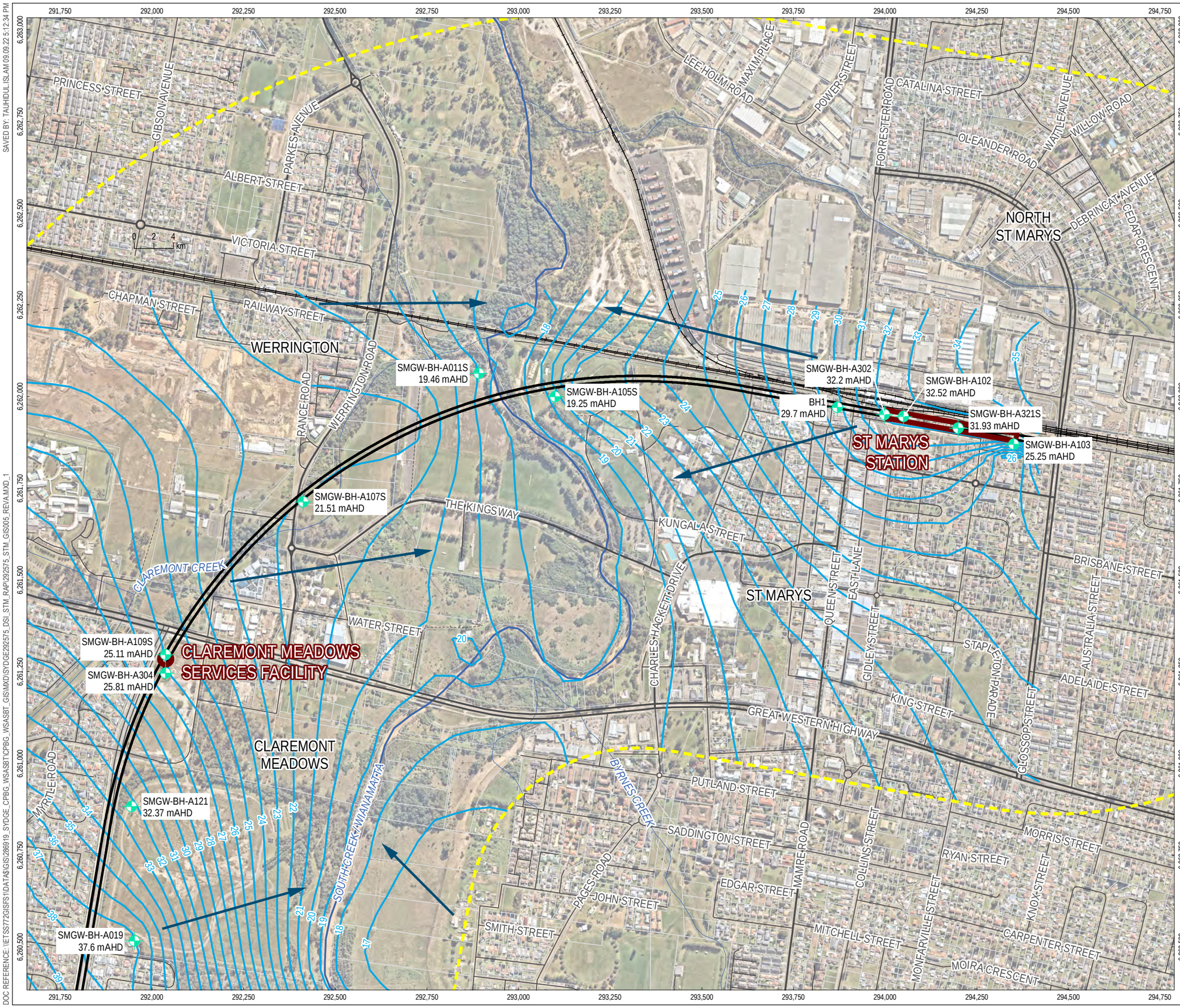
FIGURE 4

Groundwater Investigation Locations
St Marys Station

TETRA TECH COFFEY

DATE: 25.08.22 PROJECT: 754-SYDGE292575 FILE: 292575_DSI_SM_F004_GIS

Attachment 5: Inferred Groundwater Flow



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

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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

Attachment 6a: TTMP Summary of Previous Fill Results

Table 5: Analytical Results - Fill Samples

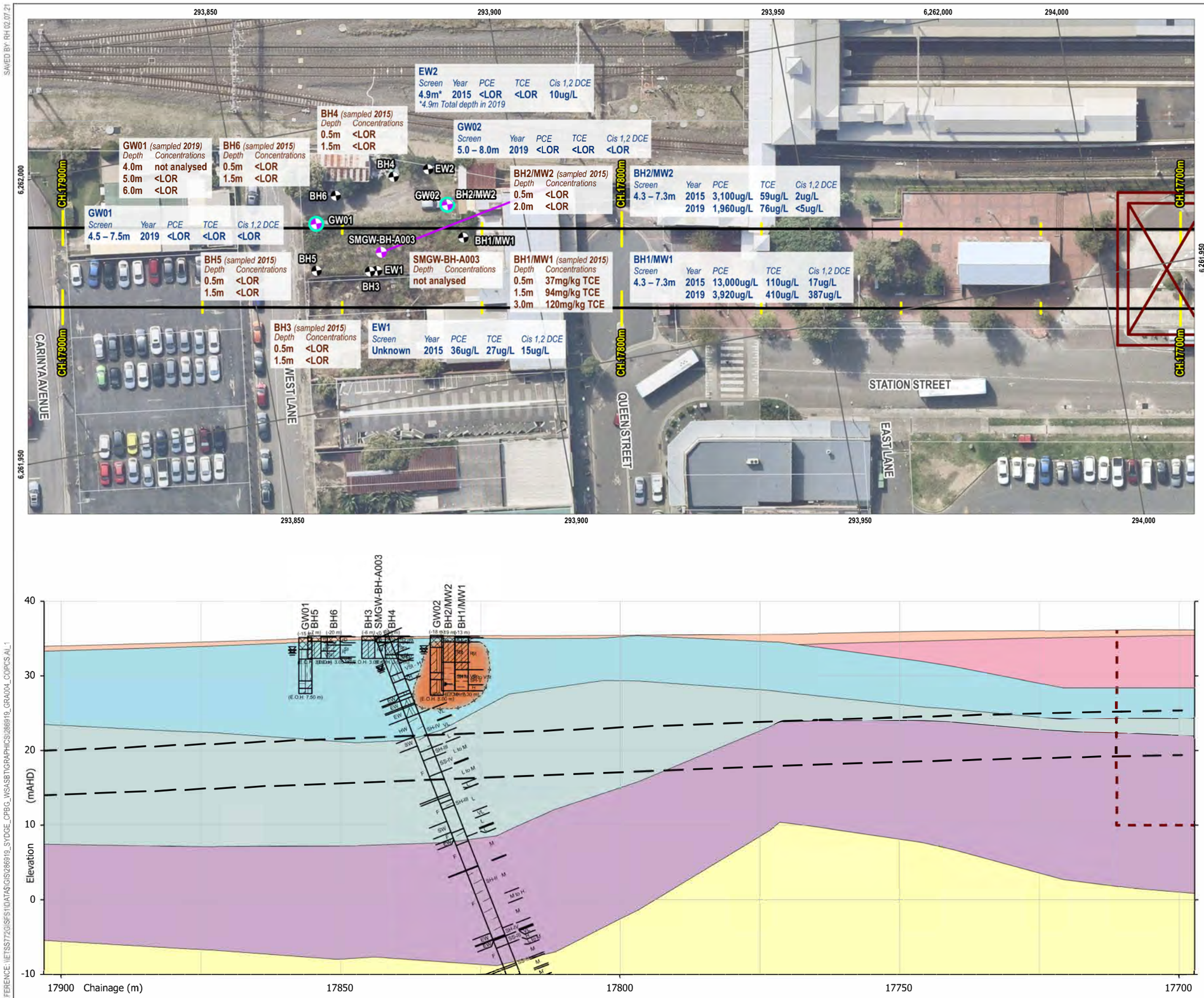
Analyte (mg/kg unless shown)	No. Samples / No. Detects	Minimum Value	Maximum Value	Commercial/ Industrial Health Guidelines (Note 1)	No. of Samples Exceeding Commercial/ Industrial Health Guidelines
Arsenic	27 / 22	<2	273	3000	Nil
Cadmium	27 / 0	<0.4	<1	900	Nil
Chromium (III+VI)	27 / 27	6	76	3600	Nil
Copper	27 / 26	<4	489	240000	Nil
Lead	27 / 27	5	259	1500	Nil
Mercury	27 / 2	<0.1	0.2	730	Nil
Nickel	27 / 26	<3	81	6000	Nil
Zinc	27 / 26	<5	330	400000	Nil
pH (aqueous extract)	9 / 9	5.9	8.9		-
TRH C6 - C10 Fraction F1	27 / 0	<10	<25	260	Nil
TRH C6 - C10 Fraction Less BTEX F1	27 / 0	<10	<25	260	Nil
TRH >C10 - C16 Fraction F2	27 / 0	<50	<50	20000	Nil
TRH >C10 - C16 Fraction Less Naphthalene (F2)	17 / 0	<50	<100	20000	Nil
TRH >C16 - C34 Fraction F3	27 / 2	<100	230	27000	Nil
TRH >C34 - C40 Fraction F4	27 / 1	<100	110	38000	Nil
TRH C10 - C40 Fraction	27 / 2	<50	340		-
Benzene	27 / 0	<0.1	<0.2	3	Nil
Toluene	27 / 0	<0.1	<0.5	99000	Nil
Ethylbenzene	27 / 0	<0.1	<1	27000	Nil
Xylenes (m & p)	27 / 1	<0.2	1		-
Xylene (o)	27 / 0	<0.1	<1		-
Xylenes (Total)	27 / 1	<0.3	1	81000	Nil
Naphthalene	27 / 0	<0.1	<1	11000	Nil
PAHs (Sum of total)	27 / 2	<0.05	7.4	4000	Nil
Benzo(a)pyrene TEQ (Calculated)	16 / 3	<0.172	1.2	40	Nil
Total Halogenated Phenol*	6 / 0	<1	<1		-
Total Non-Halogenated Phenol*	6 / 0	<20	<20		-
Perfluorooctanesulfonic acid (PFOS)	22 / 12	<0.0001	0.0032		-
Perfluorohexanoic acid (PFHxA)	22 / 0	<0.0001	<0.005		-
Sum of PFHxS and PFOS (lab reported)	22 / 12	<0.0001	0.0032	20	NIL
Sum of PFASs (n=28)	19 / 5	<0.0002	0.0034		-
PCB (Sum of Total-Lab Reported)	15 / 0	<0.1	<0.5	7	Nil

Note 1: Commercial / industrial guidelines include the NEPM HIL-D and HSL, PFAS NEMP, and the CRC Care (2011) petroleum hydrocarbon HSLs for direct contact for commercial industrial workers

Table 6: Analytical Results - Natural Samples

Analyte (mg/kg unless shown)	No. Samples / No. Detects	Minimum Value	Maximum Value	Commercial/ Industrial Health Guidelines (Note 1)	No. of Samples Exceeding Commercial/ Industrial Health Guidelines
Arsenic	40 / 33	<2	74	3000	Nil
Cadmium	40 / 1	<0.4	6	900	Nil
Chromium (III+VI)	40 / 37	<2	94	3600	Nil
Copper	40 / 39	<4	72	240000	Nil
Lead	40 / 40	6.4	26	1500	Nil
Mercury	40 / 0	<0.1	<0.1	730	Nil
Nickel	40 / 32	<2	46	6000	Nil
Zinc	40 / 38	<5	230	400000	Nil
pH (aqueous extract)	27 / 27	5.2	9.7		-
TRH C6 - C10 Fraction F1	33 / 0	<10	<25	260	Nil
TRH C6 - C10 Fraction Less BTEX F1	33 / 0	<10	<25	260	Nil
TRH >C10 - C16 Fraction F2	35 / 0	<50	<50	20000	Nil
TRH >C10 - C16 Fraction Less Naphthalene (F2)	26 / 0	<50	<100	20000	Nil
TRH >C16 - C34 Fraction F3	35 / 1	<100	120	27000	Nil
TRH >C34 - C40 Fraction F4	35 / 0	<100	<100	38000	Nil
TRH C10 - C40 Fraction	35 / 1	<50	120		-
Benzene	35 / 0	<0.1	<0.2	3	Nil
Toluene	35 / 0	<0.1	<0.5	99000	Nil
Ethylbenzene	35 / 0	<0.1	<1	27000	Nil
Xylenes (m & p)	35 / 0	<0.2	<2		-
Xylene (o)	35 / 0	<0.1	<1		-
Xylenes (Total)	35 / 0	<0.3	<3	81000	Nil
Naphthalene	35 / 0	<0.1	<1	11000	Nil
PAHs (Sum of total)	34 / 0	<0.5	<0.5	4000	Nil
Benzo(a)pyrene TEQ (Calculated)	24 / 13	<0.5	1.2	40	Nil
Total Halogenated Phenol*	8 / 0	<1	<1		-
Total Non-Halogenated Phenol*	8 / 0	<20	<20		-
6:2 Fluorotelomer Sulfonate (6:2 FtS)	35 / 1	<0.0005	0.0006		-
Perfluorobutane sulfonic acid (PFBS)	35 / 2	<0.0001	0.0002		-
Perfluorooctanesulfonic acid (PFOS)	35 / 4	<0.0001	0.0006		-
Perfluorooctanoate (PFOA)	35 / 1	<0.0001	0.0009	50	Nil
Perfluorohexanoic acid (PFHxA)	35 / 0	<0.0001	<0.005		-
Sum of PFHxS and PFOS (lab reported)	35 / 4	<0.0001	0.0006	20	Nil
Sum of PFASs (n=28)	31 / 2	<0.0002	0.0006		-
PCB (Sum of Total-Lab Reported)	5 / 0	<0.1	<0.5	7	Nil

Attachment 7: Previous Soil and Groundwater Chlorinated Data Former Dry Cleaner



LEGEND

Investigation Location - Golder-Douglas
- Borehole
- Groundwater Well

Investigation Location - Historical
- Borehole
- Reference Case Alignment
- Reference Case Alignment - Structure

Regional Lithological Model
- Zone S1
- Zone S2
- Zone S3
- Zone R1
- Zone R2
- Zone R3

Sampling results
- BH5 Soil sampling results
- BH5 Groundwater sampling results
- Chlorinated hydrocarbon impact

SOURCE
Investigation locations and alignment supplied by CPBG.
Cadastre from DFSI.
Aerial imagery from Nearmap (capture date 15.04.2021).

0 5 10 m
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PAGE SIZE: **A3**
PROJECTION: **GDA 1994 MGA Zone 56**

CPB - GHELLA

WESTERN SYDNEY AIRPORT
STATION BOXES AND TUNNELLING WORKS

FIGURE 1 **DRAFT**

Available project and historical chlorinated ethene data – plan and cross section of CH17700 to CH17900

TETRA TECH COFFEY

DATE: **02.07.21** PROJECT: **754-SYDGE286919** FILE: **MEM-COFF-CM-0002_F001_GRA**

Attachment 8: MIP Locations at Former Dry Cleaner

Attachment 9: TTMP Summary of Previous Groundwater Results

Analyte	Units	No. Samples / No. Detects	Minimum Value	Maximum Value	ANZG (2018) Freshwater 95% toxicant DGVs	No. of Samples Exceeding ANZG (2018) Freshwater 95% toxicant DGVs
Magnesium (Filtered)	mg/L	18 / 18	5	812		-
Aluminium (Filtered)	mg/L	25 / 15	<0.01	0.18	0.055	5
Arsenic (Filtered)	mg/L	26 / 19	<0.001	0.01		-
Beryllium	mg/L	24 / 11	<0.001	0.012		-
Beryllium (Filtered)	mg/L	24 / 10	<0.001	0.01		-
Boron (Filtered)	mg/L	25 / 11	<0.05	0.12	0.37	Nil
Cadmium (Filtered)	mg/L	25 / 4	<0.0001	0.0008	0.0002	2
Chromium (III+VI) (Filtered)	mg/L	25 / 2	<0.001	0.002		-
Cobalt (Filtered)	mg/L	26 / 24	<0.001	0.17		-
Copper (Filtered)	mg/L	26 / 11	<0.001	0.022	0.0014	7
Iron (Filtered)	mg/L	26 / 22	<0.05	25		-
Lead (Filtered)	mg/L	25 / 5	<0.001	0.004	0.0034	1
Manganese (Filtered)	mg/L	26 / 26	0.002	6.4	1.9	2
Mercury (Filtered)	mg/L	24 / 0	<0.0001	<0.0001	0.0006	Nil
Molybdenum (Filtered)	mg/L	24 / 18	<0.001	0.018		-
Nickel (Filtered)	mg/L	26 / 26	0.002	0.056	0.011	14
Selenium (Filtered)	mg/L	25 / 1	<0.001	0.004	0.011	Nil
Strontium (Filtered)	mg/L	25 / 25	0.081	16.8		-
Tin (Filtered)	mg/L	/				
Vanadium (Filtered)	mg/L	23 / 1	<0.005	0.019		-
Zinc (Filtered)	mg/L	25 / 17	<0.005	0.112	0.008	15
Electrical Conductivity @ 25C (lab)	µS/cm	19 / 19	615	23000		-
pH (lab)	pH_unit	18 / 18	6.19	8.51		-
Alkalinity (total as CaCO3)	mg/L	25 / 25	60	715		-
Bicarbonate Alkalinity as CaCO3	mg/L	24 / 24	60	715		-
Carbonate Alkalinity as CaCO3	mg/L	23 / 1	<1	6		-
Hardness as CaCO3	mg/L	23 / 23	40	5850		-
Ammonia as N	mg/L	26 / 24	<0.01	2.96	0.9	11
Nitrite + Nitrate as N	mg/L	23 / 11	<0.01	3.43		-
Nitrate (as NO3-N)	mg/L	26 / 11	<0.01	3.43		-
Nitrite (as NO2-N)	mg/L	25 / 5	<0.01	0.1		-
Nitrogen (Total)	mg/L	19 / 11	<0.2	3.8		-
Total Dissolved Solids @180oC	mg/L	16 / 16	316	13600		-
Perfluorooctanesulfonic acid (PFOS)	µg/L	13 / 11	<0.0002	0.0019		-
Perfluorooctanoic acid (PFOA)	µg/L	13 / 5	<0.0006	0.016		-
Sum of PFASs (n=28)	µg/L	13 / 6	<0.005	0.0312		-
Benzene	µg/L	4 / 0	<1	<1	950	Nil
Toluene	µg/L	4 / 1	<1	2		-
Ethylbenzene	µg/L	4 / 0	<1	<2		-
Xylene (o)	µg/L	4 / 0	<1	<2	350	Nil
Xylene (m & p)	µg/L	4 / 0	<2	<2		-
Xylene Total	µg/L	4 / 0	<2	<3		-
F1 (C6 - C10)	µg/L	4 / 0	<20	<20		-
F1 (C6 - C10) less BTEX	µg/L	4 / 0	<20	<100		-
F2 (C10 - C16)	µg/L	4 / 1	<50	50		-
F2 C10 - C16 (minus Naphthalene)	µg/L	4 / 1	<50	50		-
F3 (C16 - C34)	µg/L	4 / 1	<100	300		-
F4 (C34 - C40)	µg/L	4 / 0	<100	<100		-
C10 - C40 (Sum of total)	µg/L	4 / 1	<100	350		-
PAHs (Sum of total)	µg/L	6 / 2	<0.01	0.23		-
4,4-DDE	µg/L	6 / 1	<0.01	0.15		-
b-BHC	µg/L	6 / 1	<0.01	0.22		-
chlordane	µg/L	6 / 1	<0.01	0.06	0.08	Nil
DDD	µg/L	6 / 2	<0.01	0.01		-
DDT	µg/L	5 / 0	<0.01	<2	0.01	Nil
Endrin	µg/L	6 / 0	<0.01	<0.5	0.02	Nil
g-BHC (Lindane)	µg/L	6 / 0	<0.01	<0.5	0.2	Nil
Heptachlor	µg/L	6 / 0	<0.01	<0.5	0.09	Nil
Methoxychlor	µg/L	6 / 2	<0.01	0.15		-
Toxaphene	µg/L	5 / 0	<0.1	<1	0.2	Nil
Methane	µg/L	3 / 0	<0.05	<0.05		-

Attachment 10: Groundwater Investigation and Remediation Locations

CPB CONTRACTORS

Ghella 1894 5 Generations of Tunnelers

LEGEND

DSI Investigation Locations
- Groundwater Quality Well
- Monitoring Well
- Sentinel and Contingency Mitigation Well

Previous Investigation Locations
- Monitoring Well
- Tunnel
- Tunnel Alignment -
- Tunnel Alignment - Cross
- Railway
- Cadastral Boundary
- SMS Site 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: 25.08.22 PROJECT: 754-SYDGE292575 FILE: 292575_DSI_SM_F004A_GIS

SAVED BY: EAMMON.MARHA 25.08.22 4:45:56 PM
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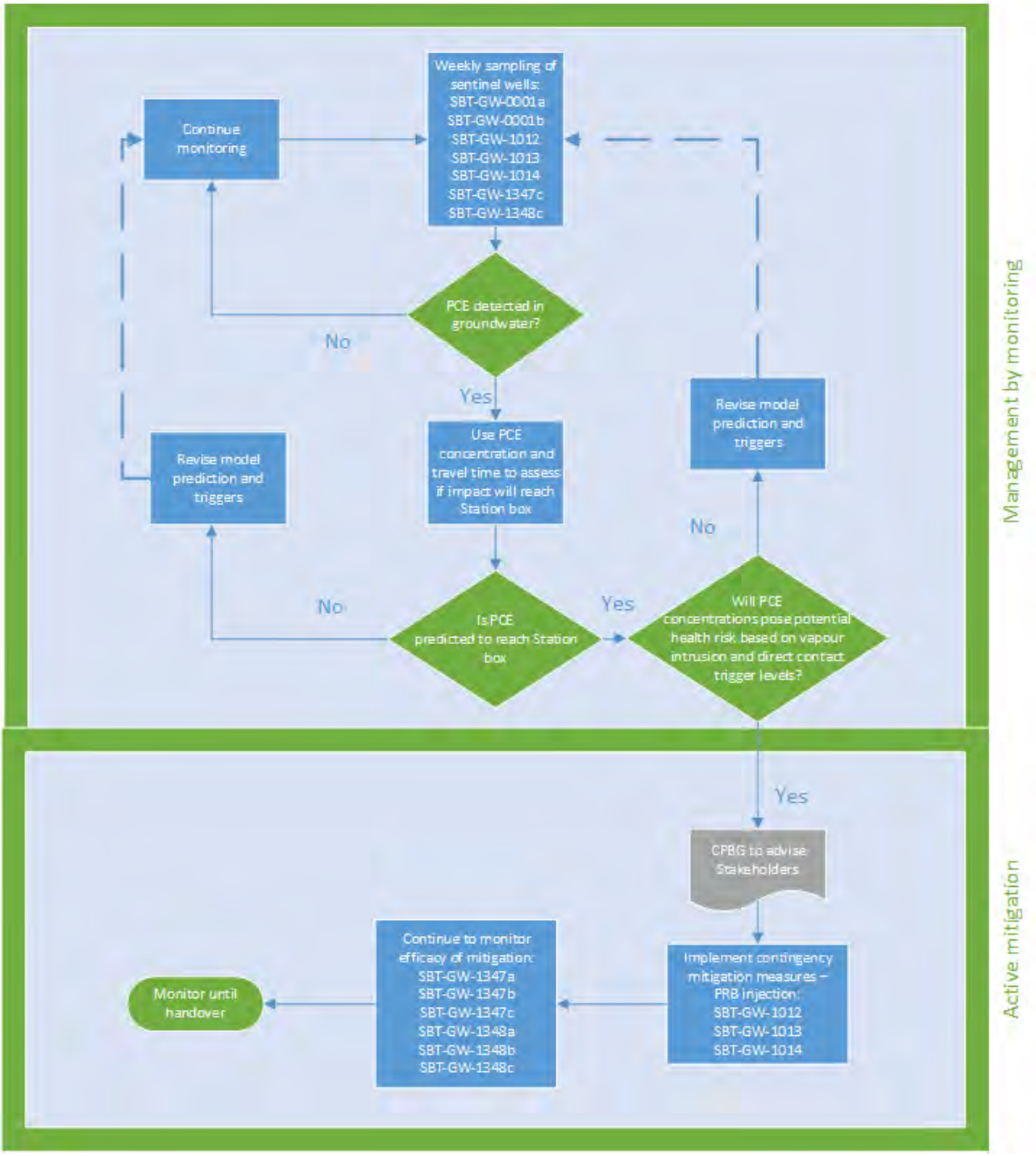


Figure B: Assessment of Trigger Values and Implementation of Contingency Plan

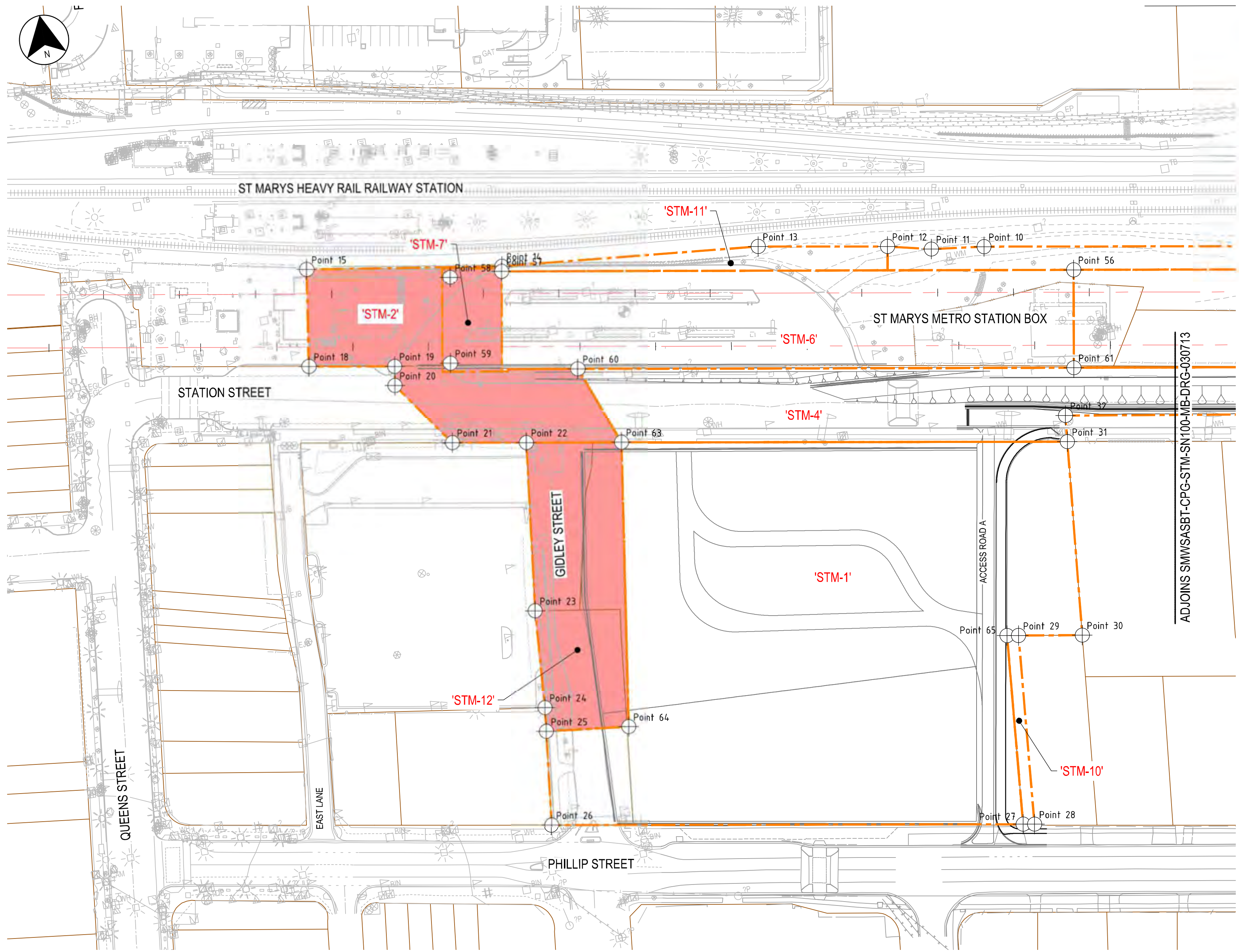
Attachment 12: Imported Materials Sample Rates

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).
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.

Attachment 13a: Construction Site Boundary - West



LEGEND

- CONSTRUCTION SITE BOUNDARY
- CADASTRAL BOUNDARY
- RAIL ALIGNMENT (BY OTHERS)
- TBM RETRIEVAL AREA
- 'STM-1' SITE ACCESS SCHEDULE PORTIONS. REFER SITE ACCESS SCHEDULES

SITE ACCESS SETOUT POINTS (SYDNEY METRO)

BOUNDARY POINTS		
POINT ID	EASTING	NORTHING
Point 1	[illegible]	[illegible]
Point 2	294462.319	6261850.163
Point 3	294463.978	6261859.045
Point 4	294466.664	6261874.948
Point 5	294450.400	6261877.723
Point 6	294428.701	6261883.583
Point 7	294394.202	6261893.851
Point 8	294384.582	6261900.668
Point 9	294369.130	6261907.598
Point 10	294148.093	6261947.076
Point 11	294134.303	6261948.910
Point 12	294123.042	6261951.633
Point 13	294089.471	6261957.701
Point 14	294021.833	6261964.581
Point 15	293971.063	6261972.871
Point 16	293926.892	6261980.032
Point 17	293923.867	6261955.300
Point 18	293967.087	6261947.570
Point 19	293989.397	6261943.580
Point 20	293988.566	6261938.615
Point 21	294000.713	6261921.086
Point 22	294020.009	6261917.627
Point 23	294014.410	6261873.577
Point 24	294012.417	6261847.966
Point 25	294011.664	6261841.768
Point 26	294008.684	6261817.244
Point 27	294131.205	6261795.400
Point 28	294134.169	6261794.872
Point 29	294138.840	6261844.561
Point 30	294155.407	6261841.684
Point 31	294160.580	6261892.577
Point 32	294161.329	6261899.434

BOUNDARY POINTS		
[illegible]	[illegible]	[illegible]
Point 34	[illegible]	[illegible]
Point 35	294270.774	6261876.278
Point 36	294270.177	6261870.508
Point 37	294269.895	6261867.776
Point 38	294273.433	6261863.063
Point 39	294421.884	6261836.539
Point 40	294425.019	6261836.806
Point 41	294427.972	6261839.108
Point 42	294430.113	6261841.603
Point 43	294433.235	6261843.742
Point 44	294447.638	6261852.831
Point 45	294449.226	6261861.690
Point 46	294383.842	6261879.403
Point 47	294378.406	6261848.443
Point 48	294301.036	6261862.028
Point 49	294293.088	6261863.540
Point 50	294285.350	6261866.081
Point 51	294280.242	6261868.483
Point 52	294277.618	6261869.667
Point 53	294356.226	6261879.531
Point 54	294358.900	6261883.835
Point 55	294360.082	6261901.232
Point 56	294170.250	6261936.874
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Point 58	294007.889	6261964.130
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FOR STAGE APPROVAL

REV.	AMENDMENT DESCRIPTION	Design by	Verified by	Approved by	Date
B	FOR AFC STAGE APPROVAL	TJ	MS	CL	22.07.22
A	STAGE 3 EXTERNAL ISSUE	JK	MS	CL	13.05.22

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.

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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
MOBILISATION AND SITE ESTABLISHMENT
SITE ACCESS PLAN
SHEET 1

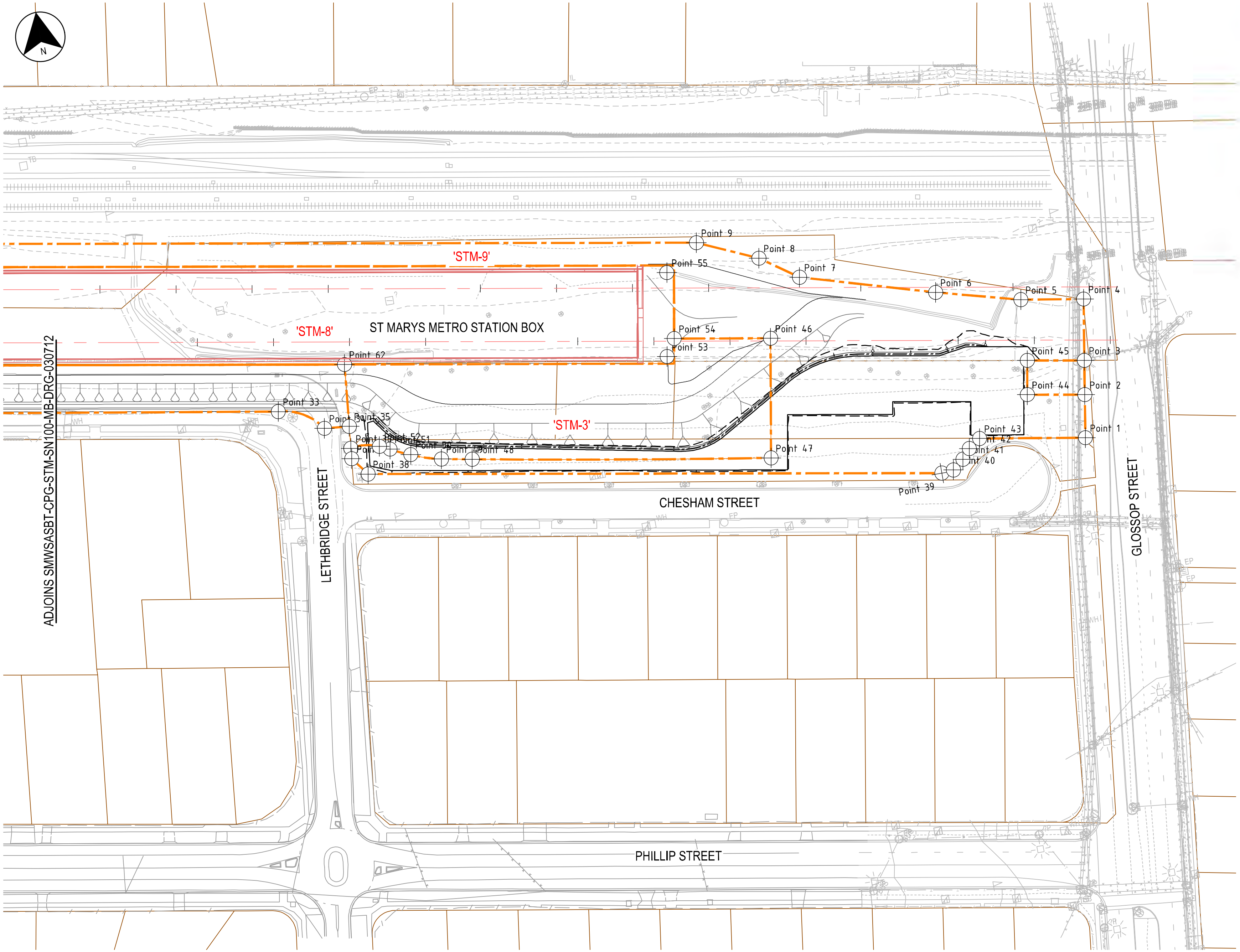
FILE No: SMWSASBT-CPG-STM-SN100-MB-M3D-030701 | SHEET: 1 OF 2 | ©

STATUS: STAGE 3 DETAILED DESIGN | EDMS No:

DRG No: SMWSASBT-CPG-STM-SN100-MB-DRG-030712 | REV B | VER

100mm AT FULL SIZE

Attachment 13b: Construction Site Boundary - East



LEGEND

CONSTRUCTION SITE BOUNDARY

CADASTRAL BOUNDARY

RAIL ALIGNMENT (BY OTHERS)

TBM RETRIEVAL AREA

'STM-1' SITE ACCESS SCHEDULE PORTIONS. REFER SITE ACCESS SCHEDULES

SITE ACCESS SETOUT POINTS (SYDNEY METRO)

BOUNDARY POINTS		
POINT ID	EASTING	NORTHING
Point 1	[illegible]	[illegible]
Point 2	[illegible]	[illegible]
Point 3	294463.978	6261859.045
Point 4	294466.664	6261874.948
Point 5	294450.400	6261877.723
Point 6	294428.701	6261883.583
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SYDNEY METRO - WESTERN SYDNEY AIRPORT - STATION BOXES AND TUNNELLING WORKS
ST MARYS STATION
MOBILISATION AND SITE ESTABLISHMENT
SITE ACCESS PLAN
SHEET 2

FILE No: SMWSASBT-CPG-STM-SN100-MB-M3D-030701 SHEET: 2 OF 2
STATUS: STAGE 3 DETAILED DESIGN EDMS No:
DRG No: SMWSASBT-CPG-STM-SN100-MB-DRG-030713 REV B

A1 Original | Co-ordinate System: GDA2020/MGAZone57 | Height Datum: AHD | This sheet may be prepared using colour and may be incomplete if copied | NOTE: Do not scale from this drawing.

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APPENDIX B
SITE AUDIT STATEMENT

NSW Site Auditor Scheme

Site Audit Statement

A site audit statement summarises the findings of a site audit. For full details of the site auditor's findings, evaluations and conclusions, refer to the associated site audit report.

This form was approved under the *Contaminated Land Management Act 1997* on 12 October 2017.

For information about completing this form, go to Part IV.

Part I: Site audit identification

Site audit statement no. TO-095-B1R

This site audit is a:

☒ statutory audit

☐ non-statutory audit

within the meaning of the *Contaminated Land Management Act 1997*.

Site auditor details

(As accredited under the *Contaminated Land Management Act 1997*)

Name: [redacted]

Company: Ramboll Australia Pty Ltd

Address: Level 3, 100 Pacific Highway, North Sydney

Postcode: 2060

[redacted] [redacted]

[redacted] [redacted]

Site details

Address: St Marys Station (Sydney Metro Western Sydney Airport), Station Street, St Marys NSW

Postcode: 2760

Property description

(Attach a separate list if several properties are included in the site audit.)

1 Station Street (Lot 1 DP1001735), 2 Station Street (Lot 2 DP1001735), 8 Station Street (Lot 8 DP734738), part 45 Station Street (part Lot 9 DP840747), part 63 Station Street (part Lot 1 DP1040178), 33-43 Phillip Street (Lot 7 DP734738), 11-13 Chesham Street (Lot 1 DP1267484) and part of Station Street (no Lot and DP) (see attachment at the end of Part I of this SAS)

Local government area: Penrith City Council

Area of site (include units, e.g. hectares): Approximately 3.9 hectares

Current zoning: SP2 (Railway), B4 (Mixed Use), R4 (High Density Residential) and IN1 (General Industrial) under the Penrith Local Environmental Plan 2010

Regulation and notification

To the best of my knowledge:

☐ **the site is** the subject of a declaration, order, agreement, proposal or notice under the *Contaminated Land Management Act 1997* or the *Environmentally Hazardous Chemicals Act 1985,* as follows: (provide the no. if applicable)

- ☐ Declaration no.
- ☐ Order no.
- ☐ Proposal no.
- ☐ Notice no.

☒ **the site is not** the subject of a declaration, order, proposal or notice under the *Contaminated Land Management Act 1997* or the *Environmentally Hazardous Chemicals Act 1985*.

To the best of my knowledge:

☐ the site **has** been notified to the EPA under section 60 of the *Contaminated Land Management Act 1997*

☒ the site **has not** been notified to the EPA under section 60 of the *Contaminated Land Management Act 1997*.

Site audit commissioned by

[redacted]

Company: CPB Contractors and Ghella Joint Venture

Address: Level 2, 177 Pacific Highway, North Sydney

Postcode: 2060

[redacted]

[redacted]

Contact details for contact person (if different from above)

[redacted]

Nature of statutory requirements (not applicable for non-statutory audits)

☐ Requirements under the *Contaminated Land Management Act* 1997 (e.g. management order; please specify, including date of issue)

☐ Requirements imposed by an environmental planning instrument (please specify, including date of issue)

☒ Development consent requirements under the *Environmental Planning and Assessment Act 1979* (please specify consent authority and date of issue)

Critical State Significant Infrastructure approval 10051, issued 23 July 2021 by the Minister for Planning and Public Spaces

☐ Requirements under other legislation (please specify, including date of issue)

Purpose of site audit

☐ **A1** To determine land use suitability

Intended uses of the land:

OR

☐ **A2** To determine land use suitability subject to compliance with either an active or passive environmental management plan

Intended uses of the land:

OR

(Tick all that apply)

☒ **B1** To determine the nature and extent of contamination

☒ **B2** To determine the appropriateness of:

- ☐ an investigation plan
- ☒ a remediation plan
- ☐ a management plan

☐ **B3** To determine the appropriateness of a **site testing plan** to determine if groundwater is safe and suitable for its intended use as required by the *Temporary Water Restrictions Order for the Botany Sands Groundwater Resource 2017*

☐ **B4** To determine the compliance with an approved:

- ☐ **voluntary management proposal** or
- ☐ **management order** under the *Contaminated Land Management Act 1997*

☒ **B5** To determine if the land can be made suitable for a particular use (or uses) if the site is remediated or managed in accordance with a specified plan.

Intended uses of the land: Construction of a future underground train station

Information sources for site audit

Consultancies which conducted the site investigations and/or remediation:

Tetra Tech Major Projects Pty Ltd (TTMP)

Titles of reports reviewed:

‘Contamination at 1-7 Queen Street, St Marys’, dated 8 July 2021, TTMP

‘Technical Memorandum: Preliminary Soil Results Eastern Portion St Marys’, dated 15 July 2022, TTMP

‘St Marys, Sampling Analysis Quality Plan, Sydney Metro Western Sydney Airport Station Boxes and Tunnelling Works’, dated 22 July 2022, TTMP

‘St Marys Station, Detailed Site Investigation, Sydney Metro Western Sydney Airport Station Boxes and Tunnelling Works’, dated 27 September 2022, TTMP

‘St Marys Station Remedial Action Plan (Interim) Preparatory Works and Initial Bulk Excavation’, dated 21 October 2022, TTMP

‘Detailed Site Investigation Addendum St Marys Station’, dated 13 October 2022, TTMP

‘Detailed Site Investigation Addendum St Marys Groundwater Monitoring Data’, dated 23 November 2022, TTMP

‘Hydrogeological Report (Project-wide), Sydney Metro Western Sydney Airport Station Boxes and Tunnelling Works’, dated 23 February 2023, TTMP

‘St Marys Station, Former Dry Cleaner, 1-7 Queen St – Assessment of Human Health Risk and Mitigation Options, Sydney Metro Western Sydney Airport Station Boxes and Tunnelling Works’, dated 26 April 2023, TTMP

‘St Marys Station, Remedial Action Plan, Sydney Metro Western Sydney Airport Station Boxes and Tunnelling Works’, dated 23 May 2023, TTMP

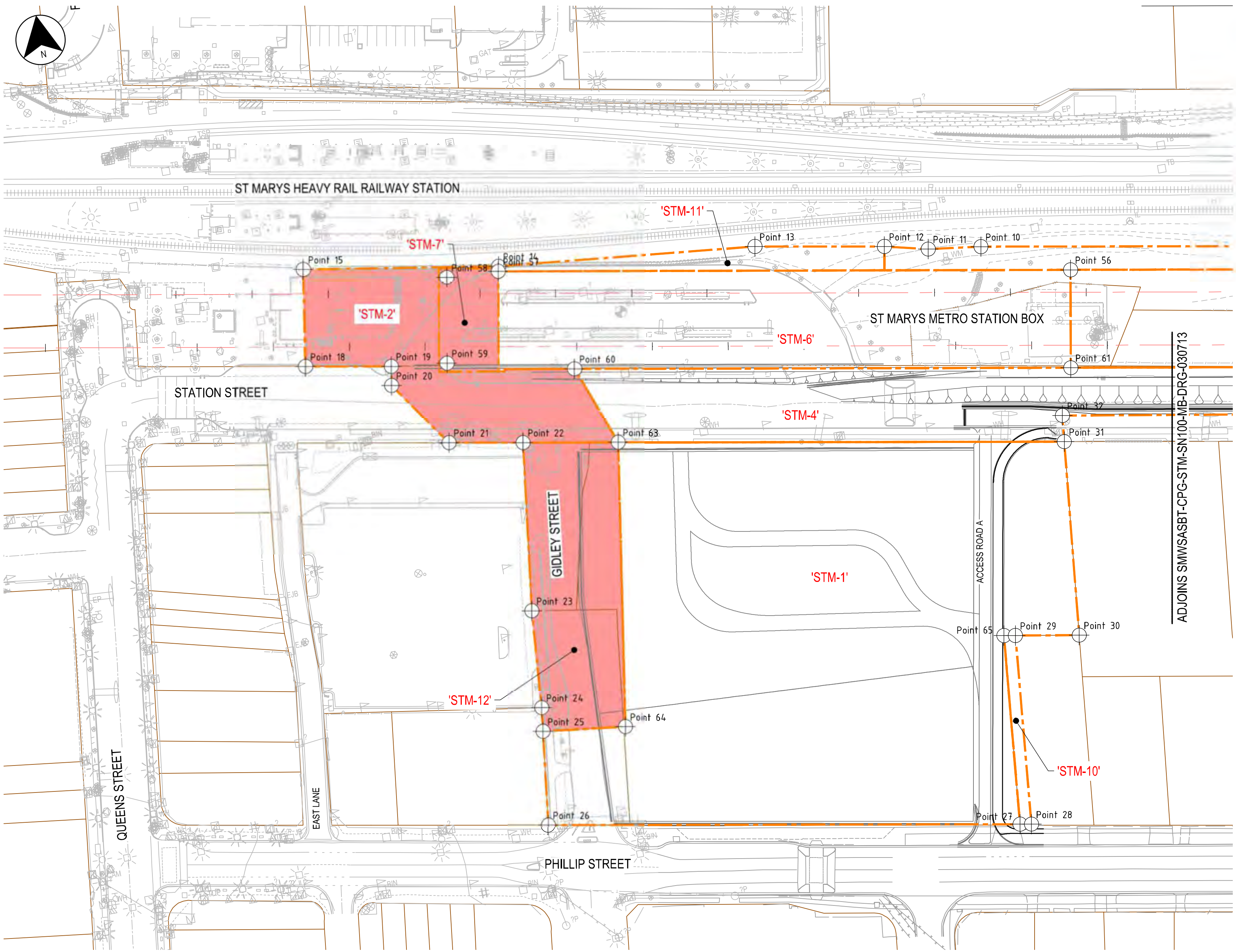
Other information reviewed, including previous site audit reports and statements relating to the site:

N/A

Site audit report details

Title: Site Audit Report – Remedial Action Plan, St Marys Station Box and Tunnelling Works, Sydney Metro Western Sydney Airport

Report no.: TO-095-B1R (Ramboll Ref: 318001447-001) Date: 16 February 2024



LEGEND

- CONSTRUCTION SITE BOUNDARY
- CADASTRAL BOUNDARY
- RAIL ALIGNMENT (BY OTHERS)
- TBM RETRIEVAL AREA
- 'STM-1' SITE ACCESS SCHEDULE PORTIONS. REFER SITE ACCESS SCHEDULES

SITE ACCESS SETOUT POINTS
(SYDNEY METRO)

BOUNDARY POINTS		
Point ID	EASTING	NORTHING
Point 1	[illegible]	[illegible]
Point 2	294462.519	6261850.163
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SYDNEY METRO - WESTERN SYDNEY AIRPORT - STATION BOXES AND TUNNELLING WORKS

ST MARYS STATION

MOBILISATION AND SITE ESTABLISHMENT

SITE ACCESS PLAN

SHEET 1

FILE No: SMWSASBT-CPG-STM-SN100-MB-M3D-030701 | SHEET: 1 OF 2 | ©

STATUS: STAGE 3 DETAILED DESIGN | EDMS No:

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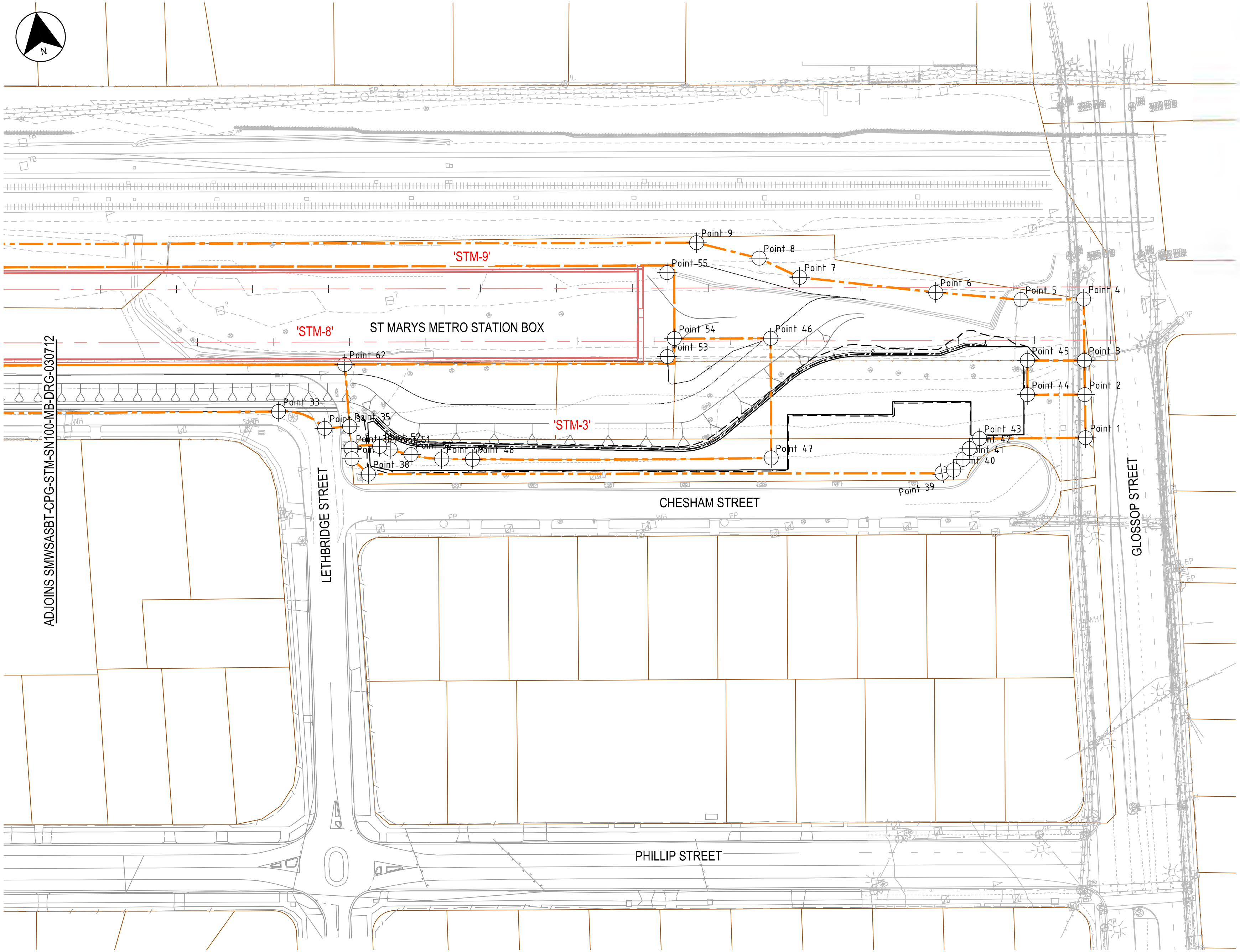

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ST MARYS STATION
MOBILISATION AND SITE ESTABLISHMENT
SITE ACCESS PLAN
SHEET 2

FILE No: SMWSASBT-CPG-STM-SN100-MB-M3D-030701 | SHEET: 2 OF 2 | ©
STATUS: STAGE 3 DETAILED DESIGN | EDMS No:
DRG No: SMWSASBT-CPG-STM-SN100-MB-DRG-030713 | REV B | VER

Part II: Auditor's findings

Please complete either Section A1, Section A2 or Section B, not more than one section. (Strike out the irrelevant sections.)

- Use **Section A1** where site investigation and/or remediation has been completed and a conclusion can be drawn on the suitability of land uses **without the implementation** of an environmental management plan.
- Use **Section A2** where site investigation and/or remediation has been completed and a conclusion can be drawn on the suitability of land uses **with the implementation** of an active or passive environmental management plan.
- Use **Section B** where the audit is to determine:
  - (B1) the nature and extent of contamination, and/or
  - (B2) the appropriateness of an investigation, remediation or management plan[1], and/or
  - (B3) the appropriateness of a site testing plan in accordance with the *Temporary Water Restrictions Order for the Botany Sands Groundwater Source 2017*, and/or
  - (B4) whether the terms of the approved voluntary management proposal or management order have been complied with, and/or
  - (B5) whether the site can be made suitable for a specified land use (or uses) if the site is remediated or managed in accordance with the implementation of a specified plan.

[1] For simplicity, this statement uses the term 'plan' to refer to both plans and reports.

Section A1

I certify that, in my opinion:

The **site is suitable** for the following uses:

(Tick all appropriate uses and strike out those not applicable.)

☐ Residential, including substantial vegetable garden and poultry

☐ Residential, including substantial vegetable garden, excluding poultry

☐ Residential with accessible soil, including garden (minimal home-grown produce contributing less than 10% fruit and vegetable intake), excluding poultry

☐ Day care centre, preschool, primary school

☐ Residential with minimal opportunity for soil access, including units

☐ Secondary school

☐ Park, recreational open space, playing field

☐ Commercial/industrial

☐ Other (please specify):

_____

OR

☐ I certify that, in my opinion, the **site is not suitable** for any use due to the risk of harm from contamination.

Overall comments:

_____

_____

_____

_____

_____

_____

Section A2

I certify that, in my opinion:

Subject to compliance with the **attached** environmental management plan[2] (EMP), the site is suitable for the following uses:

(Tick all appropriate uses and strike out those not applicable.)

☐ Residential, including substantial vegetable garden and poultry

☐ Residential, including substantial vegetable garden, excluding poultry

☐ Residential with accessible soil, including garden (minimal home-grown produce contributing less than 10% fruit and vegetable intake), excluding poultry

☐ Day care centre, preschool, primary school

☐ Residential with minimal opportunity for soil access, including units

☐ Secondary school

☐ Park, recreational open space, playing field

☐ Commercial/industrial

☐ Other (please specify):

EMP details

Title:

Author:

Date: No. of pages:

EMP summary

This EMP (attached) is required to be implemented to address residual contamination on the site.

The EMP: (Tick appropriate box and strike out the other option.)

☐ requires operation and/or maintenance of **active** control systems[3]

☐ requires maintenance of **passive** control systems only[3].

[2] Refer to Part IV for an explanation of an environmental management plan.
[3] Refer to Part IV for definitions of active and passive control systems.

~~Purpose of the EMP:~~

~~Description of the nature of the residual contamination:~~

~~Summary of the actions required by the EMP:~~

~~How the EMP can reasonably be made to be legally enforceable:~~

~~How there will be appropriate public notification:~~

~~Overall comments:~~

Section B

Purpose of the plan[4] which is the subject of this audit:

Remedial action plan for remediation to mitigate the drawdown of groundwater contaminated with volatile chlorinated hydrocarbons from 1-7 Queen Street which may pose an unacceptable risk to construction workers during excavation of the St Marys Sydney Metro station box.

I certify that, in my opinion:

(B1)

☒ The nature and extent of the contamination **has** been appropriately determined

☐ ~~The nature and extent of the contamination **has not** been appropriately determined~~

AND/OR (B2)

☒ The investigation, remediation or management plan **is** appropriate for the purpose stated above

☐ ~~The investigation, remediation or management plan **is not** appropriate for the purpose stated above~~

~~AND/OR (B3)~~

☐ ~~The site testing plan:~~

- ☐ ~~**is** appropriate to determine~~
- ☐ ~~**is not** appropriate to determine~~

~~if groundwater is safe and suitable for its intended use as required by the *Temporary Water Restrictions Order for the Botany Sands Groundwater Resource 2017*~~

~~AND/OR (B4)~~

☐ ~~The terms of the approved voluntary management proposal* or management order** (strike out as appropriate):~~

- ☐ ~~**have** been complied with~~
- ☐ ~~**have not** been complied with.~~

~~*voluntary management proposal no.~~

~~**management order no.~~

AND/OR (B5)

☒ The site **can be made suitable** for the following uses:

(Tick all appropriate uses and strike out those not applicable.)

☐ ~~Residential, including substantial vegetable garden and poultry~~

[4] For simplicity, this statement uses the term 'plan' to refer to both plans and reports.

~~☐ Residential, including substantial vegetable garden, excluding poultry~~

~~☐ Residential with accessible soil, including garden (minimal home-grown produce contributing less than 10% fruit and vegetable intake), excluding poultry~~

~~☐ Day care centre, preschool, primary school~~

~~☐ Residential with minimal opportunity for soil access, including units~~

~~☐ Secondary school~~

~~☐ Park, recreational open space, playing field~~

☒ Commercial/industrial

~~☐ Other (please specify):~~

IF the site is remediated~~/managed~~* in accordance with the following plan (**attached**):

*Strike out as appropriate

Plan title: St Marys Station, Remedial Action Plan, Sydney Metro Western Sydney Airport Station Boxes and Tunnelling Works

Plan author: Tetra Tech Major Projects Pty Ltd

Plan date: 23 May 2023 No. of pages: 561

SUBJECT to compliance with the following condition(s):

- Validation of the remediation works undertaken during excavation of the station box and tunnelling works is required to be documented in a final site validation report prepared by a qualified environmental consultant confirming that the works have been undertaken in accordance with the RAP and certifying the suitability of the site for the construction of a future underground train station.

- If an environmental management plan (EMP) is required at completion of the Station Box and Tunnelling Works, preparation of a Section B Site Audit Statement (SAS) by a NSW EPA Accredited Site Auditor reviewing the validation of remediation works and the EMP.

- Preparation of an addendum to the RAP and further site audit if ongoing dewatering of the structure is required or migration of contamination presents a risk to future site users after completion of Station Box and Tunnelling Works. The addendum to the RAP would be implemented as part of later works packages by incorporation into the design of the station or implemented as part of the operational phase of the project.

- Validation of the remediation works undertaken during construction of the station is required to be documented in a final site validation report prepared by a qualified environmental consultant confirming that the works have been undertaken in accordance with any addendum to the RAP and certifying the suitability of the site for the underground train station.

- Preparation of a Section A Site Audit Statement by a NSW EPA Accredited Site Auditor reviewing the above information and confirming the suitability of the site for the underground train station.

Overall comments:

The site history identified previous site uses with potential to cause contamination, including potential storage of fuels in USTs, uncontrolled filling of the site, demolition of former buildings and structures which contained hazardous building materials and current/former onsite and offsite commercial/industrial land uses (including an off-site dry cleaner that overlies the tunnel alignment).

Investigations at the site did not identify significant contamination requiring remediation in areas proposed to be disturbed as part of the Station Box and Tunnelling Works (SBT Works). However, a former dry cleaner located off-site at 1-7 Queen Street, St Marys was identified as a potential source of chlorinated hydrocarbon contaminants that may present an unacceptable risk to construction workers and future users of the site. The offsite dry cleaner has been notified to the NSW EPA under Section 60 of the *Contaminated Land Management Act 1997* as a potentially contaminated site due to chlorinated hydrocarbon impacts in soil and groundwater. The suspected source area is located directly over the tunnel alignment and approximately 100-120 m west of the station box excavation. Bulk excavation works beneath the groundwater table within the station box are likely to result in drawdown of impacted groundwater and migration of contamination towards the site.

A human health risk assessment (HHRA) prepared by TTMP concluded that chlorinated hydrocarbon contamination at the former dry cleaner at 1-7 Queen Street could pose a potentially unacceptable risk to worker health within the station box. The HHRA 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 should monitoring indicate that concentrations have, or will likely, become unacceptable.

A remedial action plan (RAP) prepared by TTMP proposed the establishment of a permeable reactive barrier (PRB), such as injected activated carbon, between the site and former dry cleaner to retard contaminated groundwater migration towards the station during the construction phase of the project (i.e. during dewatering of the excavation), as well as implementation of a monitoring and contingency plan.

If adequately implemented, the RAP should ensure that the site is suitable for construction of the proposed station at the completion of SBT works (construction phase works). Successful validation will be required to confirm this, which is to be documented in a validation report.

The RAP applies to SBT works. If a potential risk to the future users of the site (station staff and public) is identified after completion of Station Box and Tunnelling Works, an addendum to the RAP will be required as part of later works packages to describe measures that may be incorporated into the design of the station or implemented as part of the operational phase of the project.

A Site Audit Statement by a NSW EPA Accredited Site Auditor is required as a condition of Critical State Significant Infrastructure approval at the completion of remediation to confirm the suitability of the site for the intended use.

This SAS and accompanying Site Audit Report (SAR) were initially finalised on 11 May 2023. The RAP was subsequently updated and included requirements for an Environmental Management Plan (EMP) to be prepared to describe the scope of groundwater monitoring to

be undertaken during the later stages of works to demonstrate the Permeable Reactive Barrier (PRB) remains effective until the station box and tunnel is tanked and the groundwater flow direction returns to the pre-construction direction. CPBG requested that the SAR and SAS be revised to review the updated current version of the RAP.

Part III: Auditor's declaration

I am accredited as a site auditor by the NSW Environment Protection Authority (EPA) under the *Contaminated Land Management Act 1997.*

Accreditation no. 1505

I certify that:

- I have completed the site audit free of any conflicts of interest as defined in the *Contaminated Land Management Act 1997,* and
- with due regard to relevant laws and guidelines, I have examined and am familiar with the reports and information referred to in Part I of this site audit, and
- on the basis of inquiries I have made of those individuals immediately responsible for making those reports and obtaining the information referred to in this statement, those reports and that information are, to the best of my knowledge, true, accurate and complete, and
- this statement is, to the best of my knowledge, true, accurate and complete.

I am aware that there are penalties under the *Contaminated Land Management Act 1997* for wilfully making false or misleading statements.

Signed 

Date 16 February 2024

Part IV: Explanatory notes

To be complete, a site audit statement form must be issued with all four parts.

How to complete this form

Part I

Part I identifies the auditor, the site, the purpose of the audit and the information used by the auditor in making the site audit findings.

Part II

Part II contains the auditor's opinion of the suitability of the site for specified uses or of the appropriateness of an investigation, or remediation plan or management plan which may enable a particular use. It sets out succinct and definitive information to assist decision-making about the use or uses of the site or a plan or proposal to manage or remediate the site.

The auditor is to complete either Section A1 or Section A2 or Section B of Part II, **not** more than one section.

Section A1

In Section A1 the auditor may conclude that the land is *suitable* for a specified use or uses OR *not suitable* for any beneficial use due to the risk of harm from contamination.

By certifying that the site is *suitable*, an auditor declares that, at the time of completion of the site audit, no further investigation or remediation or management of the site was needed to render the site fit for the specified use(s). **Conditions must not be** imposed on a Section A1 site audit statement. Auditors may include **comments** which are key observations in light of the audit which are not directly related to the suitability of the site for the use(s). These observations may cover aspects relating to the broader environmental context to aid decision-making in relation to the site.

Section A2

In Section A2 the auditor may conclude that the land is *suitable* for a specified use(s) subject to a condition for implementation of an environmental management plan (EMP).

Environmental management plan

Within the context of contaminated sites management, an EMP (sometimes also called a 'site management plan') means a plan which addresses the integration of environmental mitigation and monitoring measures for soil, groundwater and/or hazardous ground gases throughout an existing or proposed land use. An EMP succinctly describes the nature and location of contamination remaining on site and states what the objectives of the plan are, how contaminants will be managed, who will be responsible for the plan's implementation and over what time frame actions specified in the plan will take place.

By certifying that the site is suitable subject to implementation of an EMP, an auditor declares that, at the time of completion of the site audit, there was sufficient information satisfying guidelines made or approved under the *Contaminated Land Management Act 1997*

(CLM Act) to determine that implementation of the EMP was feasible and would enable the specified use(s) of the site and no further investigation or remediation of the site was needed to render the site fit for the specified use(s).

Implementation of an EMP is required to ensure the site remains suitable for the specified use(s). The plan should be legally enforceable: for example, a requirement of a notice under the CLM Act or a development consent condition issued by a planning authority. There should also be appropriate public notification of the plan, e.g. on a certificate issued under s.149 of *the Environmental Planning and Assessment Act 1979*.

Active or passive control systems

Auditors must specify whether the EMP requires operation and/or maintenance of active control systems or requires maintenance of passive control systems only. Active management systems usually incorporate mechanical components and/or require monitoring and, because of this, regular maintenance and inspection are necessary. Most active management systems are applied at sites where if the systems are not implemented an unacceptable risk may occur. Passive management systems usually require minimal management and maintenance and do not usually incorporate mechanical components.

Auditor's comments

Auditors may also include **comments** which are key observations in light of the audit which are not directly related to the suitability of the site for the use(s). These observations may cover aspects relating to the broader environmental context to aid decision-making in relation to the site.

Section B

In Section B the auditor draws conclusions on the nature and extent of contamination, and/or suitability of plans relating to the investigation, remediation or management of the land, and/or the appropriateness of a site testing plan in accordance with the *Temporary Water Restrictions Order for the Botany Sands Groundwater Source 2017*, and/or whether the terms of an approved voluntary management proposal or management order made under the CLM Act have been complied with, and/or whether the site can be made suitable for a specified land use or uses if the site is remediated or managed in accordance with the implementation of a specified plan.

By certifying that a site *can be made suitable* for a use or uses if remediated or managed in accordance with a specified plan, the auditor declares that, at the time the audit was completed, there was sufficient information satisfying guidelines made or approved under the CLM Act to determine that implementation of the plan was feasible and would enable the specified use(s) of the site in the future.

For a site that *can be made suitable*, any **conditions** specified by the auditor in Section B should be limited to minor modifications or additions to the specified plan. However, if the auditor considers that further audits of the site (e.g. to validate remediation) are required, the auditor must note this as a condition in the site audit statement. The condition must not specify an individual auditor, only that further audits are required.

Auditors may also include **comments** which are observations in light of the audit which provide a more complete understanding of the environmental context to aid decision-making in relation to the site.

Part III

In **Part III** the auditor certifies their standing as an accredited auditor under the CLM Act and makes other relevant declarations.

Where to send completed forms

In addition to furnishing a copy of the audit statement to the person(s) who commissioned the site audit, statutory site audit statements must be sent to

- the **NSW Environment Protection Authority**: nswauditors@epa.nsw.gov.au or as specified by the EPA

  AND

- the **local council** for the land which is the subject of the audit.

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