SYDNEY METRO - WESTERN SYDNEY AIRPORT
STATION BOXES AND TUNNELLING WORKS

St Marys Station Validation Report

Sydney Metro Western Sydney Airport Station Boxes and Tunnelling Works

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Abbreviations

Abbreviation	Definition
ACM	Asbestos-Containing Material
ADE	ADE Consulting Group Pty Ltd
AEC	Area of Environmental Concern
AHD	Australian Height Datum
ARC	Australian Reinforcing Company
ASS	Acid Sulfate Soils
ATM	Airport Terminal Station
BSF	Bringelly Services Facility
CEMP	Construction Environmental Management Plan
CLM	Contaminated Land Management
CMF	Claremont Meadows Services Facility
COPC	Contaminant of Potential Concern
CPBG	CPB Ghella Joint Venture
CSM	Conceptual Site Model
DSI	Detailed Site Investigation
EIL	Ecological Investigation Level
EIS	Environmental Impact Statement
EMP	Environmental Monitoring Plan
ENM	Excavated Natural Materials
EPL	Environmental Protection License
HHRA	Human Health Risk Assessment
MIP	Membrane Interface Probe
NAPL	Non-Aqueous Phase Liquids
PFAS	Per- and Polyfluoroalkyl Substances
PFOS	Perfluorooctane Sulfonic Acid
POEO	Protection of the Environment Operations
PRB	Permeant Reactive Barrier
RAP	Remedial Action Plan

Abbreviation	Definition
SMF	Synthetic Mineral Fibre
SSRA	Site-Specific Risk Assessment
SSTOM	Stations Systems Trains And Operations and Maintenance
TBM	Tunnel Boring Machine
UST	Underground Storage Tank
VCH	Volatile Chlorinated Hydrocarbons
VENM	Virgin Excavated Natural Materials
WHS	Work Health and Safety
WSI	Western Sydney International

1.Introduction and Background

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

The site for the purpose of this Validation Report is located off Station St and Chesham St adjacent to the existing St Marys Railway Station on the T1 Western Line in St Marys, NSW (the STM site) as outlined in Table 2 in Section 4, and shown on Figure 1 in Appendix 1.

SBT Works at the STM site includes demolition of existing buildings/structures, establishment of temporary offices, amenities, car parking and access roads, site levelling (bulk excavation) and reuse of excavated material, piling, and station box excavation (a rectangular structure with an area of approximately 8,000m^2) to approximately 18.5 m Australian Height Datum (AHD). The SBT Works at the STM site comprises two main phases which include:

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

Completion of the St Marys Sydney Metro Station including lining of the station box such that it will comprise an undrained (tanked) structure is outside the scope of the SBT Works and will be completed under a Stations Systems Trains and Operations and Maintenance (SSTOM) works package. It is understood that the final land use for the STM site will be analogous with a commercial/industrial land use with hardstand and minimum soft landscaping.

TTMP was engaged to prepare this validation report to document the remediation and validation works carried out at the STM site during SBT Works.

TTMP previously carried out contamination investigations for the STM site including a Detailed Site Investigation (DSI), additional supplementary investigations (presented as addendums to the DSI), and preparation of a Human Health Risk Assessment (HHRA) as outlined in Section 7. In summary, contamination which required remediation/management for the SBT Works at the STM site comprised a plume of volatile chlorinated hydrocarbons (VCH) which could potentially migrate from a former dry cleaner at 1-7 Queen St (approximately 60m west-north-west of the STM site) to the station box during construction from groundwater drawdown and dewatering. A Remedial Action Plan[1] (RAP) was subsequently prepared which provided a strategy to mitigate potential risks to human health from VCH impacted groundwater during SBT Works by installing a Permeable Reactive Barrier (PRB) between the station box and source area to retard contaminated groundwater migration towards the station, complimented with a program of groundwater monitoring to monitor the potential migration of VCHs during construction, and implementation of contingency measures (if required based on the outcome of monitoring). The proposed and adopted remedial strategy is discussed in more detail in Section 9.2.

A NSW EPA Accredited Site Auditor, Tom Onus of Ramboll Australia Pty Ltd, carried out a review of the RAP (revision A07, dated 2 February 2023) and the HHRA and provided interim audit advice (IIA14[2]) and considered that the proposed remediation approach presented in the RAP was feasible and suitable for the purpose.

[1] TTMP. St Marys Station - Remedial Action Plan - Sydney Metro Western Sydney Airport Station Boxes and Tunnelling Works. Prepared for CPBG. Ref: SMWSASBT-CPG-SWD-SW000-GE-RPT-040521. Revision: A08. Dated 23 May 2023
[2] Ramboll Australia Pty Ltd. Interim Audit Advice Letter No.14 - Review of Remedial Action Plan and Human Health Risk Assessment, Sydney Metro Western Sydney Airport St Marys Station, Station Street, St Marys NSW. 7 February 2023.

1.1. Project Overview

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

The SBT Works are divided into two parts:

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

Key elements on the SBT Works include:

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

Figure A: Overview of SBT Works

1.2. Requirements to Prepare a Validation Report

Table 1 summarises Project documentation relevant to the preparation of a Validation Report for the SBT Works at the STM site.

Table 1: Requirements and Recommendations for a Validation Report for the SBT Works at the STM site.

Document	Comment
Environmental Impact Statement (EIS) and Submissions Report	The Contamination Technical Paper of the EIS and Submissions Report included a mitigation measure (SC3) for off-airport areas regarding the preparation of a RAP where additional data review and detailed site investigation confirmed that contamination would require remediation. Condition SC3 states that "Remediation would be performed as an integrated component of construction and to a standard commensurate with the proposed end use of the land."
Infrastructure Approval	Condition E95 of Sydney Metro Western Sydney Airport – Conditions of Approval (SSI 10051) requires that "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)". Validation Report(s) must be submitted to the Planning Secretary and the Relevant Council(s) for information.
Design and Construct (D&C) Deed	The Project D&C Deed[3] states that each Validation Report, Site Audit Statement and Site Audit Report must relate to each area where a Detailed Site Investigation is performed in accordance with clause 12.19, be prepared using Good Industry Practice and in accordance with the requirements of Law, the Planning Approvals, all guidelines made or approved by the EPA and any other requirements of this deed. Additionally, each Validation Report must: • Describe the Remediation activities completed. • Present all relevant information and data to demonstrate that risks associated with Contamination have been mitigated to an acceptable level. • Be reviewed and approved by a Certified Contaminated Land Consultant and endorsed by an Accredited Site Auditor. • Be accompanied by an Interim Site Audit Advice produced by the Accredited Site Auditor.
RAP	Section 12 of the RAP states that at the completion of the SBT Works, a Validation Report shall be prepared documenting the Preparatory Works completed within the site. The report shall be prepared in general accordance with the: • NSW EPA Contaminated Land Guidelines: Consultants Reporting on Contaminated Land, 2020 and • National Environment Protection Council, National Environment Protection (Assessment of Site Contamination) Measure, 1999 (amended April 2013) (ASC NEPM). The RAP also states that a separate Validation Report will be required following completion of the SSTOM works. The scope and requirements of that Validation Report is to be determined as part of the SSTOM works and documented in the RAP prepared which is specific to that work package.

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

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

2. Validation Report Objective

NSW EPA guidance[4] defines the objective of a Remediation and Validation Report as being "*to detail the site work undertaken and demonstrate compliance with the remedial action plan for the site, and compliance with contaminated land guidelines and all other applicable regulatory requirements*".

The Validation Report must:

- Clearly describe the remedial works undertaken, the validation carried out and the final condition of the site.
- Confirm statistically that the remediated site complies with the remediation criteria set for the site.
- Assess the results of the post-remediation testing against the remediation criteria stated in the RAP. Where these criteria have not been achieved, reasons must be stated and additional site work proposed to achieve the original objectives, or a management plan put in place.

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

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

3. Technical and Regulatory Framework

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

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

4.STM Site Information

4.1. STM Site Identification

The STM site is located in St Marys and is shown in Figure 1 in Appendix 1. Key attributes of the site are summarised in Table 2.

Table 2: Site Information

Attribute	Description
Address (centre of STM site)	63 Station Street, North St Marys NSW 2760 (Approx. Chainage 17,300m to 17,900m, as shown in Figure 2 in Appendix 1)
STM Site Area	Approximately 3.9 hectares (Ha).
Title Identification Details	Part Lot 6201 DP1284283 Lot 1 DP1001735 Lot 6202 DP1284283 Lot 6203 DP1284283 Lot 7 and Lot 8 DP734738 Part Lot 9 DP840717 Road and Road Reserve for part of Station Street CPBG confirmed that the site boundary is the same as presented in the RAP (Shown in Figure, Appendix 1).
Land Use (Prior to Remediation, as outlined in the RAP)	**Station Box and Surface Works Construction Area. Formerly:** • St Marys Bus Interchange • Sydney Trains Emergency Response Depot (Bus Driver Rest Compound east of bus interchange) – 1 Station Street • Cleared land within the rail corridor • Station Street • St Marys Station Plaza (commercial/retail centre) including a portion of the adjacent Car Park.
Current Land Zoning	Land zones SP2 (Infrastructure – Railway), R4 (High Density Residential) and MU1 (Mixed Use) under the Penrith Local Environment Plan 2010

Attribute	Description
Adjoining Land Uses	**North:** St Marys Train Station and Railway corridor. North of the rail corridor is the St Marys Commuter Carpark (surface and multistorey carpark) in the north-east, and commercial/light industrial (warehouse) activities in the northwest (Showerama, Evolution Windows System, Wilkins Windows). In the far north-western corner (and north of the rail corridor) is a substation. In the far north-eastern corner is the Australian Reinforcing Company (ARC) manufacturing facility (west of Forrester Road) who supply steel reinforcement to the construction industry. Land use along the northern side of Harris Street includes a range of commercial / light industrial activities (smash repairs, automotive mechanic, veterinary laboratory, agricultural chemical warehouse, timber yard, commercial cleaning, driving school, vehicle inspection service, motorhome yard). The EIS technical report indicates that two of the facilities (Vetlab and Autopak Formulations) are licenced under the POEO Act to undertake activities including: chemical production, storage, and waste generation; pesticide production, waste storage, pharmaceutical and veterinary product production, and non-thermal treatment of hazardous and other waste. **South**: South of site and east of Gidley Street is a residential area with a mixture of single detached houses and units / apartments. South of site and west of Gidley Street are commercial / retail activities and the car park for St Marys Station Plaza, and other public car park facilities. **East:** Glossop Street. East of Glossop Street is a residential area south of the rail corridor, and a commercial / industrial area north of the rail corridor. **West:** West of the site include the car park for the St Marys Station Plaza, commercial / retail premises between Gidley Street and Carinya Avenue, and a residential area west of Carinya Avenue. Approximately 60m west-north-west of the site is a former dry cleaner located at 1-7 Queen St.

4.2. Site Description (Pre-Remediation)

At the time of preparing the RAP, the site was an active construction site associated with the SBT Works. The following, where noted has been summarised from the RAP which was based on observations made by TTMP on the 14 and 15 March 2022 prior to site establishment and Preparatory Works by CPBG. A recent description of the site (post remediation) is provided in Section 9.4.

4.2.1. St Marys Station Plaza

During a site visit on the 14 and 15 March 2022, TTMP noted the following:

- St Marys Station Plaza comprised a vacant, commercial shopping centre.
- The shopping centre comprised 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 that was observed to be in good condition with some minor oil staining from motor vehicles on the hardstand.
- A small area used for the storage of cleaning chemicals was observed.
- A car wash with an oil separator and sub-surface drainage was present in the car park.
- TTMP considered that 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 property along Station Street.

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

During a site visit on the 14 and 15 March 2022, TTMP noted the following:

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

4.2.3. St Marys Bus Interchange

A description of the STM site which was previously occupied by St Marys Bus Interchange was not included in the previous reports or RAP. St Marys Bus Interchange occupied the north-eastern portion of the STM site on the northern side of Station Street opposite St Mary's Plaza and car park. Google Steet View imagery from November 2020 and an aerial photo May 2022 indicates that:

- This portion of the site was predominantly covered with hardstand (brick pavers and concrete) with some minor landscaping (trees and shrubs).
- A small building (Heritage Listed Goods Shed[5], circa 1880) was present in the north-east of the STM site.

[5] https://www.hms.heritage.nsw.gov.au/App/Item/ViewItem?itemId=5012221, accessed 20 July 2023.

5. Environmental Site Setting Summary

The following has been summarised from the RAP.

Table 3: Site Environmental Setting

Aspect	Description
Topography	The topographic map of NSW indicates the site is situated at an elevation of approximately 36 m to 50 m AHD. The land slopes down in a westerly direction towards South Creek located approximately 900 m west of the site.
Geology	The Penrith 1:100 000 scale geology map indicates that the site is underlain by Bringelly Shale of the Wianamatta Group which was deposited in a deep marine environment of the Middle Triassic. The Bringelly Shale is described as shale, carbonaceous claystone, laminite, lithic sandstone, with rare coal. Site specific ground conditions as summarised from the DSI are presented in Section 7.1.2 and a geotechnical cross-section of the site (Pre-Remediation) is included in Appendix 2.
Hydrology and Hydrogeology	There are no surface water bodies within the site. The nearest surface watercourses to the site include a minor, unnamed tributary of South Creek present approximately 420m to the north, and South Creek which is located approximately 900m to the southwest (at its nearest point). The existing groundwater level at the site within the Bringelly Shale was assessed in the St Marys DSI in 2022 to be approximately 34 m AHD, although perched water was considered to potentially be present at the soil/rock interface. Groundwater was considered to flow in a westerly direction towards South Creek.
Registered Groundwater Bores	The nearest licensed groundwater bores (GW112625, GW112626 and GW112627) are located approximately 750 m northwest of the site and are located on residential properties (previously a service station). All three bores were installed as monitoring wells to 6 m below ground surface (bgs).
Salinity	A review of the [Salinity Potential of Western Sydney] map indicates that the site is mapped as having moderate salinity.
Acid Sulfate Soils (ASS)	ASS risk mapping indicates that the site is located in an area with Extremely Low Probability of Occurrence of ASS.
List of Contaminated Sites Notified to the EPA	A search of the List of NSW Contaminated Sites Notified to NSW EPA (as of 8 March 2022) was carried out on 13 April 2022. Two properties were recorded on the register comprising the following: • NS1513: 1 to 7 Queen Street (Former dry cleaner that is now vacant). This site is located above the Tunnel from approximately Chainage 17,800 to 17,850. • NS1189: 76 Glossop Street (Service station) located approximately 300 m north of the site.
NSW EPA Contaminated Land Public Record	A search of the NSW EPA Contaminated Land Public Record was carried out on 13 April 2022 for declaration notices, orders made by the EPA under the CLM Act 1997, voluntary management proposals approved under the CLM Act 1997, and site audit statements relating to significantly contaminated land. The search of the database revealed that the site, or properties within 250 m of the site, are not listed on the contaminated land public record.

6. Site History Summary

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

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

7.Summary of Previous Reports

The reports listed in Table 4 were prepared by TTMP and were used to inform the remedial strategy outlined in the RAP. A summary of these reports, as presented in the RAP, is provided below.

Table 4: Previous Reports

Report	Reference
DSI (St Marys DSI)	St Marys Station - Detailed Site Investigation - Sydney Metro Western Sydney Airport Station Boxes and Tunnelling Works. Prepared for CPBG. Ref: SMWSASBT-CPG-SWD-SW000-GE-RPT-040513. Revision: A03. Dated 27 September 2022
DSI Addendum (St Marys Groundwater Addendum)	St Marys Station - Detailed Site Investigation Addendum Groundwater Monitoring Data - Sydney Metro Western Sydney Airport Station Boxes and Tunnelling Works. Prepared for CPBG. Ref: SMWSASBT-CPG-SWD-SW000-GE-RPT-040518. Revision: A01. Dated 23 November 2022
DSI Addendum (St Marys Plaza Addendum)	Detailed Site Investigation Addendum St Marys Station. Prepared for CPBG. Ref: SMWSASBT-CPG-SWD-SW000-GE-RPT-040516. Revision: A02. Dated 13 October 2022
Human Health Risk Assessment (Queen St HHRA)	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. Prepared for CPBG. Ref: SMWSASBT-CPG-SWD-SW000-GE-RPT-040540. Revision: A05. Dated 26 April 2023

7.1. Detailed Site Investigation

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

7.1.1. DSI Objectives and Scope Summary

The objectives of the DSI were to:

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

The DSI included:

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

7.1.2. Ground Conditions

In summary, ground conditions generally comprised:

- Hardstand in some investigation locations:
  - Commercial car park between West Lane and Carinya Ave (asphalt in SBT-CM-1022).
  - At grade car park north of St Marys Station Plaza building (asphalt in SBT-BH-1220 to SBT-BH-1222).
  - St Marys Bus Interchange (concrete in SBT-BH-1200 and brick pavers in SBT-BH-1215).
  - 1 Station Street (concrete in SBT-BH-1007, SBT-BH-1202 and SBT-BH-1232).
- Fill materials, including topsoil, were typically to depths of between 0.2 m and 1.5 m. Deeper fill was encountered in SBT-BH-1200 to a depth of 2.5 m.
  - Brick fragments were observed in shallow fill in SBT-BH-1215 (St Marys Bus Interchange) which were attributed to the brick pavers.
  - Brick, terracotta tiles and potential asbestos-containing material (ACM) as fibre cement debris was identified in fill in the offsite property of 1-7 Queen Street (SBT-GW-1018 and SBT-GW-1019).
- Residual soils were encountered beneath the fill and were generally described as silty clay with sandy clay from 6.5m bgs and increasing sand from 14m to 16m bgs. An approximately 3-metre-thick band of weathered siltstone with clay was encountered at 16m bgs, with bedrock (assumed siltstone) from 19m bgs.
- The Bringelly Shale within the site was described as distinctly bedded, inter-laminated siltstone and sandstone. Based on the cross-section presented in Appendix 2, and the Bringelly Shale Formation was encountered at approximate elevations of 42m AHD in the east of the site (Chainage 17,300m) reducing to approximately 23m AHD in the west of the site (Chainage 17,900m).

7.1.3. Groundwater

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

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

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

Project Area Excluding 1-7 Queen Street

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

Within the project area (excluding 1-7 Queen Street) groundwater monitoring identified a range of potential contaminants including metals, hydrocarbons, organic compounds, ammonia and PFAS that exceeded the adopted assessment criteria for the project. The DSI concluded these

contaminants of potential concern (COPC) were likely to be derived from natural and diffused urban/industrial sources within and surrounding the project area.

1-7 Queen Street

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

The maximum concentrations of chlorinated hydrocarbons reported were higher than those reported in previous investigations and were identified in deeper groundwater monitoring wells installed at this site and those which were installed to target areas which reported highest levels of impact from a membrane interface probe (MIP) survey.

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

In comparison to the project area excluding 1-7 Queen St, concentrations of PFAS were reported in monitoring wells from the former dry cleaners at1-7 Queen St. The highest concentration of Perfluorooctane sulfonic acid (PFOS) reported from groundwater monitoring wells was 1.07 µg/l which exceeded the Freshwater Guidelines with 95% species protection[8]. Dry cleaners are known potential sources of PFAS.

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

7.1.4. Key Findings of DSI and Queen St HHRA

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

- Potential ACM (as fibre cement debris) was identified in fill at the 1-7 Queen Street property; however the presence of asbestos was not confirmed through laboratory analysis. The presence and extent of asbestos impact at this property is unknown however the risk was considered to be low given no excavation works associated with the SBT works for the STM site were planned at this property. Zinc was also identified in soil at this property above ecological criteria however no soil disturbance was proposed in this area during construction.
- At 1-7 Queen Street VCHs (PCE, TCE, DCE and vinyl chloride) were identified in soil and groundwater and soil vapour at the 1-7 Queen Street Property (former dry cleaners) with highest concentrations reported close to the building. The concentrations reported were considered to pose potentially unacceptable risks to future occupants of the property and subsurface construction workers during construction of the station box and tunnel. In addition to posing a potential unacceptable risk to human health, contaminated groundwater migrating towards the station box was considered to have the potential to

[6] Chlorinated hydrocarbons reported include tetrachloroethene (PCE) and trichloroethene (TCE), cis-1,2-dichloroethene (cis-1,2 DCE), trans-1,2-dichloroethene (trans-1,2-DCE) and vinyl chloride
[7] TCE, DCE and vinyl chloride are breakdown products of PCE.
[8] LDPE hydrasleeves were used in the monitoring wells at 1-7 Queen St and HDPE sleeves were used in all other monitoring wells. LDPE hydrasleeves have the potential to absorb PFAS however it is considered unlikely that the deployment of these hydasleeves would have changed findings which have reported elevated concentrations of PFAS at this site.

impact on the classification of soil/rock materials requiring excavation and disposal for construction of the tunnel and station box.

- PFAS, heavy metals and nutrients (ammonia) were identified in groundwater which were considered to be derived from diffused sources in the project area and considered unlikely to pose an unacceptable risk to construction workers and future users of the site. Groundwater intercepted by the project containing these COPC would be treated to comply with Planning Condition E129 or an Environmental Protection License (EPL) approved by the NSW EPA.
- Fill, soil and rock materials within the Station Box and St Marys Plaza site was not considered to pose an unacceptable risk to future users of the site where the completed train station would be predominately covered in hardstand with minimal soft landscaping.

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

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

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

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

- Classification of waste spoil prior to off-site disposal.

With regards to uncertainty of asbestos and lead within AEC 3A noted above, TTMP prepared a Technical Memorandum[9] discussing preliminary results of the DSI. The Technical Memo concluded that there was a low-risk of contamination within area AEC3A based on a review of additional information including a Valuation Report which stated that remediation works had taken place at 11-13 Chesham Street (which includes the former location of the Girls Guide Hall (AEC3A)) including the excavation and off-site disposal of asbestos impacted soils; validation of removal by environmental consultant; and reinstatement of remedial excavation with validated Virgin Excavated Natural Materials (VENM). A recommendation was made in the Technical Memorandum to segregate topsoil/fill within the footprint of AEC 3A and buffer around this area as a precaution prior to reuse/disposal.

7.2. St Marys Plaza DSI Addendum

Investigation locations completed at St Marys Plaza were reported in the DSI Addendum (St Marys Plaza Addendum). TTMP concluded for the St Marys Plaza site that the land was suitable for commercial/industrial use. Analytical data tables included in this addendum have been included in Appendix 3.

7.3. Groundwater Monitoring DSI Addendum: Findings

The groundwater data included in the DSI Addendum (St Marys Groundwater Addendum) indicated that groundwater in the project area was impacted with contaminants including metals, hydrocarbons, organic compounds, ammonia and PFAS which were considered likely to be derived from natural and diffuse urban/industrial sources in the project area. During construction groundwater was required to be treated to comply with Planning Condition E129 or an Environmental Protection License (EPL) approved by the NSW EPA.

7.4. Queen Street HHRA: Findings

Further investigation and HHRA were undertaken at the former dry cleaner located at 1-7 Queen Street, St Marys. The location of the former dry cleaners is shown in Figure 1, Appendix 1 and is located approximately 60 m west-north-west of the station box.

The scope of work completed included:

- Drilling and sampling to refine the understanding of vertical distribution of chlorinated hydrocarbon impact in soil and rock.
- Additional groundwater sampling was conducted at multiple depths in new and existing wells, along with hydraulic conductivity testing in all available groundwater wells within 30 m of the suspected source area.

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

- Using the new and existing site-specific information the preparation of a transport model to estimate the time contaminated groundwater would take to reach the station box, once de-watering induces drawdown.
- Completion of a Human Health Risk Assessment (HHRA).

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

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

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

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

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

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

The HHRA indicates that the RAP, which was being prepared at the time of the HHRA) adopted the installation of a PRB in Queen Street as the primary mitigation measure with consideration to other project requirements including spoil management and the SSTOM Works.

8. Conceptual Site Model (Pre-Remediation)

Contamination, if not managed appropriately could pose a potential risk to human health and/or the environment during construction or future use of the site. For an environmental or human health risk from contamination to be present, there must be a plausible pollutant linkage between the source and a receptor by means of a transport mechanism (pathway).

A summary conceptual site model (CSM) for the STM site based on the findings of the previous site assessments is presented in Table 5.

Table 5: Conceptual Site Model (Pre-Remediation)

Identified Contamination Sources	Potential Transport Mechanisms & Plausible Exposure Pathways	Potential Receptors
VCH Contaminated Groundwater at 1-7 Queen Street, St Marys	Potential migration of the groundwater plume during construction. Associated with excavation of the station box which will including groundwater drawdown and dewatering. Volatilisation of seepage water in an unlined excavation (station box structure).	Station box workers from inhalation of VHCs should groundwater impact reach the excavation.
	Groundwater inflow (minor seepage) into the station during operational and maintenance phases following waterproofing of the station box as part of the SSTOM Works Package.	Future site users from inhalation of VHCs should groundwater impact reach the station.

9. Remediation and Validation Works

9.1. Remediation Objectives

The primary objective for the remediation of the site, as outlined in the RAP, was to make it suitable for its intended use as a train station.

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

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

However, it was considered that bulk excavation beneath the groundwater table could cause VCH impacted groundwater to migrate from the former dry cleaner at 1-7 Queen St to the station box as a result of groundwater drawdown and dewatering. It was concluded in the Queen Street HHRA that VCH contaminated groundwater may pose an unacceptable risk to construction workers working within the station box from vapour inhalation until the excavation was lined (tanked), which triggered the need for remediation / management.

9.2. Remedial / Management Strategy

The RAP included a remediation strategy to manage potential risks from VCH impacted groundwater off-site during both construction and operational phases of the project.

9.2.1. Construction Phase (SBT Works)

The remedial / management strategy adopted for the site was generally consistent with that outlined in the RAP comprised:

- Installation of a PRB to abate the migration of contaminated groundwater from 1-7 Queen Street towards the station box.
- Groundwater monitoring and implementation of a contingency plan for active mitigation of the VCH groundwater plume, if required.

Furthermore, the RAP included requirements to:

- Inspect fill during excavation for potential ACM.
- Segregate topsoil/fill within AEC3A and Buffer during excavation.
- Assess and manage surplus spoil prior to off-site disposal or export in accordance with the Waste and Recycling Management Procedure developed for the Project.
- Assess imported materials to confirm suitability (from a contamination perspective) for use at the STM site.
- Manage unexpected finds.

CPBG confirmed there were no deviations from the RAP.

9.2.2. Operational Phase (SSTOM Works Package)

The RAP also included potential management measures to mitigate/manage potential risks to human health at the STM site from VCH impacted groundwater as part of the operational phase (to be delivered as part of the SSTOM works package) such that the site could be made suitable for use as a train station. Implementation and validation of such measures is outside the scope of this Validation Report.

9.3. Key Parties Involved in Remediation and Validation

The following companies were involved in the remediation and validation works at the site.

Table 6: Key Parties involved in Remediation and Validation

Party	Role
CPBG	Principal Contractor / Developer. CPBG were responsible for implementing the RAP.
Airsafe Laboratories Pty Ltd	Occupational Hygienist / Licenced Asbestos Assessor: Asbestos fibre air monitoring and clearance certificates
ADE Consulting Group Pty Ltd (ADE)	Environmental Consultant: Preparation of material classification assessments.
Auswide Operations Pty Ltd Trading as Mann Group NSW (Auswide)	Demolition Contractor & Earthworks Subcontractor SafeWork NSW Class A Licenced Asbestos Removal Contractor (SafeWork Licence AD212715)[10] / Supervisor
United Infrastructure Pty Ltd	Site Establishment Earthworks Subcontractor
Cono Services Pty Ltd	Bulk Excavations of Station Box
Spoil Haulage Contractors	Bakers Group, Mann Group, and Burtons
TTMP	Validation consultant. TTMP carried out the following scope: • Preparation of material classification assessments. • Groundwater monitoring associated with PRB installation. • Site visit at the completion of remedial works. • Review of documentation provided by CPBG relating to remedial works carried out. • Preparation of this Validation Report.

[10] https://verify.licence.nsw.gov.au/details/Asbestos%20Removal%20Licence/30728, accessed 19 July 2023.

9.4. Site Description (Post-Remediation)

A site inspection was carried out by a suitably qualified and experienced Environmental Consultant on 19 July 2023. Site photographs are presented in Appendix 9. The following key observations were made:

- Cut/Fill Earthworks:
    - CPBG advised that no further cut and fill activity at the site was required. All excavation activity associated with the top 2m of fill around the Station Box was complete.
    - It was noted that a temporary earthen access ramp had been constructed adjacent to the south-western corner of the Station Box (between the railway easement boundary and Station Box). A relatively small volume of existing soil between the railway easement boundary and the station box appeared to have been excavated to form the ramp. Some soil and vegetation remained undisturbed around a power pole. No visual and/or olfactory evidence of contamination, foreign material (including suspected ACM) was apparent within the exposed soil. Some Station Box spoil (crushed Bringelly Shale) had also been transported to the area and used to form the ramp.
- Station Box excavation: The excavation of the Station Box was in progress. CPBG indicated that completion of the Station Box excavation was scheduled for the end of August 2023.
- Stockpiles: Stockpiles were observed within the St Marys Plaza comprising:
    - Two relatively large stockpiles of mixed clays and shales from the Station Box. This material was being transported from the Station Box in Moxy Earthmovers to the lay down area where it was being loaded into truck and dogs and transported off site.
    - One relatively small stub tunnel stockpile (not observed in close proximity due to accessibility/safety constraints) was located at the south-eastern corner of the Plaza. This material was reportedly being segregated from other materials.
    - A segregated stockpile of imported crushed sandstone was located along the eastern boundary of the Plaza area.
    - A relatively small, segregated stockpile of concrete waste (including rubble and washout waste) was located in the south-western portion of the Plaza
- Retained Pavements:
    - Areas surrounding the Plaza to the west and north-west comprised remnant roadways/kerbing and paving that had remained undisturbed.
    - Also, an area surrounding a heritage building (Goods Shed) were largely undisturbed, however some paving appeared to have been removed/relocated as part of construction.
- General site conditions: The site appeared be well organised with machinery, tools and equipment being stored and/or operating within designated areas. Chemical storage appeared to be contained, with portable bunds in use under bulk containers, and bunded areas being utilised where potential spills may occur (i.e., grout batching plant at western portion of Plaza). No evidence of uncontrolled waste or spills were apparent. No evidence of the presence of suspected ACM was observed.

9.5. Unexpected Finds and Incidents

CPBG provided TTMP with an Incident Register, a copy of which is included in Appendix 10.

9.5.1. Unexpected Finds

With the exception of ACM within soil and as conduits, CPBG did not report any other unexpected finds during delivery of the SBT Works at the STM site.

The table below summarises how CPBG managed each of the unexpected finds based on information provided by CPBG and TTMPs interpretation of these records. Documentation and correspondence provided by CPBG is included in Appendix 10. The inferred location of UPFs are also shown on Figure 6 in Appendix B.

UPF Management			
neral Comments	Disposal Information	Asbestos Clearance Certificate	Asbestos
M impacted soil was initially identified during clearing rks on 22 July 2022 in the vicinity of Gate 1. e ACM impacted soil was subsequently excavated and posed off-site. MP understands that the extent of ACM impacted soil sociated with this UPF was inferred/guided by visual servations made by CPBG Mann Group.	The ACM impacted soil associated with these UPFs were excavated and disposed off-site by Mann Group between: • 2 and 5 September 2022 with waste classification report 'WAC1.v1f'. • 29 September to 12 October 2022 with waste classification report 'MAC1a-v3f'. This spoil was captured in a Spoil Tracking Register - waste disposal records are discussed in Section 9.6.4.	A clearance certificate was prepared following the removal of the ACM impacted soil (Refer to ACC01 in Table 13 - inspection date of 29 July 2022). TTMP notes that this clearance states that *"In-situ material remains in the form of stockpiles on site. These are still considered contaminated and are not part of this clearance report."* CPBG subsequently provided a time lapse photograph (dated 25 August 2022) which shows stockpiles had been removed/moved from that area with the exception of an asbestos impacted stockpile(s) and asbestos impacted soil along a batter which was covered with white geotextile fabric – refer to UPF05, UPF06 and UPF07 below.	Asbestos f carried out monitoring summarise
M impacted soil was identified during earthworks in the inity of Gate 2. The ACM impacted soil was emu picked Mann Group and then subsequently excavated and posed off-site. MP understands that the extent of ACM impacted soil sociated with this UPF was inferred/guided by visual servations made by CPBG Mann Group.		A clearance certificate was prepared following emu picking (Refer to ACC02 in Table 13 - inspection date of 2 August 2022).	
M impacted soil was identified during a waste ssification assessment in the vicinity of a test pit (TP18) d Gate 2 on 14 September 2022. e ACM impacted soil was subsequently excavated and posed off-site. MP understands that the extent of ACM impacted soil sociated with this UPF was inferred/guided by visual servations made by CPBG Mann Group.		A clearance certificate was prepared following the removal of ACM impacted soil (Refer to ACC04 in Table 13 - inspection date of 7 October 2022).	
M impacted soil was identified during earthworks in the inity of test pit (TP18) and Gate 2 on 8 October 2022. e ACM impacted soil was subsequently excavated and posed off-site. MP understands that the extent of ACM impacted soil sociated with this UPF was inferred/guided by visual servations made by CPBG Mann Group.		A clearance certificate was prepared following the removal of ACM impacted soil (Refer to ACC05 in Table 13 - inspection date of 12 October 2022).	

UPF Management			
neral Comments	Disposal Information	Asbestos Clearance Certificate	Asbestos
stockpile denoted AEC 3A, discussed in CPBG's 'STM bestos Report – August 2023', was confirmed to ntain asbestos during preparation of a waste ssification report (Ref: WAC1.V1f). PBG has provided a time lapse photograph (dated 25 gust 2022) which shows a stockpile(s) which was vered with geofabric adjacent to UPF06 spoil at the top the batter. Given the date of disposal and location, it's ssible that this stockpile(s) contains the AEC 3A spoil.		A clearance certificate (Refer to ACC03 in Table 13 - inspection date of 5 September 2022). TTMP notes that it is unclear whether this clearance is related to Stockpile AEC 3A as the photographs in the clearance certificate do not provide sufficient context.	
soil from Stockpiles A, B and C discussed in CPBG's TM Asbestos Report – August 2023' were placed along existing batter in the north-east of the site under pervision of an asbestos supervisor to enable the nstruction of the site sheds. spected ACM was subsequently identified in the spoil, d ADE classified the spoil (approximately 1,000m^3) as ecial Waste – Asbestos under report 22.0880.LTR1.v2f. MP understands that the extent of ACM impacted soil sociated with this UPF was inferred/guided by visual servations made by CPBG Mann Group. PBG has provided a time lapse photograph (dated 25 gust 2022) which shows this spoil was covered with ofabric along the batter.	ACM impacted spoil associated with this UPF was excavated and disposed off-site between 29 August 2022 and 2 September 2022 with material classification report 22.0880.LTR1.v2f. This spoil was captured in a Spoil Tracking Register - waste disposal records are discussed in Section 9.6.4.	A clearance certificate was prepared following the removal of ACM impacted soil (Refer to ACC03 in Table 13 - inspection date of 5 September 2022).	Asbestos f carried out monitoring 29/08/2022 31/08/2022 02/09/2022 summarise
ne (9) loads (144.26 tonnes) of soil were sent to andown Waste Facility[12] for disposal as GSW but were ected/returned to site on 4 August 2022 due to the esence of ACM. The spoil was stockpiled (discussed in PBG's 'STM Asbestos Report – August 2023') in the stern portion of the site and subsequently disposed off- e. PBG has provided a time lapse photograph (dated 25 gust 2022) which shows a stockpile(s) which was vered with geofabric adjacent to UPF06 spoil at the top the batter. Given the date of disposal and location, it's ssible that this stockpile(s) contains the rejected terial from Brandown. sed on information and a plan provided by CPBG (refer STM Asbestos Report – August 2023, in Appendix 10), MP understands that the source of the impacted soil s from topsoil/fill within 3 areas denoted Area 1, Area 2 d Area 3 (fill classified as GSW) excluding the AEC3A ea (fill with the potential for ACM). These areas span	The stockpile was disposed off-site by Mann Group between 29 August and 2 September 2022 with classification report 22.0880.LTR1.v2f. This spoil was captured in a Spoil Tracking Register - waste disposal records are discussed in Section 9.6.4.	CPBG subsequently provided a time lapse photograph (dated 25 August 2022) which shows that the stockpiles noted in ACC01 had been removed/moved from that area. The photograph shows that an asbestos impacted stockpile(s) and asbestos impacted soil along a batter had been covered with white geotextile fabric. A clearance was subsequently prepared (Refer to ACC03 in Table 13 - inspection date of 5 September 2022) following the removal of ACM impacted soil along the batter. TTMP notes that it is unclear whether this clearance is directly related to Stockpile AEC 3A or the returned loads from	As per UP

UPF Management			
neral Comments	**Disposal Information**	**Asbestos Clearance Certificate**	**Asbestos**
rts of Lots 6201, 6202 and 6203 in DP1284283. osoil/fill in this area was excavated down to natural soil d stockpiled prior to off-site disposal as shown in otographs in a Clearance Certificate (ACC01 in Table – inspection date of 29 July 2022) and time lapse otograph provided by CPBG both included in Appendix		Brandown (stockpiled) as the photographs in the clearance certificate do not provide sufficient context or specifically note these materials.	
nduits suspected of containing asbestos were identified ring site excavation on 21 October 2022[13]. The extent the pipes within the site boundary were removed in-tact Mann Group on 3 November 2022 for off-site disposal. event log was created for this UPF 30080.W7.SAF.291021.00312150) with photos provided owing the area demarcated with signage and geofabric. PBG have confirmed that the location noted in the event is incorrect; the Occupational Hygienist (Shevan hamad) confirmed that the pipes were found between tes 3 and 4.	A waste disposal docket (GEN1513630-2), dated 4 November was provided by CPBG relating to the disposal of this UPF(s) – waste disposal records are discussed in Section 9.6.4.	A clearance certificate (ACC06 in Table 13 – inspection date of 3 November 2022) was provided by CPBG for this UPF(s). TTMP notes that the clearance states *"Insitu pipe remains at both gate 3 and 4. This material falls outside the scope of works and will be removed once access becomes available. Care should be taken during further excavation works." Photographs in the clearance certificate show the pipes remaining in-situ.".* CPBG confirmed that the conduits which remain in-situ were outside of the site boundary, as shown on Figure 6 in Appendix 1.	Asbestos f carried out monitoring 03/11/2022 Section 9.1
lescription of the UPF was provided in an Event Log 30080.W7.SAF.241022.00311095) which states *uspected asbestos cement pipe less than 0.5m ntified on ground surface. UXF procedure applied with ea flagged off and sign posted. No sampling and testing nducted. The size of the pipe was less than 10m^2, erefore did not require an ARCP as per WHS gulations. However, Veng from Mann Group (asbestos pervisor) removed the asbestos in accordance with the MP (SMWSASBT-CPG -1NL-NL000-SF-PLN-000024). per AMP and WHS Regulation, asbestos clearance d air monitoring is not required.".* e event log states that the pipe was identified on 21 tober 2022 between Gate 1 and Gate 2, and a otograph has been provided. The photograph appears show fill surrounding where asbestos signage was ced in close proximity to the rail line. CPBG confirmed t this was an isolated fragment which was collected d disposed of with the conduits (UPF08).			

Although records for unexpected asbestos finds were limited as they did not demonstrate 'cradle to grave' tracking in all occassions, and there was some ambiguity in relation to the validity of clearance reports for some of the UPFs, TTMP considers that CPBG had systems in place to manage unexpected finds and asbestos waste was segregated from other materials and disposed of at licenced landfill facilities (refer to Section 9.6.4). The segregation of ACM fragments, ACM impacted soil, and ACM conduits were segregated from other soils in-situ as guided by visual observations by CPGB personnel and the licenced asbestos assessor from Mann Group. An occupational hygienist was also on site during the project. As such, TTMP does not consider that the limited records and uncertainty around clearances to materially affect the outcome of the assessment with regards to site validation. The reuse of spoil is discussed separately in Section 9.7.

9.5.2. Incidents

Environmental incidents were limited to minor spills on sealed surfaces; CPBG confirmed that environmental incidents were managed as follows:

- Spills were reported internally within CPBG in accordance with management plans[14].
- Spills were cleaned with spill kit materials.
- Contaminated spill kit materials were disposed of to an appropriately licenced facility.

9.6. Bulk Excavation and Waste Disposal

Whilst bulk excavation and waste disposal was not considered to be remediation in the RAP, the NSW EPA G*uidelines for the NSW Site Auditor Scheme* (NSW EPA 2017) include specific requirements for Site Auditors to review waste management records including that waste/spoil has been:

- Classified in accordance with the NSW EPA Waste Classification Guidelines 2014 or NSW EPA resource recovery order/exemption.
- Taken to a facility lawfully able to receive that waste. Auditors must check that the consultant or waste generator (or their representative) has provided the following:
    - The estimated volume of waste taken off-site.
    - Receipts verifying the facility has received that volume and class of waste from the waste generator (or its representative). This may include a valid consignment authorisation.
    - Reconciliation documents demonstrating the total volume of waste taken off site is consistent with the total volume of waste generated from the site.

The information presented in this section of the report has been provided to document the volume of soil disposed, exported, and reused during the SBT Works at the STM site, and facilitate the Site Auditor fulfil their obligations under the guidelines.

[14] Tetra Tech Coffey understands the management plans comprised the Project CEMP and associated procedures, available online at https://cimicdigital-cdn.azureedge.net/-/media/projects/cimic/cpb/pdfs/environmental-materials/sydney-metro-western-sydney-airport-sbt/management-plans/construction-environment-management-plan.pdf?la=en.

9.6.1. Survey

CPBG provided TTMP with the following surveys:

- Surface Detail Survey, dated 20 July 2022. This survey was carried out prior to bulk excavation. TTMP notes that this survey does not appear to provide relevant information and as such a copy has been included for information purposes only.
- An AutoCAD file (2156 STM Detail Update 230731.dwg) showing several construction related features including excavation zones/areas (STM-1 to STM-8) which have been inferred on Figure 2 in Appendix 1.
- Cut/Fill Plan, dated 24 January 2023. This survey was carried out following Preparatory Works including the importation of materials to site to prepare the STM site for construction, off-site disposal/export of spoil, and reuse of spoil onsite. The survey indicates that approximately 50,669m^3 of cut and 13,083m^3 of fill had occurred. These areas of cut/fill are also shown on Figure 2 in Appendix 1.

The extent of the site boundary with coordinates is shown in Figure 1.

9.6.2. Visual Inspections

TTMP understands that CPBG carried out periodic visual inspections of fill material during excavation. Unexpected finds reported by CPBG are discussed in Section 9.5.

sification Assessments

cation reports were prepared to assist remedial works, copies of which are provided in Appendix 4.

ification Reports

ed	Summary of classification
	TTMP prepared an in-situ classification report for soil proposed to be excavated during Preliminary Works within the eastern portion of the STM site (Preliminary Works Area). It was estimated b earthworks required to reduce levels by up to 3m below ground surface within the Preliminary Works Area would generate approximately 10,000m^3 of surplus spoil, comprising a mixture of fill an The assessment was based existing and additional data collected to inform the St Marys DSI (discussed in Section 7.1) and presented in a Technical Memorandum (*Preliminary Soil Results Ea prepared by TTMP in July 2022*), including observations and analytical results from 52 soil samples collected from 12 individual sampling locations. The Preliminary Works Area covered an area of approximately 8,800m^2 (0.9 hectares) and cut to fill contours shown on Figure 1 of the report indicates that soil was proposed to be excavated fr approximately 5,500m^2 (0.55 hectares). It's noted that the sampling density was slightly less than recommended in the *NSW Sampling Design Guidelines* however recommendations were made and carrying out visual inspections during excavation to reduce uncertainty. TTMP concluded that: • Soil which was proposed to be excavated during the proposed preliminary works met the classification of **General Solid Waste (GSW) – Non-Putrescible**. • Natural, residual soil within the Preliminary Works site below a depth of 1mbgs was classified as **Virgin Excavated Natural Material (VENM)**, provided such materials were not mixed v shallow natural soil, or any other waste. TTMP made a number of recommendations including further assessment of fill within the footprint of the former Girl Guide Hall (an area defined as AEC3A) for asbestos, or conservatively disp Special (Asbestos) Waste.

	TTMP prepared an in-situ classification report for natural soil and rock materials to be excavated during the construction of the station box at the STM site. It was estimated by CPBG that approx surplus natural material would be generated, comprising a mixture of residual soil and rock.
	
	The assessment was based on existing and additional data collected to inform the St Marys DSI (discussed in Section 7.1), including observations and analytical results from 113 soil samples c sampling locations. TTMP adopted a sampling density of approximately 1 sample per 200m^3 of spoil proposed to be excavated. It is noted that the number of sampling locations exceeded the m sampling locations recommended (19) outlined in the *NSW Sampling Design Guidelines* based on the area of the station box (8,000m^2 / 0.8 hectares).
	
	TTMP provided the following classifications:
	• **VENM** – natural soil and rock materials which do not contain PFAS.
	• **GSW non-putrescible** – natural soil and rock materials which contain PFAS. This classification related to spoil in two (2) areas shown on a plan in the report denoted as:
	  ○ Area A: Approximately 350m^3 – assumed an area of 350m^2 between the top of natural material (1 m bgs to 2m bgs).
	  ○ Area B: Approximately 400 m^3 – assumed an area of 2000m^2 between the top of natural material (1 m bgs) to 3m bgs.
	• Natural site won materials are suitable for **on-site reuse**.
	
	For material classified as GSW, TTMP recommended that further assessment may be carried out to facilitate assessment against ENM criteria and/or reuse of the material as beneficial fill mate Airport FS01 site.
	
	TTMP also recommended further assessment during bulk earthworks to confirm the lateral extent of PFAS impacted soil in the vicinity of Area A and Area B.

ed	Summary of classification
	ADE prepared an in-situ material classification report which provided the following classifications to facilitate off-site disposal and reuse of fill from the STM site: • Great River Excavated Material Order 2021 Compliant: Approximately 12,266m^3 of fill covering an area of approximately 24,532m^2 and to an average depth of 0.5m (i.e., fill which is no below). • General Solid Waste (non-putrescible): fill surrounding hotspots shown on a plan in the report encompassing TP7, TP21, TP32, TP35, BH_A102, BH_A002 and BH-101: Approximately area of approximately 3,268m^2 and to an average depth of 0.5m. • Special Waste (Asbestos) with General Solid Waste: Asbestos impacted fill at TP18. No volume was provided for this classification, however ADE recommended that asbestos impacte cleared prior to removal of surrounding fill material. ADE reported that *'One bonded asbestos fragment was observed within the immediate vicinity of TP18 and sampled for analysis.'* A indicates the fragment of ACM (fibre cement) was on the ground surface. Coffey notes that the laboratory reports included in the appendices did not include the result for the sample of analysis (Sample WAC1_FC1). The fill assessed by ADE covered an area of approximately 27,800m^2. The assessment was based on observations and laboratory results from 63 soil samples collected from 46 test pit location report indicates that ADE also considered existing data from the St Marys DSI (discussed in Section 7.1); the existing data was not presented in the material classification report however four (4 BH1011, SMGW-BH_A102, SMGW-BH-A002 and SMGW-BH-A101) were shown on Figure 1 of the report. It's not clear from the report whether ADE considered existing soil data from other loc Marys DSI or St Marys Plaza Addendum; nonetheless TTMP considers that the data collected is likely to be reasonably representative of ground conditions at the time the assessment was carri sampling density adopted and relatively grid based sampling approach adopted by ADE. The sampling density adopted exceeded the minimum number of sampling locations recommended (40) in the *NSW Sampling Design Guidelines* based on the assessment area (27,800m^2 / 2.8 reported that the number of test pits also exceeded the minimum number of sampling locations outlined in the Great River Order.

	ADE prepared an in-situ material classification report for natural soil and rock within the station box (approximate in-situ volume of 172,000 m^3) and other areas of the STM site (approximate in-s ADE provided the following classifications:
	• GSW (non-putrescible): Natural Materials 0-2.0 m BGL in North Section (covering an area of approximately 16,450 m^2) – Based on the detections of PFAS in that area.
	• VENM (subject to further assessment of TRH impacts in groundwater and the potential UST at SBT-GW-1232, SBT-GW-1234 and SMGW-BH-A321):
	  ○ Natural Materials 0-2.0 m BGL in South Section (covering an area of approximately 10,225 m^2):
	  ○ Natural Materials >2.0 m BGL whole site (excluding SBT-BH1208, which was not proposed to be disturbed/excavated).
	The report indicates that the assessment was based on 67 sample results from 51 investigation locations (26 by ADE and 25 by Coffey [TTMP]); TTMP was unable to check the accuracy of this which existing locations were considered in the assessment, as summary tables of analytical results were not included in the report and the number of investigation locations shown on the figure number of locations in the report. Furthermore, the report indicates that ADE adopted a reduced sampling density for the assessment of natural soils (50 sample locations for a 4-hectare site) ba *former data and low risk of contamination within natural material'*. TTMP considers that the number of sampling locations (50 or 51) would exceed the minimum number of sampling locations rec *NSW Sampling Design Guidelines* for the total area assessed (26,675m^2 (2.65 hectares) based on 16,450m^2 for the northern area + 10,225m^2 for the southern area).

ed	Summary of classification
	ADE prepared an in-situ material classification report to facilitate the beneficial reuse of fill at the STM site (ADE referred to the site as the WSA-SBT site). The assessment was based on data fr TP46) originally collected to facilitate off-site disposal (as reported in version v2f of the MAC1a-v3f[17] report). ADE also carried out a high-level review of the St Marys DSI report (summarised in S concluded that fill covering an area of 26,675m^2 was suitable for beneficial re-use within the STM site "*with the exception of soil materials surrounding sample locations:* • *TP18 – ACM present. This should be disposed offsite in accordance with the classification provided by ADE in report A101022.0967.00_WAC1a_v2f.* • *TP21_0.3-0.4 arsenic exceeding the ecological investigation level".* TTMP notes that the concentration of arsenic was less than 2.5 times the adopted generic ecological investigation le appraisal of results (including consideration of a 95% upper confidence limit value) was not carried out. The sampling density adopted exceeded the minimum number of sampling locations recommended (40) in the *NSW Sampling Design Guidelines* based on the assessment area (26,675m^2 / 2.7 considers that the data collected is likely to be reasonably representative of ground conditions at the time the assessment was carried out based on the sampling density and relatively grid base adopted by ADE.
	ADE prepared an in-situ material classification report to facilitate the off-site beneficial reuse of natural soil (approximately 6,200 m^3 of sandy clay/silty sand, with an excavation depth of 1m belo within the northern portion of the proposed station box. The report indicates that natural soil in this area was previously classified by ADE as GSW (in version v2f of the MAC1b-v3f[18] report sumr trace PFAS detections. A previous material classification report by TTMP summarised above (MCA 040533[16]) recommended that further assessment of natural soil in this area may be carried out to facilitate assessme The assessment was based on sampling and analysis of soil samples from 17 test pits and comparison of results against threshold criteria in the ENM Order. TTMP considers that the sampling number of samples analysed (34) by ADE meets the number of systematic sampling points and requirements recommended in Table 2 and Table 3 of the *NSW ENM Order 2014*. Based on the results of the assessment, ADE classified the soil as Excavated Natural Materials (ENM).
	A review of the letter report prepared by ADE indicates that: • The letter report was prepared as an addendum to a previous Material Classification Assessment report prepared by TTMP (MCA 040530[15], discussed above). A summary of informatio TTMP report regarding the potential for ACM to be present within the footprint of the former Girl Guide Hall (area defined as AEC3A). • An occupational hygienist/environmental consultant from ADE attended site on 9 August 2022 to inspect a stockpile that was sourced from earthworks conducted onsite. • ADE identified a fragment of bonded fibre cement within the stockpiled materials inspected. A photograph of the fragment of fibre cement shows the sample was labelled FC1 TP8 NBS states that testing of the fragment was not carried out but could be done so at the request of the client. • ADE classified the stockpile (approximately 1,000m^3) for off-site disposal purposes as Special Waste – Asbestos based on the assumption that the fragment contained asbestos. A separate plan provided by CPBG (also included in Appendix 4) indicates that the stockpile was sourced from surface works in the eastern portion of the site.

ed	Summary of classification
	A review of the letter report prepared by ADE indicates that: • ADE classified approximately 360m^3 (720 tonnes based on a bulking factor of 2 t/m^3) of stockpiled soil as GSW (non-putrescible) – Special Waste (Bonded Asbestos). • Fieldwork was carried out on 3 August 2022. • Laboratory analysis confirmed the presence of chrysotile asbestos within fibre cement sample AC1-TP7-FC1. • The spoil was '*sourced from earthworks conducted onsite*.' The location of the stockpile at the time of sampling was presented in the letter report, however the location from where the s was not described/shown in the letter report. A separate plan provided by CPBG (also included in Appendix 4) indicates that the stockpile was sourced from surface works in the eastern of the station box opposite Lethbridge Street). • TTMP notes that the number of primary soil samples analysed (10)[23] meets the minimum number of sampling locations recommended (10) outlined in the *NSW Sampling Design Guide* stockpile.
f: WSASBT-CM-LET-010823)[24] which indicates that stub tunnel spoil (classified as GSW under the following two (2) reports (MCA 040556 and MAC22.v1f) met the criteria for Excavated Public Road M rder 2014. TTMP provided a review of the two (2) reports which is also included as an attachment to the letter prepared by CPBG confirming that *"the material from the stubtunnels can be recovered u al has been derived from a road corridor and/or land which is owned or managed by Penrith City Council or Roads and Maritime Services (RMS) and associated with a road corridor."*	
	TTMP prepared a waste classification report to facilitate the off-site disposal of a stockpile of spoil (approximately 400m^3 / 800 tonnes) generated during excavation of stub tunnels in the Bringell the eastern end of the Station Box. The assessment was based on visual observations and laboratory results from samples collected from two (2) boreholes and five (5) stockpile samples which exceeds the sampling density outli *EPA ENM Order 2014*. TTMP classified the spoil as General Solid Waste – non-putrescible, primarily based on the percentage of foreign materials and pH.
	A review of the letter report prepared by ADE indicates that: • ADE classified approximately 1,500m^3 of spoil (predominantly shale with some foreign materials including shotcrete, plastic fibres and steel) as GSW (non-putrescible). • The spoil was sourced from *'stub tunnel excavations extending form the eastern side of the station box excavation*'. TTMP notes that the number of primary soil samples analysed (10) meets the minimum number of sampling locations recommended (10) outlined in the *NSW Sampling Design Guidelines* for th

9.6.4. Waste/Spoil Tracking and Off-Site Disposal/Reuse

TTMP was provided with documentation relating to the off-site disposal/export of surplus spoil generated during Preparatory Works and Bulk Excavation.

Waste tracking and spoil disposal/export was the responsibility of CPBG and their contractors. TTMP was provided with the following waste documentation for review and inclusion in this validation report:

- Spoil Tracking Register[27].
- Tip Dockets and Consignment Records for Disposal/Export.

A review of the above documentation[28] and discussions with CPBG indicates that:

- 17,537.75 tonnes of spoil was sent for disposal at the facilities outlined in Table 9. A search of the NSW EPA POEO register online indicates that those facilities were licensed to receive the respective classes of waste. Copies of Environment Protection Licences (EPLs) are provided in Appendix 7 for reference.
- 238,172.85 tonnes of soil was exported for beneficial reuse at properties outlined in Table 10.
- A spot check of waste disposal dockets indicates that the waste disposal dockets provided appear to be valid/legitimate and reasonably complete. TTMP identified the following inconsistencies between the dockets provided, and information presented on the Spoil Tracking Register. Whilst these inconsistencies reflect some deficiencies in waste tracking off-site, they are not considered to affect the outcome of the assessment with regards to site validation.
    - Some dockets were duplicated or provided multiple times.
    - Some dockets were provided which appeared not to be related to the STM Project as they included reference to 'North Strathfield' or 'Five Dock'[29].
    - Some dockets for asbestos waste were provided but not listed in the Spoil Tracking Register. TTMP considers that this is likely because the spoil tracking register was updated with WasteLocate Consignment Records (some of which do not align with the disposal dockets or were incomplete) rather than using the information presented on the dockets.
    - A docket (GEN1468523-1) for 1.1 tonnes of 'Asbestos Sheeting' waste was provided which was not included on the Spoil Tracking Register. CPBG were unable to confirm the source of the asbestos sheeting, however TTMP considers it likely that this docket relates to demolition waste given it was included in a summary report (Q5023-22 Aug Waste Report.pdf) with other demolition waste. Nonetheless, the docket confirms that the material was segregated from other materials and disposed of at an appropriately licenced facility.

[27] WSASBT-STM-Spoil Waste Tracking Register - 05.22 to 06.23.xls
[28] Review of spoil tracking and dockets relating to Demolition Waste listed in the Spoil Tracking Register is outside the scope of this Validation Report.
[29] Provided in the following files: 23.82 SYD METRO WEST #B65161.pdf, 23.82 SYD METRO WEST #B65162.pdf , 23.82 SYD METRO WEST #B70141.pdf , 23.82 SYD METRO WEST #B70142.pdf, 23.8.22 SYD METRO WEST #B70763.pdf , and 23.8.22 SYD METRO WEST #B72871.pdf

- The approximate volumes of waste spoil disposed/exported was generally consistent with the volumes classified in corresponding material classification reports, as summarised in Table 11. TTMP notes that no soil or rock has been disposed/exported:
    - Under TTMP material classification report 'MCA 040533'[16] as reports prepared by ADE were used instead. TTMP notes that ADE's material classification report 'MAC1b-v3f'[18] was based on the same data as report 'MCA 040533'[16] and was supplemented by additional data from test pits and therefore supersedes the waste classification prepared by TTMP for natural soil within the areas classified by ADE.
    - As GSW (for natural soil) under report 'MAC1b-v3f'[18] as the spoil was excavated and disposed together with overlying fill (also classified as GSW) under report 'MAC1a-v2f'[17].
    - Under ADE material classification report 'MAC9.v1f'[20] as this spoil (natural soil classified as both ENM and GSW) was disposed of as GSW.

Furthermore, TTMP notes that under clauses 76 and 79 of the POEO (Waste) Regulation 2014, waste operators, transporters, and waste and recycling facilities are required to use WasteLocate when "consigning, transporting or accepting more than 100 kilograms of asbestos waste, or more than 10 square metres of waste asbestos sheeting, in any single load.". WasteLocate Consignment dockets are provided in Appendix 6 with the exception of consignment ID 2BW4PYHV7HXB because the file was damaged.

Table 9: Summary of Disposed Spoil

Facility	Licence Holder*	Facility[NOTE1]	POEO Licence Number NOTE1	Classification of Material Disposed	Mass Disposed (tonnes)	Approximate Volume disposed (m^3) [30]
Spoil Tracking Register Information						
Bingo Eastern Creek Landfill	Dial-A-Dump (EC) PTY LTD	1 Kangaroo Avenue, Eastern Creek, NSW 2766	13426	GSW-Asbestos	725.08 NOTE3, NOTE4	365
Erskine Park Landfill (Cleanaway)	Enviroguard PTY Limited	4 Quarry Road, Erskine Park, NSW 2759	4865	GSW-Asbestos	3,539.48 NOTE2, NOTE3	1,770
Brandown, Kemps Creek	Brandown PTY. Limited	Lot 90 Elizabeth Drive, Kemps Creek, NSW 2178	5186	GSW (non-putrescible)	13,261.95	6,630
Additional Docket (GEN1513630-2) not included in the Spoil Tracking Register, relating to UPF08 and UPF09 (ACM Conduits and ACM Fragment)						
Bingo Eastern Creek Landfill	Dial-A-Dump (EC) PTY LTD	1 Kangaroo Avenue, Eastern Creek, NSW 2766	13426	Asbestos Soils	11.24	5
				Total Disposed	17,537.75	8,770

NOTES

NOTE1: Details obtained from NSW EPA POEO Public Register online at https://apps.epa.nsw.gov.au/prpoeoapp/, 3 August 2023.
NOTE2: This mass includes 144.26 tonnes of ACM impacted soil returned to site from Brandown (refer to Table 7).
NOTE3: Mass presented here is a sum of the mass presented in the waste disposal dockets (TTMP notes that incorrect and missing values are presented on the Spoil Tracking Register and WasteLocate Consignment Dockets for some of the disposal dockets issued by Cleanaway and Bingo).
NOTE4: Docket GEN1468523-1 not included as TTMP considers this docket likely relates to demolition waste rather than soil/spoil management.
GSW – Asbestos: General Solid Waste (non-putrescible) mixed with Special (Asbestos) Waste (shown on the tracker as ASBESTOS)
GSW: General Solid Waste (non-putrescible) (shown on the tracker as GSW and GSW-NP)

[30] Based on a bulk density of 2 tonnes / m3 for clayey soils, rounded to the nearest 5.

Table 10: Summary of Exported Spoil for Reuse Off-site

Development	Property Location	Resource Recovery Order / Exemption	Classification of Material Exported	Mass Exported (tonnes)	Approximate Volume Exported (m^3) [30]
Great River NSW - Nepean Business Park (NBP)	Lot 1, 2 and 3 DP1263486 (14-98 Old Castlereagh Road, Penrith NSW).	The Great River excavated material (GREM) Order / Exemption 2021[31]	GREM (GSW suitable for reuse under the GREM Order/Exemption.	20,230.66	10,115
			VENM	165,232.06	82,615
Orchard Hills	34-38 Landsdowne Road, Orchard Hills, NSW 2748#	N/A	VENM	19,910.24	9,955
Caddens	89-115 O'Connell St, Caddens	N/A	VENM	32,779.89	16,390
AJW (The Yards Kemps Creek)	AWJ Earthmoving 657-769 Mamre Road, Kemps Creek NSW 2178	The Excavated Public Road Material Order / Exemption 2014	EPRM	4,812.20	2,405
			Total Spoil Exported for Off-Site Reuse	**242,965.05**	**121,480.00**

NOTES

 # Other property associated with the SBT Works (POEO EPL 20986).

[31] Resource Recovery Order under Part 9, Clause 93 of the Protection of the Environment Operations (Waste) Regulation 2014 (Included in Appendix 7).

Table 11: Quantities of Spoil Disposed vs Material Classifications

Classification of Material Disposed / Exported	Mass Disposed / Exported (tonnes)	Approximate Volume disposed / exported (m^3) [30]	MCA Report	Volume of Spoil Classified under this MCA Report (m^3)	Material Type	Comments
GSW-Asbestos	2,861.68	1,430	LTR1.v2f NOTE1	1,000 (Stockpile)	ACM impacted fill	CPBG confirmed that the quantity disposed with this material classification report also includes the 144.26 tonnes (approx. 70m^3) of ACM impacted soil returned to site as an unexpected find from Brandown (Refer to UPF07 in Table 7). The difference in the total volume of material disposed with respect to that classified (including the additional 70m^3) may be attributed to uncertainty associated with estimating the volume of the stockpile in the LTR1.v2f report which was based on qualitative visual observations rather than a volumetric quantitative survey.
GSW-Asbestos	677.80	340	WAC1.v1f NOTE1	360 (Stockpile)	ACM impacted fill	The volume of spoil disposed is commensurate with the volume classified.
GSW-Asbestos	725.08	365	MAC1a-v3f NOTE1	No volume provided – fill in the vicinity of TP18	ACM impacted fill	No volume of GSW-Asbestos waste was provided in the waste classification report. CPBG confirmed that the extent of excavation/remediation in this area was based on visual observations.
GSW (non-putrescible)	8,356.83	4,180	MAC1a-v3f	1,634 (in-situ)	Fill	CPBG confirmed that this volume of fill also included underlying natural soil which was also classified as ENM (in report MAC9.v1f) and GSW non-putrescible (in report MAC1b-v3f).

Classification of Material Disposed / Exported	Mass Disposed / Exported (tonnes)	Approximate Volume disposed / exported (m^3) [30]	MCA Report	Volume of Spoil Classified under this MCA Report (m^3)	Material Type	Comments
GSW (non-putrescible)	4,905.12	2,450	MCA 040530	10,000 (in-situ)	Fill	The volume of soil disposed of as GSW under this classification report is significantly less than what was classified even when accounting for asbestos impacted soil removed from the area classified. TTMP notes that this is likely to be due to less excavation being required for preliminary works than anticipated.
GREM (GSW suitable for reuse under the GREM Order/Exemption.	20,230.66	10,115	MAC1a-v3f	12,266 (in-situ)	Fill	The volume of spoil disposed is commensurate with the volume classified. TTMP notes that this variation in volume is likely due to the natural soi
EPRM	4,812.20	2,405	L010823_RRO_EPRM	1,900 m^3	Stockpiles: Natural Soil and Stub Tunnel Spoil	The volume of spoil disposed is commensurate with the volume classified when accounting for a higher bulk density than 2.0 t/m3 for sandstone.
VENM	202,452.47	101,225	MAC1b-v3f	No volume provided	Natural soil	-
VENM	15,469.72	7,735	MCA 040530	No volume provided	Natural soil	-

NOTES

NOTE1: As shown on a previous iteration of the Spoil Tracking Register (WSASBT-STM-Spoil Waste Tracking Register - 05.22 to 06.23_last modified 150823).

9.7. Spoil Reuse

A review of the spoil tracking register[27] provided by CPBG indicates that approximately 17,088 tonnes (equivalent to approximately 8,550m^3) of soil was excavated and reused within the southern portion of the site (St Marys Plaza). The spoil was excavated from bulk excavation areas:

- STM-3: approximately 16,491 tonnes (approximately 8,250 m^3) of natural soil, classified as VENM in reports MCA 040530[15] and MAC1b-v3f[18].
- STM-8: approximately 597 tonnes (300 m^3) of fill assessed to be suitable for beneficial re-use within the STM site by ADE in report MAC7.v1f[19]. The fill was excavated on the 13, 18 and 19 October 2022 from bulk excavation area STM-8 (within the footprint of the Station Box) following off-site disposal of the majority of asbestos finds (excluding UPF08 and UPF09).

Bulk excavation areas STM-3 and STM-8 are shown on Figure 2 in Appendix 1.

With regards to reuse of site-won soil, TTMP notes the following:

- Fill impacted with arsenic above an EIL (160 mg/kg) was identified at investigation location TP21 (393.8 mg/kg) in report MAC7.v1f[19]. This location was in the vicinity of area STM-8. Although ADE concluded that fill within the vicinity of TP21 would not be suitable for reuse at the site, TTMP notes that a statistical appraisal of results was not caried out as part of the investigation. TTMP does not consider that the concentrations of arsenic detected would pose an unacceptable risk to ecological receptors (terrestrial flora and fauna) if reused at the STM site when considering a statistical appraisal of results; TTMP has carried out a statistical appraisal[32] of arsenic results presented in the ADE report and note that the:
    - Highest reported concentration of arsenic was less than 2.5 times the EIL;
    - Standard deviation was less than 50% of the EIL; and
    - 95% upper confidence limit (UCL) value (45.51 mg/kg) was less than the EIL.
- CPBG were not able to provide photographs showing the fill reused on site however no unexpected finds including suspected ACM were reportedly observed by CPBG in the spoil reused during excavation and handling.

Based on the assessments carried out by ADE and TTMP above, the management of unexpected finds by CPBG, and visual observations made by CPBG, TTMP considers that the site-won soil used as fill within St Marys Plaza is suitable for use at the site from a contamination perspective.

[32] The 95% UCL of the arithmetic mean contaminant concentrations and standard deviation results were calculated using the software 'ProUCL'. Where results were recorded below the laboratory limit of reporting (LOR), a value equal to the LOR was adopted. ProUCL inputs and outputs are provided in Appendix 11.

9.8. Imported Products

CPBG Imported products during site establishment as summarised in Table 12. This material is proposed to remain at the site at the completion of the SBT Works. A Materials Import Register, Supplier Documentation, and Delivery Dockets/Summary Report are included in Appendix 12, which were compiled and provided by CPBG.

TTMP understands that the following process was implemented by CPBG during import for each of these materials. TTMP notes that this process is not strictly in accordance with the procedure outlined in the RAP or Material Reuse and Importation Procedure[33] (also included in Appendix 12) as the Contaminated Land Consultant/Professional[34] was not provided opportunity to review supplier documentation or carry out further assessment (if required) of imported materials prior to import.

- Supplier documentation was reviewed by a CPBG Environmental Coordinator (EC) prior to import to confirm that the material was sourced from a quarry with an appropriate EPL, classified as either VENM or ENM, or supplied in accordance with a NSW EPA Resource Recovery Order / Resource Recovery Exemption (RRO/RRE). TTMP has provided a summary of the documentation provided in the following sections.
- CPBG visually inspected the materials (including quarried VENM) during import and placement to confirm that the material was commensurate with that described in the supplier documentation. TTMP understands that no unexpected finds were reported (including suspected asbestos-containing material, staining or malodours) during importation of each of the materials, and the materials were visually commensurate with the documentation provided. Two (2) photographs taken by CPBG during import are provided in Appendix 8. No photos of the materials supplied by Dunmore, Gosford Quarries or Elfords could be provided.

[33] Included in Appendix 6 of Version A04 of the RAP but unintentionally left out of subsequent editions.
[34] Definition in the RAP & Material Reuse and Importation Procedure; considered to be the equivalent of the Validation Consultant (TTMP) for this report.

Table 12: Summary of Imported Products

Product	Site Placement	Qty Imported (tonnes)[35]	Source
Recovered Aggregate (DGB20)	10 Wheeler – Office pad	160.32	Boral Recycling Widemere Road, Wetherill Park
	LV Road	500.34	
Recovered Aggregate (DGB20)	10 Wheeler – Office pad	147.86	ECORR Pty Ltd (ECORR), Eco Resource Recovery, 155 Newton Rd, Wetherill Park
	10 Wheeler – LV Road	112.48	
Quarry material (Rail Ballast rock)	Road for Moxies	35.32	Dunmore Quarry – 33-38 Tabbita Road, Dunmore
VENM Crushed sandstone	Northern haul road/ haul roads	864.18	Gosford quarries – Wisemans Ferry Road, Cattai
Sandstone	Piling pad	154.84	Elford Group Pty Ltd (Elfords) – 320-400, Badgerys Creek Road, Badgerys Creek

[35] TTMP carried out a review of the delivery dockets/summary report for crushed VENM sandstone supplied by Gosford Quarries, and confirms that the quantities noted on the Material Import Register are consistent with the dockets/summary report.

9.8.1. Boral - Recovered Aggregate (DGB20)

The documentation provided comprises delivery dockets, laboratory test results and a Resource Recovery Order Compliance Letter from Boral.

The delivery dockets and Boral's website[36] state that *"Boral Recycling complies with 'The recovered aggregate order 2014' outlined in part 9, clause 93 of POEO Regulation 2014 (Waste)"*.

A Resource Recovery Order Compliance Letter from Boral dated 11th August 2023 indicates that:

- Boral's recycled products are manufactured from construction and demolition (C&D) waste materials such as concrete and brick.
- Boral implement strict inspection and receival protocol for incoming materials which includes an inspection and testing regime to comply with the testing requirements and frequencies of "The Recovered Aggregate Order 2014".

Laboratory test reports for chemical and other attributes was provided which indicates that a sample of recovered aggregate collected by Boral on 20 June 2023 from Boral's Recycling Facility was analysed by Boral Construction Materials for foreign materials and metals (arsenic, cadmium, chromium, copper, mercury, nickel, lead, zinc) and conductivity. The results reported were less than the limit of reporting and/or the absolute maximum concentrations for characterisation of recovered aggregate presented in Column 2, Table 1 of The Recovered Aggregate Order 2014[37] (NSW EPA RAO 2014). Foreign materials (metal, plaster, rubber, plastic, paper, wood, cloth, paint, vegetable matter) were not detected.

An Asbestos Analytical Report prepared by Hibbs & Associates Pty Ltd (Hibbs) indicates that one sample of recovered aggregate collected from Boral Recycling Widemere on 20 June 2023 was analysed for asbestos. The sample (weighing approximately 0.64kg) was described by the analyst as 'recovered aggregate' and was analysed for asbestos using a NATA accredited method; no asbestos was detected in the sample at the reporting limit of 0.1 g/kg or by trace analysis.

TTMP notes that the chemical test results presented in the supplied documentation were also less than assessment criteria (health investigation levels (HILs) and EILs) relevant to a commercial/industrial land use presented in the ASC NEPM. TTMP acknowledges that the samples are not likely to be representative of the actual material imported to the site given the samples were collected in June 2023 and the material was imported to the site approximately nine (9) months earlier in August 2022, however the test certificates were provided to demonstrate that Boral implement testing to meet the Recovered Aggregate Order 2014.

Although the DGB20 was not assessed during importation (as required by the RAP), based on the information provided and visual observations made by CPBG, TTMP considers that the DGB20 imported from Boral is suitable (from a contamination perspective) for use at the site given that:

- The material was imported from a commercial supplier which maintains an EPL (EPL No. 11815)[38] to provide such material, and who undertake regular and required sampling of the material for maintenance of their EPL.
- The final land use (commercial/industrial) of the site is non-sensitive.

[36] https://www.boral.com.au/orders-and-exemptions, accessed 12 August 2023.
[37] Available at https://www.epa.nsw.gov.au/your-environment/recycling-and-reuse/resource-recovery-framework/current-orders-and-exemption, accessed 12 August 2023.
[38] EPL 11815, available from https://app.epa.nsw.gov.au/prpoeoapp/ViewPOEOLicence.aspx?DOCID=187702&SYSUID=1&LICID=11815, accessed 30 August 2023.

- No unexpected finds were reported by CPBG during import of the material.

9.8.2. ECORR - Recovered Aggregate (DGB20)

The documentation provided comprises delivery dockets, laboratory test results, and a letter from ECORR.

The dockets state that *"Eco Resource Recovery material complies with the EPA recovered aggregate order 2014"* and a letter provided by ECORR indicates that ECORR – Eco Resource Recovery Pty Limited at 155 Newton Road, Wetherill Park operates under Environmental Protection Licence 10699 and conducts Recovered Aggregate testing in accordance with The Recovered Aggregate Order 2014.

A Materials testing report (recovered aggregate) for chemical and other attributes was provided which indicates that four (4) samples of recovered aggregate (crushed concrete/brick) collected on 21 July 2022 were analysed by Resource Laboratories Pty Ltd for foreign materials, metals (arsenic, cadmium, chromium, copper, mercury, nickel, lead, zinc) and conductivity. The results reported were less than the limit of reporting, the maximum average and/or the absolute maximum concentrations for characterisation of recovered aggregate presented in Column 2, Table 1 of The NSW EPA RAO 2014.

An Analytical Report prepared by ALS Environmental indicates that four (4) samples of crushed concrete/brick collected on 21 July 2022 were analysed for asbestos. The samples (weighing between 481 g and 567g) were analysed for asbestos using a NATA accredited method; no asbestos was detected in the samples at the reporting limit of 0.1 g/kg or by trace analysis.

TTMP notes that the chemical test results presented in the supplied documentation were also less than assessment criteria (HILs and EILs) relevant to a commercial/industrial land use presented in the ASC NEPM.

Although the DGB20 was not assessed during importation (as required by the RAP), based on the information provided and visual observations made by CPBG, TTMP considers that the DGB20 imported from ECORR is suitable (from a contamination perspective) for use at the site given that:

- The material was imported from a commercial supplier which maintains an EPL to provide such material, and who undertake regular and required sampling of the material for maintenance of their EPL.
- The final land use (commercial/industrial) of the site is non-sensitive.
- No unexpected finds were reported by CPBG during import of the material.

9.8.3. Dunmore - Quarried Rail Ballast

Dockets provided by CPBG indicate that the rail ballast (described as 'BALLAST CLEAN' on the dockets) was collected from 38 Tabbita Road Dunmore. TTMP notes that Boral Dunmore Quarry at this premise has an EPL for extractive purposes (EPL 77).

Based on this information and visual inspections carried out by CPBG during import, TTMP considers that the quarried rail ballast supplied by Dunmore is suitable (from a contamination perspective) for use at the site.

9.8.4. Gosford Quarries – Crushed Quarried Sandstone

CPBG confirmed that the crushed sandstone was sourced from Gosford Quarries at Cattai Sandstone Quarry Wisemans Ferry Road, Cattai, NSW, 2756. TTMP notes that Gosford Quarries has an EPL for extractive purposes (EPL 12023).

Based on this information and visual inspections carried out by CPBG during import, TTMP considers that the crushed sandstone supplied by Gosford Quarries is suitable (from a contamination perspective) for use at the site.

9.8.5. Elfords - Sandstone

Despatch dockets and a truck register indicates that material described as 'Stockpile 55' by Elfords and 'SS' (interpreted to mean sandstone) by CPBG was imported to the site.

A search of readily available information online indicates that Elfords:

- Is the owner and operator of the Badgerys Creek Quarry and Resource Recovery Facility, located at 320 Badgerys Creek Road.
- Is the licensee of an EPL (20498)[39] for Extractive activities, resource recovery and waste storage at the above property. This licence permits the acceptance of tunnel spoil from various infrastructure projects for resource recovery including *'Soils that meet the criteria of the Rozelle Interchange Tunnel Spoil Resource Recovery Order 2019 or as superseded from time to time.'* The licence does not permit the acceptance of materials other than VENM, ENM or Tunnel Spoil meeting project specific Tunnel Spoil Resource Recovery Orders.

CPBG provided TTMP with an in-situ Waste Analysis and Classification Assessment report[40] relating to the sandstone which was imported to the site from Elfords to construct a piling pad.

- The report indicates that ADE classified approximately 57,750m^3 of in-situ sandstone (covering an area of 2,600m^2 and an average excavation depth within rock of 19.25m) at Rozelle Railyards, Rozelle NSW as VENM. The rock was proposed to be excavated to facilitate delivery of the Westconnex Stage 3B – Rozelle Interchange tunnelling and excavation works and the Western Harbour Tunnel (WHT) enabling works package.
- The scope of work carried out by ADE included a preliminary desktop study, and sampling of sandstone rock (from 10 shallow test pits) for analysis of contaminants of potential concern.
- TTMP notes that photographs in the report taken at the time of initial fieldwork (August 2020) show the presence of fill which appeared to have been removed at the time subsequent fieldwork was carried out (January 2021).
- The analytical results in Appendix 15 of the ADE report are consistent with VENM (metals less than ambient background concentrations (ABC) presented in Schedule B5b of the amended ASC NEPM 2013[41]; organic compounds less than the laboratory limit of reporting; and no asbestos detected).

Although the sandstone was not assessed during importation (as required by the RAP), based on the information provided and visual observations made by CPBG, TTMP considers that the sandstone imported from Elfords is suitable (from a contamination perspective) for use at the site given that:

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[39] EPL 20498, available online at apps.epa.nsw.gov.au/prpoeoapp/ViewPOEOLicence.aspx?DOCID=272058&SYSUID=1&LICID=20498, accessed 30 August 2023.
[40] ADE. Waste Analysis and Classification Report. Westconnex Stage 3B – Rozelle Interchange Site, Rozelle NSW. Prepared for: John Holland CPB Joint Venture. WCX-08-18183 / WAC190 / v2f. 2 February 2021.
[41] National Environment Protection Council, National Environment Protection (Assessment of Site Contamination) Measure, 1999 (April 2013) (ASC NEPM 2013).

- The sandstone was classified as VENM prior to excavation at its source (Rozelle Interchange Project) and would be required to be exported to Elfords as VENM or tested to comply with the Rozelle Interchange Tunnel Spoil Resource Recovery Order 2019, which states that the spoil must be naturally occurring soil or rock which has not been contaminated with manufactured chemicals or process residues (except for shotcrete) and contains no more than 0.4% w/w shotcrete.
- The sandstone was imported from a resource recovery facility which maintains an EPL to provide such material.
- The final land use (commercial/industrial) of the site is non-sensitive.
- No unexpected finds were reported by CPBG during import of the material.

9.9. PRB and Groundwater Monitoring

TTMP, on behalf of CPBG, prepared an 'Implementation of Permeable Reactive Barrier' report (PRB Installation Report[42]) which describes the installation of a (PRB) to mitigate the potential risk of construction related drawdown mobilising chlorinated hydrocarbon impact in groundwater to the west of St Marys Station. A copy of the PRB Installation Report is provided in Appendix 17 and a summary is provided below.

The RAP identified the preferred mitigation option as implementation of a PRB based on technical feasibility, ease of deployment, cost and program requirements.

Based on the predicted migration of contamination the installation of the PRB was required within 6 to 8 weeks of bulk excavation of the station box.

To minimise changes in the groundwater plume geometry, the PRB was installed in the Queen Street cul-de-sac, as close as possible to the suspected source area.

Investigations in the source area completed to inform the HHRA indicated that a plume of heavily contaminated groundwater was approximately 10m wide. The PRB installed comprised three injection wells at 5 metres intervals, resulting in a barrier of approximately 25m width (assuming an injection radius of at least 5 metres for each well) perpendicular to the plume.

The injection wells were installed in early May 2023 to 20mAHD, approximately 3m below the estimated base of the plume to allow for vertical migration due to drawdown. Hydraulic conductivity testing undertaken on the three injection wells informed injection rates and volumes, and also identified that the relatively high permeability in the northern portion of the PRB.

Based on a conservative estimated flux of chlorinated hydrocarbons, 180kg of colloidal activated carbon (Plumestop™) was required to form an effective barrier to reduce the mass flux of chlorinated hydrocarbons by over an order of magnitude for more than two years. The injection of 200kg of Plumestop™ was completed over four days from 16 May to 19 May 2023. A significant proportion (75%) was injected into the northern most injection well in the high permeability zone where contaminant mobilisation was expected to be greatest.

Groundwater conditions as of 7 July 2023 indicated that no chlorinated hydrocarbon contamination was present pre-construction in groundwater in the vicinity of the PRB (mitigation monitoring well network) and the STM station box.

[42] CPBG. St Marys Station – Implementation of Permeable Reactive Barrier. Sydney Metro Western Sydney Airport Station Boxes and Tunnelling Works. Ref: SMWSASBT-CPG-SWD-SW000-GE-RPT-040561, Revision A02, 15 August 2023.

Given the potential for unacceptable inhalation or direct contact risk, a targeted multi-level groundwater monitoring and contingency mitigation approach has been applied, to allow contingency mitigation to be implemented before an unacceptable exposure occurs.

Weekly monitoring of groundwater between the source area and the PRB, and between the PRB and station box, commenced on 30 June 2023. Where contamination is detected, concentrations will be compared to predictions and risk-based triggers to identify whether contingency mitigation is required as outlined in the RAP and Environmental Monitoring Program (refer to Section 12).

Weekly groundwater monitoring results are not included within this Validation Report and are being reported separately as the data is obtained and collated. The results shall be presented to the Site Auditor and Sydney Metro at the frequency nominated in the RAP (monthly). The RAP also states that "*The CPBG Leadership Team, Sydney Metro and the Site Auditor are to be notified within 5 business days if the assessment of groundwater data shows that the Trigger Values in Table 14 may be exceeded and contingency mitigation measures in Section 11.6 need to be implemented."*[43].

9.10. Construction Water Management

CPBG carried out water quality monitoring prior to discharge of construction water in accordance with the NSW (Off-Airport) Soil and Water Management Sub-Plan[44] (Off-Airport S&WM-SP).

CPBG provided TTMP with Discharge and Dewatering Permits confirming that water quality monitoring at four (4) locations (denoted as 'Fish Tank', 'Water Tank #1', 'Water Tank #2', and 'Sed Basin') met the adopted criteria (for pH, turbidity, and oil and grease) presented in the Off-Airport S&WM-SP for off-site discharge. The permits relate to water quality monitoring carried out on 40 occasions between 24 November 2022 and 1 May 2023.

Copies of the Discharge and Dewatering Permits are provided in Appendix 13.

9.11. Asbestos Management

9.11.1. Management Plans

TTMP was provided with two management plans in relation to the management of asbestos-containing material, copies of which are provided in Appendix 14:

- CPBG. Asbestos Management Plan. Sydney Metro Western Sydney Airport Station Boxes and Tunnelling Works. Ref: SMWSASBT-CPG -1NL-NL000-SF-PLN-000024. Revision B. Dated 21 November 2022 (CPBG AMP).
- CPBG. Asbestos Removal Control Plan – Shopping Centre. Sydney Metro Western Sydney Airport Station Boxes and Tunnelling Works. Ref: SMWWSASBT-CPG-SWD-SF-PLN-000026. Revision 07. Dated 31 October 2022 (CPBG Shopping Centre ARCPs)[45].

[43] Table 14 and Section 11.6 referenced here are of the RAP.
[44] CPBG. NSW (Off-Airport) Soil and Water Management Sub-Plan. Sydney Metro Western Sydney Airport Station Boxes and Tunnelling Works. Ref: SMWSASBT-CPG-1NL-NL000-WA-PLN-000002, Revision 1. Dated 21 September 2022.Available online (accessed 14 July 2023) at https://cimicdigital-cdn.azureedge.net/-/media/projects/cimic/cpb/pdfs/environmental-materials/sydney-metro-western-sydney-airport-sbt/management-sub-plans/nsw-offairport-soil-and-water-management-subplan.pdf?la=en
[45] TTMP was also provided previous versions of this ARCP comprising version B (25 May 2022), C (1 July 2022), 01 (12 August 2022), 05 (19 August 2022), and 06 (23 September 2022).

The CPBG AMP was prepared to provide a procedure to manage risks associated with asbestos if identified during the Project. The AMP does not include an asbestos register but does include an Unexpected Asbestos (ACM) Find Procedure in the event that ACM was identified during the SBT Works.

The CPBG Shopping Centre ARCPs were prepared to *"assist Mann Group to meet the requirements associated with the hazmat removal in plaza shopping centre St Marys associated with the overall scope of demolition works as set out by Safework NSW and NSW WHS Act 2011 and its applicable regulations."* A review of the ARCPs indicates that:

- A copy of the Materials Analysis & Classification Report prepared by ADE for fill (version v1f of the MAC1a-v3f[17] report discussed in Section 9.6.3) was included in Version 6 of the ARCP showing the location of 'asbestos identified' at TP18.
- A Site Inspection and Waste Classification Letter report was included in Version 5 of the ARCP which classified a stockpile of spoil as Special Waste – Asbestos. The letter report (LTR1.v1f) was superseded by a later revision (LTR1.v2f[21]) which is discussed in Section 9.6.3.
- A Waste Analysis & Classification Report (WAC1.v1f[22]) was included in Version 5 of the ARCP which classified a stockpile of soil as General Solid Waste (non-putrescible) – Special Waste (Bonded Asbestos). The letter report is discussed in Section 9.6.3.
- Pipes suspected of containing asbestos were identified within (or within close proximity to) the footpath of Station Street at two (2) locations. These pipes are the same as the suspected ACM conduits discussed in Table 7 as UPF08. The locations are shown in a plan in Appendix 1 of version 7 of the ARCP and the location where conduits were retained (outside the site boundary) are shown on Figure 6 of this report (Appendix 1).
- A Hazardous Materials Survey (report 62722) for the building at St Marys Plaza (shopping complex with multiple store and underground parking) was included in Versions B and C of the ARCP. The survey was prepared by Airsafe and included a register of where hazardous materials (comprising asbestos, lead paint, lead in ceiling dust, synthetic mineral fibre (SMF) PCBs and Ozone depleting substances (OCDs)[46], as well as miscellaneous items (syringes from a pharmacy and cleaning chemicals[47]) were identified or suspected. Inaccessible areas comprised 'Below Concrete slab', 'Behind Retaining Wall' and 'Ceiling Space and External Wall Cavities' where suspected ACM and lead dust was suspected.
- Notices of intent to remove friable and non-friable asbestos were included in various versions of the ARCP:
    - A notice of intent to remove friable asbestos (943R-00353601-01 dated 5 August 2022) was submitted to and accepted by SafeWork NSW for the removal of friable asbestos. The notice of intent was submitted by Auswide for the removal of 'Asbestos in Soil'. Included in Version 5 of the ARCP.
    - A notice of intent to remove friable asbestos (943R-00358235-01 dated 20 September 2022) was submitted to and accepted by SafeWork NSW for the removal of friable asbestos. The notice of intent was submitted by Auswide for the removal of 'Broken Pieces of Asbestos in Ground'. Included in Versions 6 and 7 of the ARCP.

[46] No PCBs or ODS were identified or suspected.
[47] CPBG confirmed that the syringes and cleaning chemicals had been removed prior to CPBG occupying the site.

- A notice of intent to remove friable asbestos (943R-00342592-01 dated 21 April 2022) was submitted to and accepted by SafeWork NSW for the removal of friable asbestos. The notice of intent was submitted by Auswide for the removal of building materials from St Marys Plaza. Included in Versions B and C of the ARCP.
- A notice of intent to remove non-friable asbestos (940R-00342598-01 dated 21 April 2022) was submitted to and accepted by SafeWork NSW for the removal of friable asbestos. The notice of intent was submitted by Auswide for the removal of wall sheeting from St Marys Plaza. Included in Versions B and C of the ARCP.

CPBG confirmed that asbestos removal works was completed by Auswide Operations Pty Ltd Trading as Mann Group NSW & supervised by Veng Chour as outlined in the ARCP. TTMP checked the SafeWork NSW website[48] and confirm that Auswide hold a Class A (Friable) Asbestos Removal Licence (AD212715). Coffey considers that the documentation provided complies with the asbestos licencing and approval requirements set by SafeWork NSW with regards to excavating soil impacted with asbestos.

9.11.2. Asbestos Fibre Air Monitoring Reports

Asbestos Fibre Air Monitoring Reports associated with demolition and remediation works were provided to TTMP by CPBG; copies of which are provided in Appendix 15. A review of the test reports indicates that:

- Monitoring was carried out by Airsafe on 33 occasions between Tuesday, 28 June 2022 and Thursday, 3 November 2022.
- The number of fibres reported during air monitoring was equivalent to the detection limit (<0.01 fibres per millilitre of air (f/mL) and as such the results were:
  - Less that the control and action limits (0.01 f/ml and 0.02f/ml respectively) defined within the *SafeWork NSW How to Safely Remove Asbestos Code of Practice 2022.*
  - Considered to be equivalent to background concentrations.

9.11.3. Asbestos Clearance Certificates

Asbestos Clearance Certificates associated with demolition and remediation works were provided to TTMP by CPBG; copies of which are provided in Appendix 16. A summary of the clearance certificates is provided in Table 13.

GPBG provided a plan showing the location of each clearance which is included in Appendix 16.

[48] https://verify.licence.nsw.gov.au/details/Asbestos%20Removal%20Licence/30728, accessed 15 August 2023.

earance Title	Date of Removal Works	Clearance Location	Asbestos Removed	Licensed Asbestos Removalist^	Inspection Date	Comments
SA SBT Project Station Plaza – ate 1	Not Stated	Soil Surface	Asbestos Cement Sheeting Debris	Mann Group NSW (AD210134)	29 July 2022	Photographs provided in the clearance certificate show th ground surface following removal works. Photographs are in-situ stockpile(s). The plan provided by CPBG indicates that the area inspe in the vicinity of where suspected ACM was identified pre as AEC3A discussed in Section 9.6.3. Airsafe concluded that: • *"asbestos material specified has been removed Code of Practice: How to Safely Remove Asbes 2020] and that the asbestos removal area, and t surrounding it, are free from visible asbestos co surface."; and* *"In-situ material remains in the form of stockpiles on site. contaminated and are not part of this clearance report."* CPBG subsequently provided a time lapse photograph (d which shows these stockpiles had been removed/moved appears to be natural soil is exposed.
SA SBT Project Station Plaza – ate 2	Not Stated	Not Stated	Asbestos Cement Sheeting Debris on soil surface	Mann Group NSW (AD210134)	2 August 2022	Photographs provided in the clearance certificate show s ACM fragments. Photograph 1 in the certificate indicates that the area whi the vicinity of where a fragment of ACM fibre cement nea identified, as discussed in a Materials Analysis and Class by ADE (MAC1a-v3f[17]) discussed in Section 9.6.3. Airsafe concluded that "*A clearance inspection of the abo asbestos material specified has been removed in accorda Practice: How to Safely Remove Asbestos [Safe Work Au asbestos removal area, and the area immediately surrou visible asbestos contamination on the ground surface.* *The results of the clearance inspection indicate the asbes pose a risk to health and safety from exposure to asbesto occupied."*
SA SBT Project Station Plaza – ate 1 [05.09.22]	29/08/2023 to 05/09/2023 (as clarified by CPBG the clearance incorrectly reports removal was between 29/09/22 – 05/09/22).	Asbestos Stockpile and Excavator - 99759-D	Asbestos Containing Soil	Mann Group NSW (AD210134)	5 September 2022	Photographs provided in the clearance certificate show th ground surface following removal works. The plan provided by CPBG indicates that the area inspe in the north-eastern portion of the site. Airsafe concluded that *"the asbestos material specified h accordance with the Code of Practice: How to Safely Rer Australia, 2020] and that the asbestos removal area, and surrounding it, are free from visible asbestos contaminati*

earance Title	Date of Removal Works	Clearance Location	Asbestos Removed	Licensed Asbestos Removalist^	Inspection Date	Comments
SA SBT Project Station Plaza – ate 2	Not Stated	Shown in Photograph 1 of the clearance	Soil contaminated with asbestos cement sheet debris over an area of approximately 500m^2.	Mann Group NSW (AD210134)	7 October 2022	Photographs provided in the clearance certificate show th ground surface following removal works. Photograph 1 sh the clearance was carried out. The plan provided by CPBG indicates the area inspected the vicinity of where a fragment of ACM fiber cement nea identified, as discussed in a Materials Analysis and Class by ADE (MAC1a-v3f[17]) discussed in Section 9.6.3. Airsafe concluded that *"the asbestos material specified ha accordance with the Code of Practice: How to Safely Rer Australia, 2020] and that the asbestos removal area, and surrounding it, are free from visible asbestos contaminati*
SA SBT Project Station Plaza – ate 2	Not Stated	Shown in Photograph 1 of the clearance	Soil contaminated with asbestos cement sheet debris over an area of approximately 250m2.	Mann Group NSW (AD210134)	12 October 2022	Photographs provided in the clearance certificate show th ground surface following removal works. Photograph 1 sh the clearance was carried out. The plan provided by CPBG indicates the area inspected the vicinity of where a fragment of ACM fibre cement nea identified, as discussed in a Materials Analysis and Class by ADE (MAC1a-v3f[17]) discussed in Section 9.6.3. Airsafe concluded that *"the asbestos material specified ha accordance with the Code of Practice: How to Safely Rer Australia, 2020] and that the asbestos removal area, and surrounding it, are free from visible asbestos contaminati*
SA SBT Project Station Plaza – ate 1 [05.09.22]	03/11/22	33-43 Phillip Street, St Mary's - Gate 3 – Service Trench - Gate 4 – Service Trench	Molded Asbestos cement pipe	Mann Group NSW (AD210134)	3 November 2022	Airsafe concluded that: • *"the asbestos material specified has been remov Code of Practice: How to Safely Remove Asbes 2020] and that the asbestos removal area, and t surrounding it, are free from visible asbestos co surface."* and • *"Insitu pipe remains at both gate 3 and 4. This m scope of works and will be removed once acces should be taken during further excavation works* clearance certificate show the pipes remaining i

was noted in the clearances to be Mann Group NSW (license number AD210134). CPBG confirmed that the removalist was Auswide Operations Pty Ltd Trading as Mann Group NSW.

10. Quality Assurance and Quality Control

Where TTMP has been engaged to complete a programme of assessment that has been used to support the validation of the site, the findings of that assessment has been documented within a standalone report. In addition, the field and laboratory data generated from that activity has been assessed against the DQI within the individual report, and not repeated herein.

In general, TTMP notes the following quality assurance/quality control procedures have been adopted during the implementation of remediation and validation activities:

- A site visit to observe site conditions an experienced consultant from TTMP.
- Material classification assessments were carried out by reputable environmental consultancies which included their own quality assurance and quality control procedures.

In the preparation of this validation report, TTMP has adopted data generated by CPBG and their subcontractors. This data has been reviewed by TTMP using regular discussions with CPBG representatives involved with that particular aspect of the project to ascertain its accuracy and/or request additional data to support decisions regarding the validation of the site.

In summary, TTMP consider the data collated to support the validation assessment is reasonably accurate, comparable, precise, complete and representative in which to draw conclusions.

11. Updated Conceptual Site Model

A CSM was developed prior to remedial works taking place (described in Section 8).

Contamination, if not managed appropriately could pose a potential risk to human health or the environment. For an unacceptable risk to exist, there must be a plausible pollutant linkage between the source and a receptor by means of a transport mechanism (pathway).

Based on the nature of contamination identified off-site (VCH impacted groundwater), Coffey considers that this residual contamination may pose unacceptable risks to human health without management. An updated CSM is presented below.

Table 14: Updated Conceptual Site Model

Contamination	Transport Mechanisms & Plausible Exposure Pathways	Receptors
VCH Contaminated Groundwater at 1-7 Queen Street, St Marys	Potential migration of the groundwater plume during construction. Associated with groundwater drawdown and dewatering until the station box is waterproofed (tanked). Volatilisation of seepage water in an unlined excavation (station box structure).	Station box workers from inhalation of VHCs should groundwater impact reach the excavation.
	Groundwater inflow (minor seepage) into the station during operational and maintenance phases following waterproofing of the station box as part of the SSTOM Works Package.	Future site users from inhalation of VHCs should groundwater impact reach the station.

12. Environmental Monitoring Plan (EMP)

As outlined in the RAP, an EMP shall be prepared to outline the requirements of a groundwater monitoring program 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.

13. Conclusions and Recommendations

Based on the information reviewed and observations made on 19 July 2023, TTMP concludes that:

- At the time of the site visit (19 July 2023) the site was an active construction site associated with the SBT Works. Cut/fill works appeared to have been completed and excavation of the Station Box was in progress which was scheduled for completion at the end of August 2023. No evidence of uncontrolled waste or spills were apparent. No evidence of the presence of suspected ACM was observed.
- CGU Imported products during site establishment which comprised recycled DGB20 (from ECORR and Boral), quarried rail ballast (from Dunmore), crushed quarried sandstone (from Gosford Quarries) and sandstone (from Elfords). TTMP considers that these imported materials are suitable from a contamination perspective for use at the site. Further detail is provided in Section 9.8.
- Approximately 17,088 tonnes (equivalent to approximately 8,550m^3) of site won soil was reused within the southern portion of the site (St Marys Plaza) comprising approximately 16,491 tonnes (approximately 8,250 m^3) of VENM and 597 tonnes (300 m^3) of fill. No unexpected finds including suspected ACM were reportedly observed by CPBG in this spoil during excavation and handling. Based on the assessments carried out by ADE and TTMP, the management of unexpected finds by CPBG, and visual observations made by CPBG, TTMP considers that the site-won soil used as fill within St Marys Plaza is suitable for use at the site from a contamination perspective.
- Waste was managed by CPBG and their subcontractors.
    - Waste dockets appear to be valid/legitimate and reasonably complete.
    - The approximate volumes of waste spoil disposed/exported was generally consistent with the volumes classified in corresponding material classification reports. Waste was disposed of at facilities appropriacy licenced to accept the classification of spoil provided. 17,537.75 tonnes of spoil was disposed off-site at appropriately licenced facilities and 238,172.85 tonnes of soil was exported off-site for beneficial reuse as VENM, EPRM and GREM (GSW suitable for reuse under the GREM Order/Exemption).
    - A spot check of waste disposal dockets indicates that the waste disposal dockets provided appear to be valid/legitimate and reasonably complete. TTMP identified some inconsistencies between the dockets provided, and information presented on the Spoil Tracking Register. Whilst these inconsistencies reflect some inconsistancies in waste tracking off-site, they are not considered to affect the outcome of the assessment with regards to site validation.
    - Asbestos waste was tracked during transport and disposal using the NSW EPA WasteLocate system.
- Water quality monitoring associated with Construction Water Discharge was carried out by CPBG, and appropriate Discharge and Dewatering Permits were provided and included in this validation report for information purposes.

- A groundwater PRB was installed in general accordance with the RAP and HHRA to mitigate the potential risk of construction related drawdown mobilising VCH impacted groundwater to the west of St Marys Station. Groundwater conditions as of 7 July 2023 indicated that no chlorinated hydrocarbon contamination was present pre-construction in groundwater in the vicinity of the PRB (mitigation monitoring well network) and the STM station box. Weekly monitoring of groundwater between the source area and the PRB, and between the PRB and station box, commenced on 30 June 2023. Where contamination is detected, concentrations will be compared to predictions and risk-based triggers to identify whether contingency mitigation is required as outlined in the RAP and Environmental Monitoring Program. A recommendation to implement ongoing groundwater monitoring and management/maintenance of the PRB is provided below.
- Unexpected finds identified during the SBT Works at the STM site comprised ACM within soil and as conduits. Environmental incidents were limited to minor spills on sealed surfaces which were appropriately managed. Although records for unexpected asbestos finds were limited as they did not demonstrate 'cradle to grave' tracking at all times, and there was some ambiguity in relation to the validity of clearance reports for some of the UPFs, TTMP considers that CPBG had systems in place to manage unexpected finds and asbestos waste was segregated from other materials and disposed of at licenced landfill facilities. The segregation of ACM fragments, ACM impacted soil, and ACM conduits were segregated from other soils in-situ as guided by visual observations by CPGB personnel and the licenced asbestos assessor from Mann Group. An occupational hygienist was also on site during the project. As such, TTMP does not consider that the limited records and uncertainty around clearances to materially affect the outcome of the assessment with regards to site validation.
- Asbestos licences and approvals held or obtained by Auswide / Mann Group for the management of unexpected finds complied with appropriate regulatory requirements (SafeWork) for the removal of asbestos.
- Overall, TTMP considers that contamination has been appropriately managed during the SBT Works, and the site is suitable for the proposed development subject to:
    - Ongoing groundwater monitoring and management/maintenance of the PRB as per the requirements of the RAP and the EMP, until water proofing (tanking) of the station box has been completed and post construction groundwater flow from 1-7 Queen Street into the metro station is negligible.
    - Preparation of an Addendum to the RAP as part of the SSTOM works package, which describes how potential impacts to future users of the site from VCH in groundwater will be managed as part of the operational phase of the project and incorporated into the design of the metro station.

Appendix 1 Figures


FORRESTER ROAD
ST MARYS MULTI-STOREY COMMUTER CAR PARK
HARRIS STREET
ST MARYS COMMUTER CAR PARK
GLOSSOP STREET
ST MARYS TRAIN STATION
X: 293971.0682
Y: 6261972.8678
X: 294021.8385
Y: 6261964.5782
X: 294083.3304
Y: 6261956.2201
X: 294116.8943
Y: 6261953.487
X: 294152.3612
Y: 6261949.5539
6201/DP1284283
X: 293967.0949
Y: 6261947.5453
X: 294071.0384
Y: 6261956.2201
TATION STREET
X: 293988.5726
Y: 6261938.6102
ST MARYS BUS INTERCHANGE
X: 293989.4046
Y: 6261943.5752
1/DP1001735
BUS DRIVERS COMPOUND / 1 STATION STREET
X: 294020.0145
Y: 6261917.6231
X: 294000.7416
Y: 6261921.0492
8/DP734738
6202/DP1284283
X: 294468.8754
Y: 6261894.1583
2 STATION STREET
X: 294161.3132
Y: 6261899.2409
X: 294264.2619
Y: 6261876.9267
CAR WASH
X: 294269.8989
Y: 6261867.7727
9/DP840717
X: 294014.4145
Y: 6261873.5741
ST MARYS STATION PLAZA
X: 294253.0899
Y: 6261883.4187
11-13 CHESHAM STREET
X: 294467.8094
Y: 6261882.0603
6203/DP1284283
X: 294012.4225
Y: 6261847.9621
X: 294138.8452
Y: 6261844.5579
X: 294270.7759
Y: 6261876.2527
X: 294433.2395
Y: 6261843.7384
X: 294273.4379
Y: 6261863.0597
CHESHAM STREET
7/DP734738
X: 294008.6895
Y: 6261817.2411
CHEMICAL STORAGE / CLEANING SUPPLIES
X: 294155.4121
Y: 6261841.6798
X: 294421.8875
Y: 6261836.5354
X: 294460.8314
Y: 6261838.9593
X: 294424.9205
Y: 6261836.7654
PHILLIP STREET
X: 294134.1502
Y: 6261794.6118
EAST LANE
GIDLEY STREET
BLAIR AVENUE
ST MARYS
ROSS PLACE
LETHBRIDGE STREET
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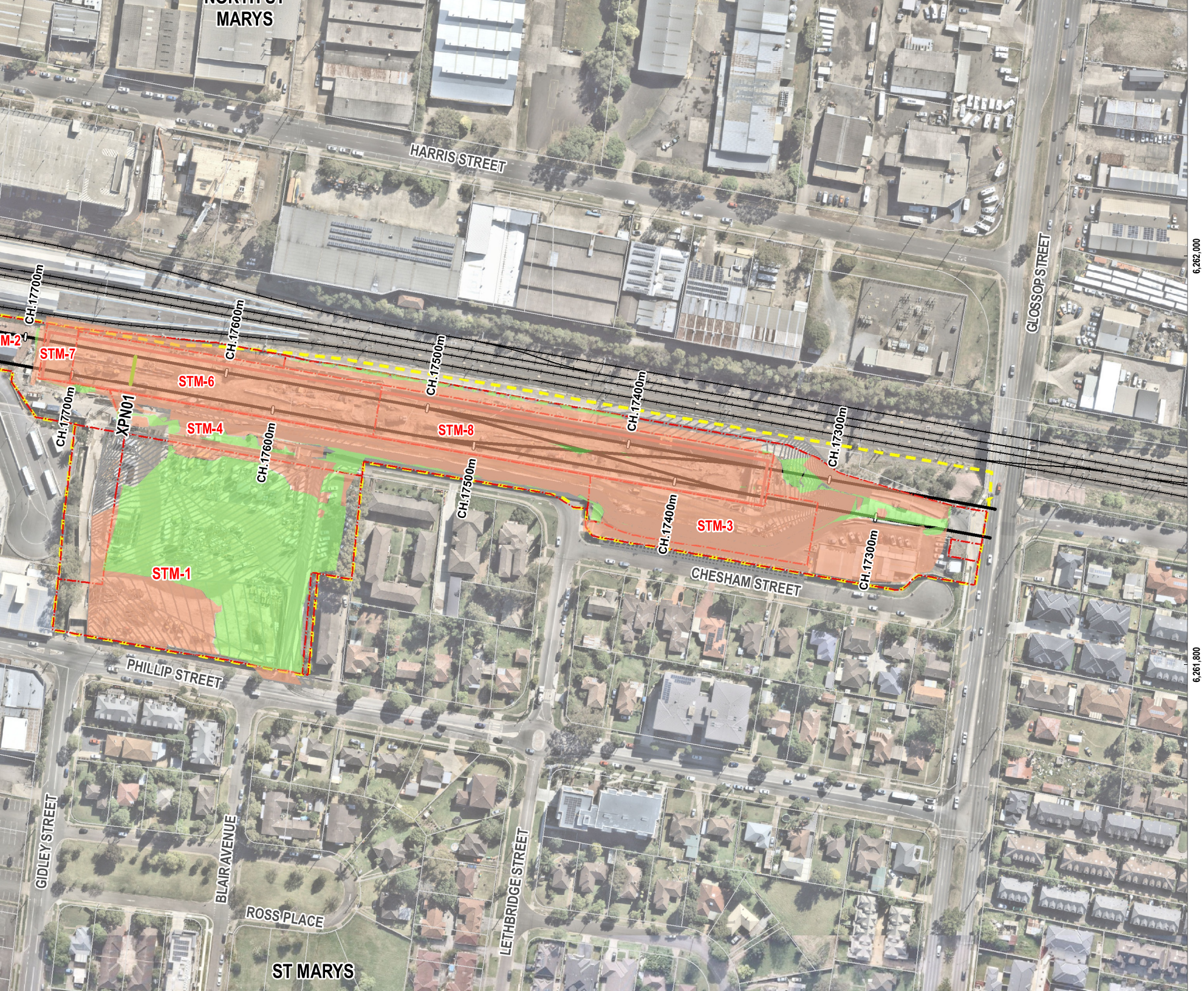

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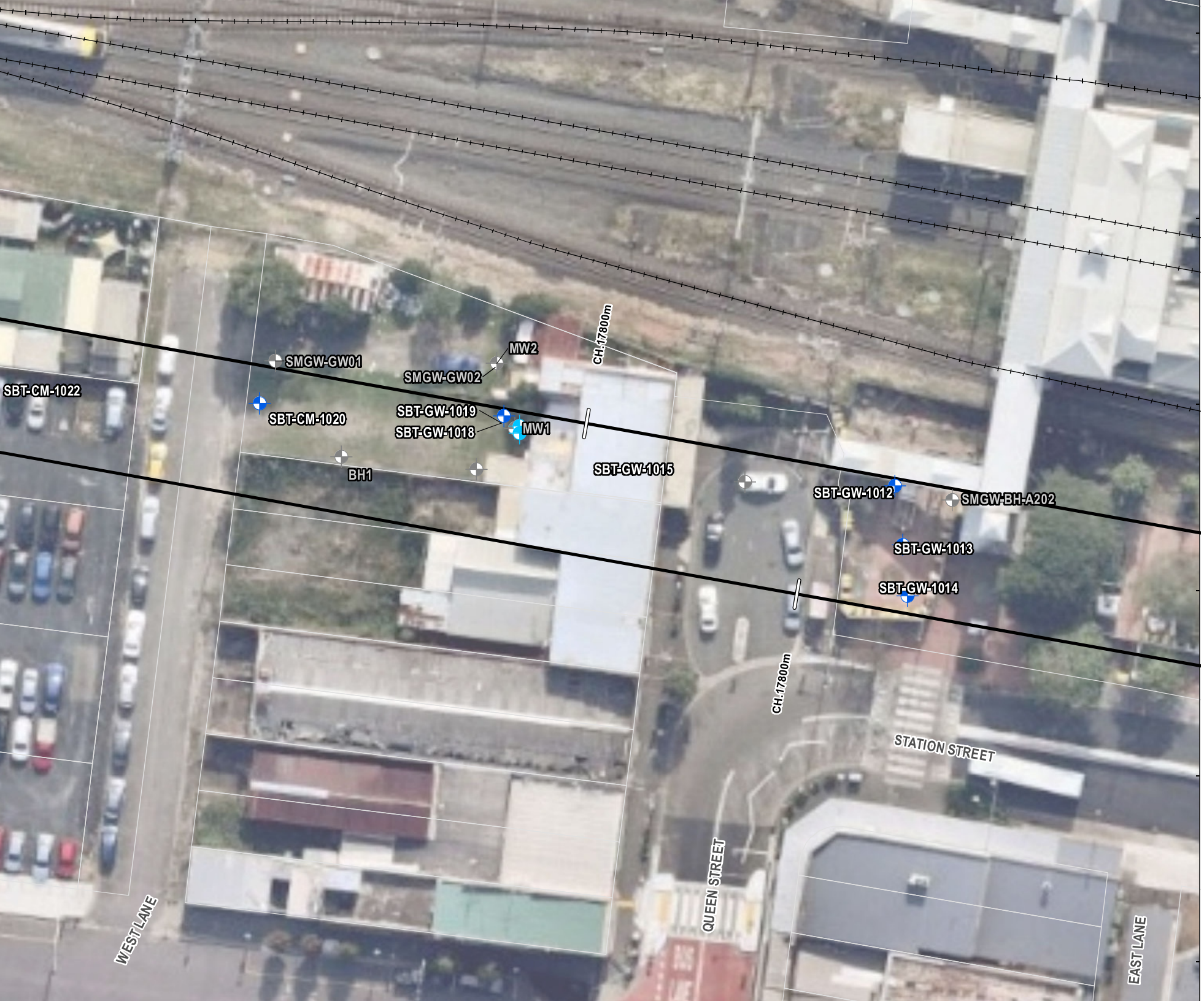
SMGW-GW01
MW2
SMGW-GW02
CH.17800m
SBT-CM-1022
SBT-CM-1020
SBT-GW-1019
SBT-GW-1018
MW1
BH1
SBT-GW-1015
SBT-GW-1012
SMGW-BH-A202
SBT-GW-1013
SBT-GW-1014
CH.17800m
STATION STREET
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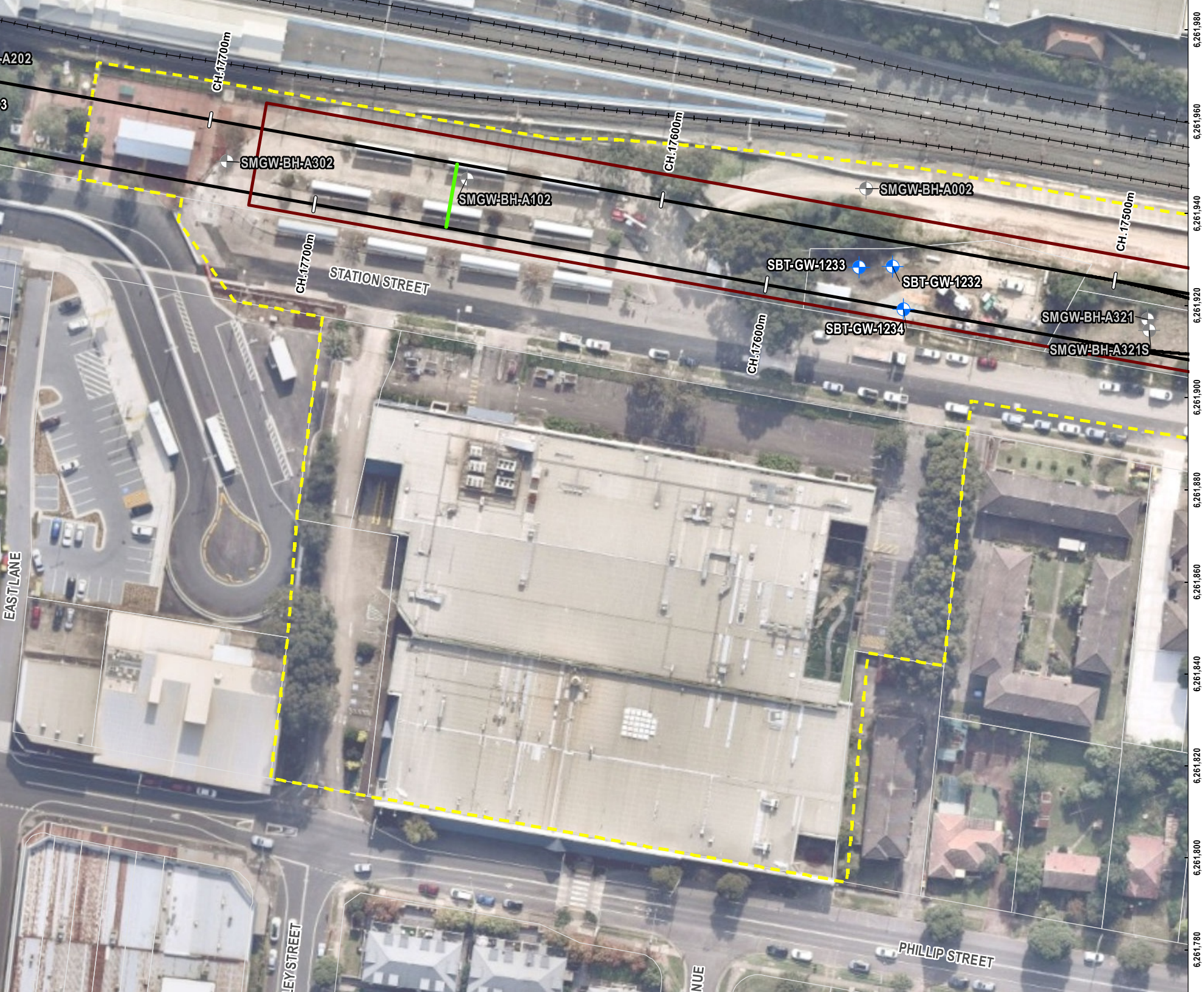

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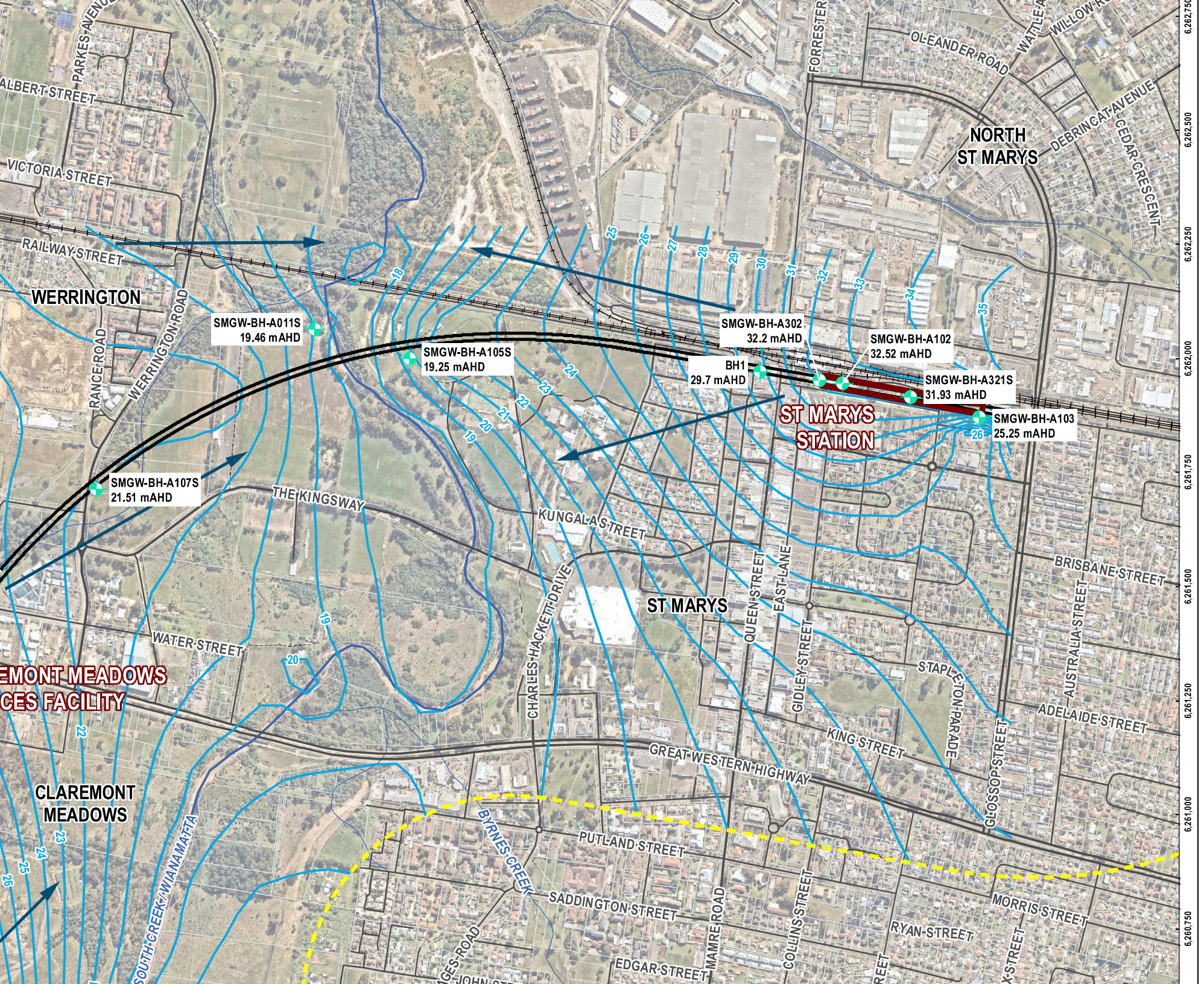
SMGW-BH-A011S
19.46 mAHD
SMGW-BH-A105S
19.25 mAHD
SMGW-BH-A107S
21.51 mAHD
SMGW-BH-A302
32.2 mAHD
BH1
29.7 mAHD
SMGW-BH-A102
32.52 mAHD
SMGW-BH-A321S
31.93 mAHD
SMGW-BH-A103
25.25 mAHD
ST MARYS STATION
WERRINGTON
NORTH ST MARYS
ST MARYS
CLAREMONT MEADOWS
RAILWAY STREET
VICTORIA STREET
ALBERT STREET
PARKES AVENUE
WERRINGTON ROAD
RANCE ROAD
THE KINGSWAY
KUNGALA STREET
WATER STREET
CHARLES HACKETT DRIVE
QUEEN STREET
EAST LANE
GIDLEY STREET
BRISBANE STREET
AUSTRALIA STREET
STAPLETON PARADE
ADELAIDE STREET
KING STREET
GREAT WESTERN HIGHWAY
GLOSSOP STREET
PUTLAND STREET
BYRNES CREEK
SADDINGTON STREET
MAMRE ROAD
COLLINS STREET
RYAN STREET
MORRIS STREET
EDGAR STREET
OLEANDER ROAD
DEBRINCAT AVENUE
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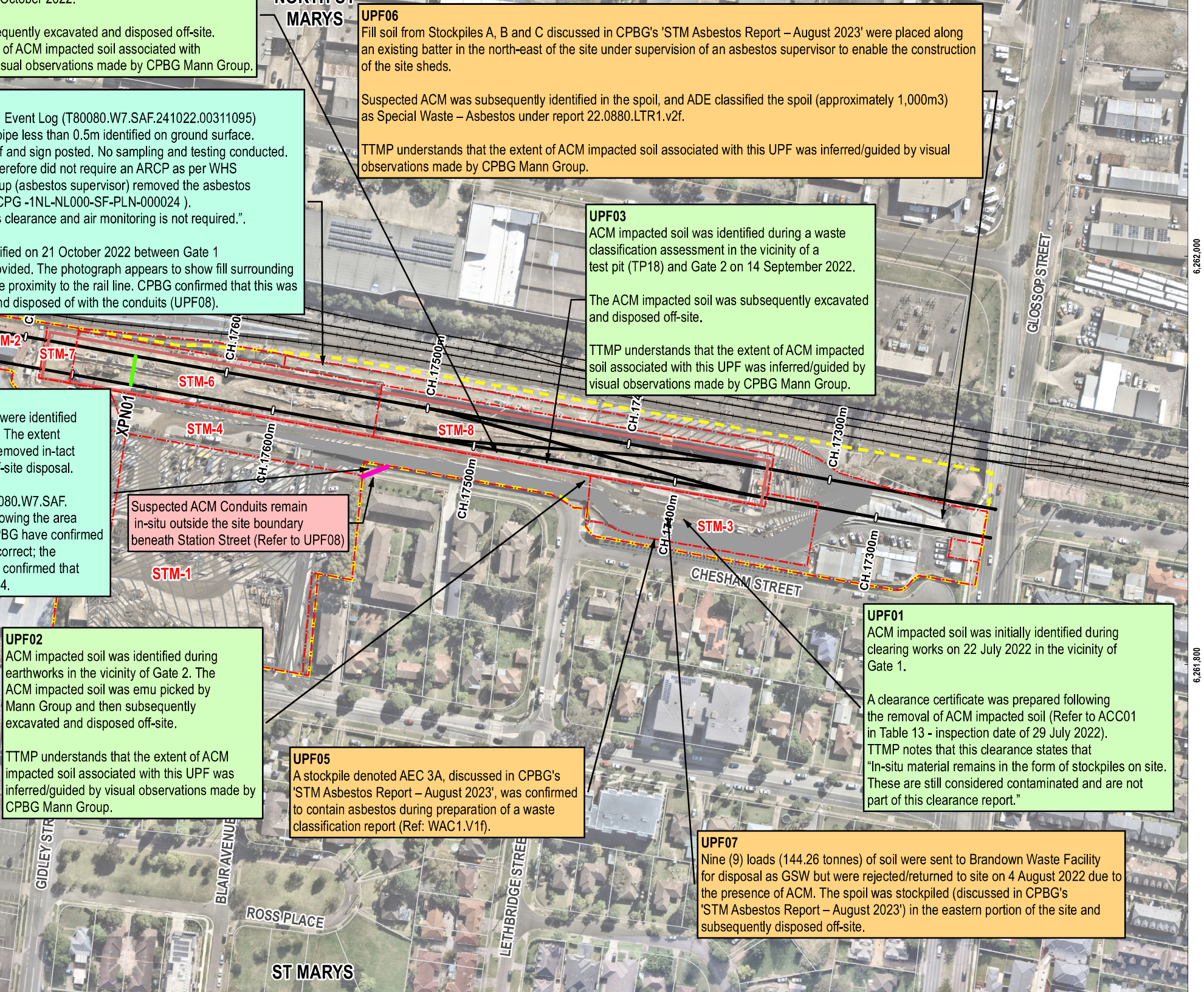
UPF06
Fill soil from Stockpiles A, B and C discussed in CPBG's 'STM Asbestos Report – August 2023' were placed along an existing batter in the north-east of the site under supervision of an asbestos supervisor to enable the construction of the site sheds.
Suspected ACM was subsequently identified in the spoil, and ADE classified the spoil (approximately 1,000m3) as Special Waste – Asbestos under report 22.0880.LTR1.v2f.
TTMP understands that the extent of ACM impacted soil associated with this UPF was inferred/guided by visual observations made by CPBG Mann Group.
UPF03
ACM impacted soil was identified during a waste classification assessment in the vicinity of a test pit (TP18) and Gate 2 on 14 September 2022.
The ACM impacted soil was subsequently excavated and disposed off-site.
TTMP understands that the extent of ACM impacted soil associated with this UPF was inferred/guided by visual observations made by CPBG Mann Group.
Suspected ACM Conduits remain in-situ outside the site boundary beneath Station Street (Refer to UPF08)
UPF02
ACM impacted soil was identified during earthworks in the vicinity of Gate 2. The ACM impacted soil was emu picked by Mann Group and then subsequently excavated and disposed off-site.
TTMP understands that the extent of ACM impacted soil associated with this UPF was inferred/guided by visual observations made by CPBG Mann Group.
UPF05
A stockpile denoted AEC 3A, discussed in CPBG's 'STM Asbestos Report – August 2023', was confirmed to contain asbestos during preparation of a waste classification report (Ref: WAC1.V1f).
UPF01
ACM impacted soil was initially identified during clearing works on 22 July 2022 in the vicinity of Gate 1.
A clearance certificate was prepared following the removal of ACM impacted soil (Refer to ACC01 in Table 13 - inspection date of 29 July 2022).
TTMP notes that this clearance states that "In-situ material remains in the form of stockpiles on site. These are still considered contaminated and are not part of this clearance report."
UPF07
Nine (9) loads (144.26 tonnes) of soil were sent to Brandown Waste Facility for disposal as GSW but were rejected/returned to site on 4 August 2022 due to the presence of ACM. The spoil was stockpiled (discussed in CPBG's 'STM Asbestos Report – August 2023') in the eastern portion of the site and subsequently disposed off-site.
STM-1
STM-2
STM-3
STM-4
STM-6
STM-7
STM-8
XPN01
CH.17600m
CH.17500m
CH.17400m
CH.17300m
CHESHAM STREET
GLOSSOP STREET
GIDLEY STR
BLAIR AVENUE
ROSS PLACE
LETHBRIDGE STREE
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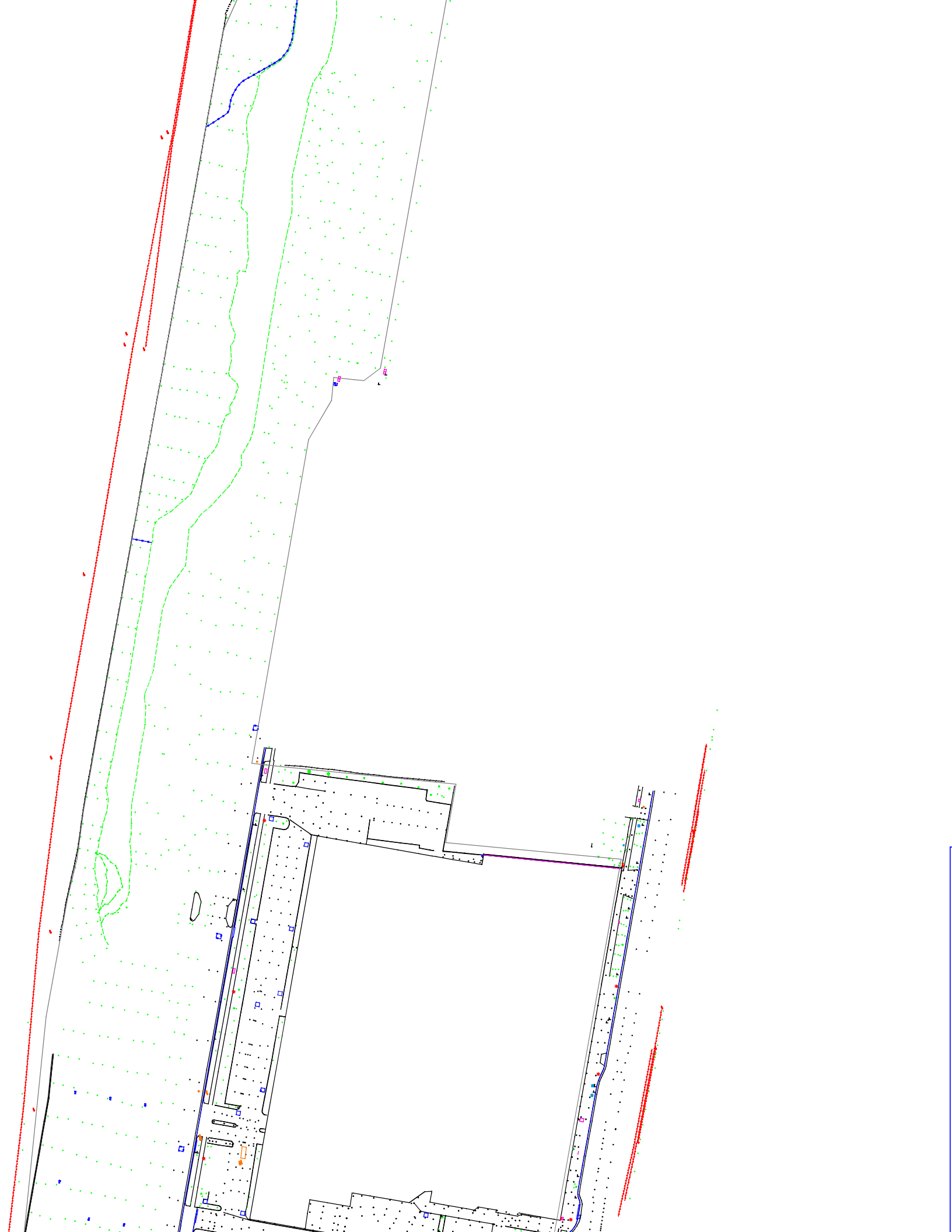
Appendix 2 Surveys and Plans

Additional AutoCAD files provided electronically:

2156 STM Detail Update 230731.dwg

SE Earthworks Cut & Fill Heat Map.dwg



LAY to High Plasticity SILT

AY

lasticity CLAY

asticity CLAY

AY to Low Plasticity SILT


MH - High Plasticity SILT


ML - Low Plasticity SILT


Organic


OL - Low Plasticity ORGANIC CLAYS and SILTS


SANDSTONE


SC - Clayey SAND


SHALE


SILTSTONE


SILTSTONE & SANDSTONE


SM - Silty SAND


SP - Poorly Graded SAND


SP-SC - Poorly Graded SAND to Clayey SAND


SW - Well Graded SAND


SW-SC - Well Graded SAND to Clayey SAND


SP - Poorly Graded SAND


GP - Poorly Graded GRAVEL

H - HARD
Fb - FRIABLE
VL - VERY LOOSE
L - LOOSE
MD - MEDIUM DENSE
D - DENSE
VD - VERY DENSE

PROJECT UNITS

T	- TOPSOIL
T/F	- TOPSOIL/FILL
F	- FILL
A	- ALLUVIUM
R	- RESIDUAL SOIL
SS & SHS (Class #)	- LOCAL SANDSTONE CLASSIFICATION
SH (Class #)	- LOCAL SHALE CLASSIFICATION

SOIL LEGEND

S1 - FILL

S2 - ALLUVIUM

S3 - RESIDUAL SOILS

ROCK LEGEND

R1 - TYPICALLY CLASS V/IV BRINGELLY SHALE

R2 - TYPICALLY CLASS III BRINGELLY SHALE

R3 - TYPICALLY CLASS II OR BETTER BRINGELLY SHALE

SPT N Value

N=

Drilling Water Info

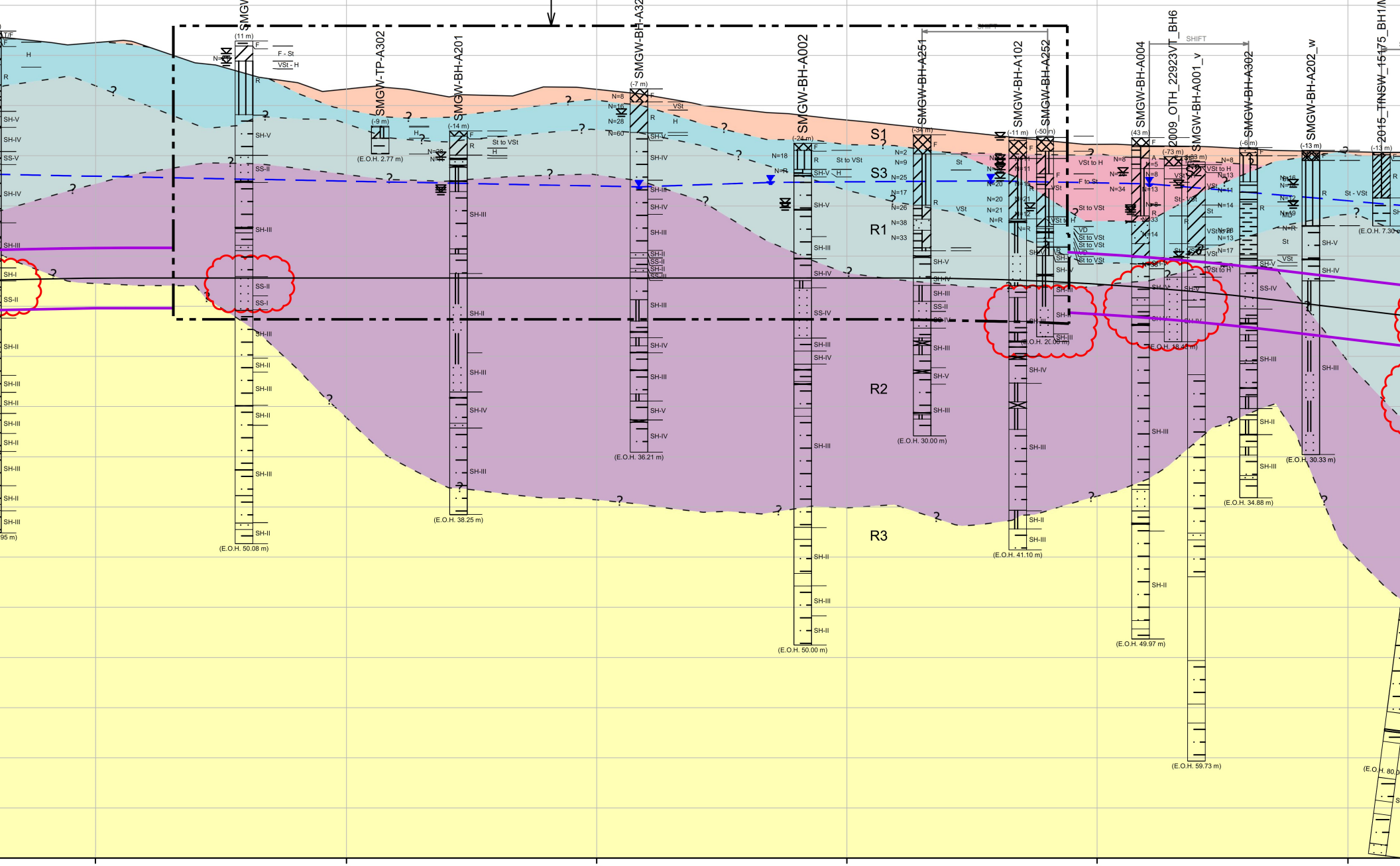
(E

URFACE

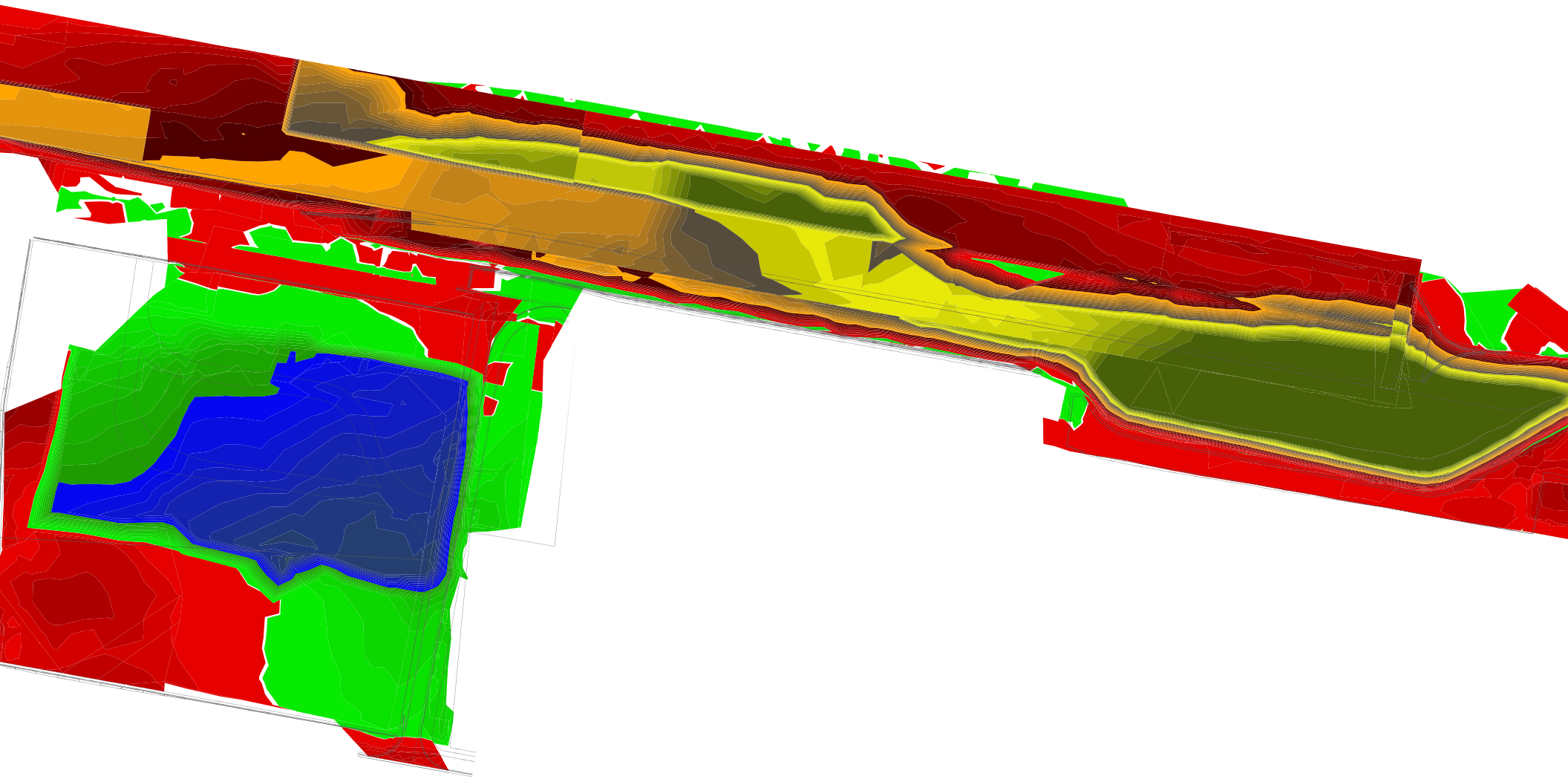
CAL BOUNDARY

FACE BETWEEN SH-V & SH-IV

1. SITE-SPECIFIC INVESTIGATION DATA IS INCOMPLETE A LOCATIONS.
2. NO GUARANTEE CAN BE GIVEN AS TO THE VALIDITY, N SUBSURFACE FEATURES SHOWN.
3. INFERRED SUBSURFACE CONDITIONS BETWEEN BORE INTERPOLATION AND/OR EXTRAPOLATION OF DISCRE SHOWN ARE AN INTERPRETATION AND MUST BE CONS
4. LOCAL VARIATIONS OR ANOMALIES IN GROUND COND PARTICULARLY BETWEEN DISCRETE TEST HOLE LOCA
5. FOR DETAILS AND PRECISE LOCATIONS OF PARTICUL THE ORIGINAL LOGS FROM SOURCE DOCUMENTS.
6. GROUND SURFACE SHOWN IS BASED ON THE LIDAR P FROM GEOSCIENCE AUSTRALIA (2019) WITH THE EXCE CLIENT PROVIDED DATA.
7. THE BEDROCK HAS GENERALLY BEEN CATEGORISED (2019) METHOD. HERE CLASS V AND IV HAVE BEEN CO HAVE ALSO BEEN COMBINED AS A SINGLE UNIT.
8. ROCK ZONES ARE DENOTED AS "TYPICALLY CONTAINI ROCK ZONE MAY CONTAIN AREAS OF HIGHER AND LO SUCH VARIATION IN THEIR DESIGN.
9. POSITIONS OF TUNNELS, STATION BOXES, DIVE STRU ONLY.
10. FOR GEOTECHNICAL CROSS-SECTIONS, POSITION "0" SOUTHBOUND TUNNEL ALIGNMENT.



	50% CLASS III, 50% CLASS >II	NOT APPLICABLE	80% CLASS IV/V, 20% RS	
	80 - 100%	NOT APPLICABLE	0 - 100%	
	17 - 9 MPa	NOT APPLICABLE	2.5 MPa	
	MEDIUM	NOT APPLICABLE	LOW TO VERY LOW	



TOTAL CUT TO-DATE:
50,669m3

TOTAL FILL TO-DATE:
13,083m3

Appendix 3 Previous Investigation Summary Tables of Results