Attachment AN

Supplementary Environmental Site Assessment

Supplementary Environmental Site Assessment

Canberra Brickworks

Yarralumla ACT

Prepared for:	DOMA Group
Date:	3 July 2021
Reference No:	JC0546
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Supplementary Environmental Site Assessment Canberra Brickworks			JC0546_SESA.01	
Written			**Approved**	
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1.0 INTRODUCTION

1.1 Preamble

DOMA Group (DOMA) engaged Agon Environmental Pty Ltd (Agon) to conduct a Supplementary Environmental Site Assessment (SESA) at the Canberra Brickworks defined as Block 764 Canberra Central and Block 7 Section 102 Yarralumla (the site, see Figure 1). It is understood that DOMA intend to the redevelop the site as a mixed-use development inclusive of residential, commercial and public space areas. Specific development Precincts are presented in **Section 2.1**.

A number of environmental investigations have been undertaken at the site; however, data gaps were identified in Arcadis (2017) *Data Review and Data Gap Analysis and Sampling, Analysis and Quality Plan, V03 dated 26 June 2017* (the SAQP). Accordingly, this SESA has been prepared to address the data gaps identified in the SAQP and is subject to review by the ACT EPA approved Contaminated Land Site Auditor Dr Lange Jorstad of Geosyntec Consultants in preparation of a Site Audit Statement (SAS) of the site.

In additional, this SESA presents all the contemporary and historical site assessment data with respect to the proposed development Precincts. The intent is to determine which Precincts are suitable, from a contamination perspective, for the proposed redevelopment and if any management and/ or remediation strategies are required to render any Precinct suitable for their intended uses.

For ease of review figures have been included in report with tabulated soil and groundwater analysis results provided in **Appendix A**.

1.2 Objectives

The primary objectives of the SESA are as follows:

- Identify and characterise the nature and extent of potential site contamination targeting the Areas of Environmental Concern (AECs) identified in the Arcadis (2017) SAQP.
- Determine if a potential risk exists to the identified receptors from any site contamination in context of the Development precincts.
- If required, the development of strategies to remediate and/ or manage any identified contamination and render any Precincts site suitable for the proposed redevelopment.

1.3 Scope of Work

The scope of work for this assessment comprised:

- Review of available site history data and previous findings.
- Drilling of 15 boreholes (BH01-BH15) to a maximum depth of 17 metres below ground level (mbgl). Conversion of boreholes BH101, BH103, BH104, BH105 and BH106 to groundwater monitoring wells (MW100-MW104 respectively).
- Excavation of 59 test pit locations (TP201-TP259) to a maximum depth of 5.0 mbgl.
- Completion of a groundwater monitoring event of all newly installed groundwater wells and existing groundwater wells at the site.
- Collection and laboratory analysis of soil and groundwater samples by commercial analytical laboratories for identified contaminants of concern using NATA registered methods.
- Comparison of analytical results with applicable guidelines, to provide a preliminary indication of risks to human health and/ or the environment.
- Revision of the Conceptual Site Model (CSM) presented in the Arcadis (2017) SAQP.
- Compilation of this information in this report and provision of a conclusion as to the suitability of each development Precinct for the proposed redevelopment

1.4 Supporting Documents

Agon has reviewed the following supporting documentation in preparation of this SESA:

- Robson (2015) Stage 1 Environmental Site Assessment. Canberra Brickworks Remediation Project, Block 1 Section 102 Yarralumla, Canberra Central ACT. February 2015 (revised March 2015). Ref 9623_EAR_Stage 1 ESA Report_20150312.
- SMEC (2014) Preliminary (Environmental) Site Investigation, Canberra Brickworks. 18 February 2014. Ref 3002369.
- SMEC (2016a) Canberra Brickworks: Detailed Environmental and Geotechnical Site Investigation. Canberra Brickwork Precinct, Yarralumla, ACT. 31 October 2016. Ref 3002523.
- SMEC (2016b) Canberra Brickworks: Groundwater Investigation-Addendum Report. Canberra Brickwork Precinct, Yarralumla, ACT. Ref 3002523.
- Arcadis (2017) Data Review and Data Gap Analysis and Sampling, Analysis and Quality Plan, V03.

1.5 Legislative Framework

The DSI has been prepared in general accordance with the guidelines endorsed by the ACT EPA (2017) Contaminated Sites Environment Protection Policy (CSEPP).

2.0 SITE DETAILS

2.1 Site Identification

Formal identification of the site is summarised below in Table 1.

Table 1: Site Identification

Site Address	End of Denman Street, Yarralumla, ACT
Allotment Description	Block 7 Section 102, Yarralumla Block 764, Canberra Central and Block 1 Section 102 Yarralumla Blocks 11 & 12 Section 38, Fyshwick, Canberra ACT
Land Zoning	CZ6: Leisure and Accommodation RZ1: Suburban PRZ2: Restricted Access Recreation Zone
Current Land Use	Vacant
Proposed Land Use	Mixed use including residential, commercial and public space. Development Precincts are defined as follows: • Heritage Core – Commercial Land use. • Road and Open Space Network • Precincts 1, 2, 3, 4, 5, 6, 7, 8, 9 – Medium Density Residential. • Precinct 10 & 11 – Low Density Residential. The development Precincts are shown in Figure 1.
Total Area	16 Hectares or thereabouts

2.2 Physical Setting and Current Land Use

The site is situated in the division of Yarralumla within the Canberra Central district and is bound by the Royal Canberra Golf Course (west and north), Bentham Street (north) and low density residential (south). Access to the site is made via Denman Street (south). The site itself is the former Canberra Brickworks and comprises:

- Former Brickworks (western portion of the site), several remnant buildings including 6 kilns, 4 stack houses, office building and amenities, 3 machinery sheds, workshops, boiler house, a substation, a powerhouse, storage sheds and other minor buildings. This portion of the site was previously occupied by Thor's Hammer, a wood recycling business.
- The quarry (eastern portion of the site) includes a large grassed area with several exposed natural siltstone bedrock features which has been levelled with an unknown amount of fill and bricks which have also been formed into mounds.
- The demolished and overgrown workers accommodation area (south).
- Vacant areas (south).

Figure 1: Site Location and Precinct Plan
Source: ACTmapi (2021)

2.4 Surrounding Land Uses

Surrounding areas comprise the suburb of Yarralumla. These suburbs include commercial, residential, community and open urban land uses as permitted under the Territory Plan Zoning. The immediate surrounding land uses to the site are summarised below in Table 2.

Table 2: Surrounding Land Use

Direction	Land Use
North	Lane Poole Place and Bentham Street, residential properties surrounding the roads and beyond
East	Schomburgk Street, Woollis Street and Bentham Street with associated residential properties
South	Denman Street leads to and bisects the northern and southern portions of the Site, beyond which is Block 7 Section 102 comprising numerous trees and open spaces. Cotter Road lies beyond the trees.
West	Treed area, beyond which lies the Royal Canberra Golf Course

2.5 Site Geology, Hydrology and Hydrogeology

The environmental setting of the site is summarised from SMEC (2016) and Arcadis (2017) as follows:

- The Geology of Canberra 1:100, 000 Sheet 8287 (1992) shows that the Canberra brickworks is underlain by calcareous and tuffaceous mudstone and siltstone of the Late Silurian Yarralumla Formation. The formation outcrops within multiple areas within the site.
- Review of the 1:100,000 Hydrology of the Australian Capital Territory and Environs (1984) indicated that the groundwater beneath the Site is generally present in fractured rock. The quality tends to be variable and was described as 500 – 1,000 mg/ L TDS. The yield was described as approximately 1.0 L/ s.
- The topography of the Site is variable due to historical brick material extraction works. The site generally slopes to the west north-west. SMEC (2016) identified a total of five catchments in the site.
- The southern areas of the site gradually slope to the southwest, south, and southeast. The topography of this area has been modified to include the Cotter Road and Yarra Glen/ Adelaide Avenue. Surface water flow has been mapped to generally flow south towards Yarralumla Creek which discharges into the Molonglo River.

3.0 HISTORICAL INFORMATION

3.1 General History

The Canberra Brickworks was operated between 1913 and 1976. Since its closure, it has remained largely vacant with the exception of a commercial wood working/ recycling business known as Thor's Hammer. The brickworks itself contains a range of structures/ areas associated with the brick production process; for the purpose of this SESA, these historical areas at the site have been extracted from the SMEC (2014) PSI and shown in Figure 2.

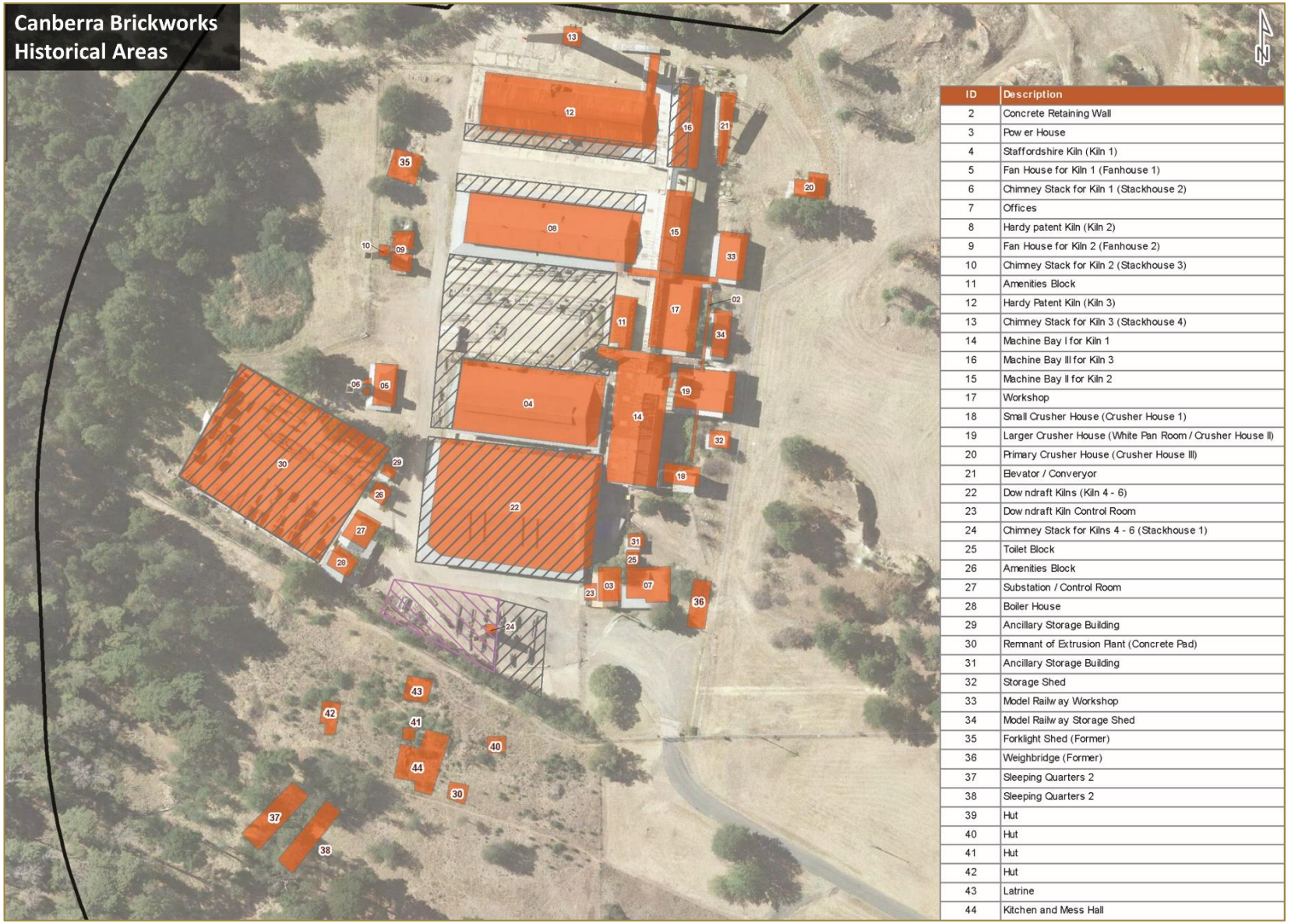
3.2 Previous Environmental Investigations

A detailed account of the site history is provided in Arcadis 2017 (SAQP); in summary:

- Contaminants of Potential Concern (CoPC) were generally below adopted criteria. Exceedances of Lead and Zinc were reported in isolated areas. Bonded asbestos was also identified in an area known as the Asbestos Dump and surficially around the brickworks.
- Potential risk to ecological receptors and human health associated with the brickworks, quarry, and former worker's accommodation was considered low-moderate.
- The southern areas of the site typically comprised natural soil grading to weathered rock. As analytical results were below the adopted site criteria, SMEC (2016) considered the potential for contamination to be present as low.
- Based on the results of the surface water and groundwater assessment SMEC (2016) recommended additional surface and groundwater monitoring to further investigate the presence of benzene in water.

3.3 Areas of Environmental Concern

The Arcadis (2017) SAQP identified the following AECs which warranted further assessments. See Table 3 below.



ID	Description
2	Concrete Retaining Wall
3	Pow er House
4	Staffordshire Kiln (Kiln 1)
5	Fan House for Kiln 1 (Fanhouse 1)
6	Chimney Stack for Kiln 1 (Stackhouse 2)
7	Offices
8	Hardy patent Kiln (Kiln 2)
9	Fan House for Kiln 2 (Fanhouse 2)
10	Chimney Stack for Kiln 2 (Stackhouse 3)
11	Amenities Block
12	Hardy Patent Kiln (Kiln 3)
13	Chimney Stack for Kiln 3 (Stackhouse 4)
14	Machine Bay I for Kiln 1
16	Machine Bay III for Kiln 3
15	Machine Bay II for Kiln 2
17	Workshop
18	Small Crusher House (Crusher House 1)
19	Larger Crusher House (White Pan Room / Crusher House II)
20	Primary Crusher House (Crusher House III)
21	Elevator / Converyor
22	Dow ndraft Kilns (Kiln 4 - 6)
23	Dow ndraft Kiln Control Room
24	Chimney Stack for Kilns 4 - 6 (Stackhouse 1)
25	Toilet Block
26	Amenities Block
27	Substation / Control Room
28	Boiler House
29	Ancillary Storage Building
30	Remnant of Extrusion Plant (Concrete Pad)
31	Ancillary Storage Building
32	Storage Shed
33	Model Railw ay Workshop
34	Model Railw ay Storage Shed
35	Forklight Shed (Former)
36	Weighbridge (Former)
37	Sleeping Quarters 2
38	Sleeping Quarters 2
39	Hut
40	Hut
41	Hut
42	Hut
43	Latrine
44	Kitchen and Mess Hall

Figure 2: Historical Areas
Source: SMEC (2014)

Table 3: Areas of Environmental Concern

AEC	CoPCs	Description
AEC#01 Kilns	Metals BTEX PAHs Dioxins TRH	Sands, dust, surface areas located within the Kilns. This media reported elevated concentrations of Lead and Zinc in excess of the adopted ASC (2013 NEPM HIL D criteria).
AEC#02 Surface Soils Kiln 1 Fan House	Metals	Surface soils west of the fan house for Kiln 1 reported elevated concentrations of Zinc and Lead.
AEC#03 Quarry Fill	Metals OCP/ OPP TRH PCBs BTEX Asbestos. PAHs	Soil sampling within the infilled quarry has not identified the presence of any gross chemical contamination. However, there is uncertainty in the exact nature, extent and composition of filling activities. Further assessment was recommended to reduce this uncertainty.
AEC#04 Groundwater Quarry Area	Metals PAHs TRH PCBs BTEX	Defined as the groundwater directly below the former Quarry which has been extensively infilled. Insufficient historical assessment has been performed at this AEC.
AEC#05 Brickworks Soils	Metals PAHs TRH PCBs BTEX	Defined as general soils around and below the brickworks (i.e., the Heritage Core area). Insufficient historical assessment has been performed at this AEC.
AEC#06 Groundwater Brickworks Area	Metals PAHs TRH PCBs BTEX	Defined as the groundwater directly below the brickworks (i.e., the Heritage Core area). Insufficient historical assessment has been performed at this AEC.
AEC#07 UST	Metals BTEX TRH PAHs	A former UST was identified by SMEC (2016). Insufficient historical assessment has been performed at this AEC.
AEC#08 Asbestos Dump	Metals OCP/ OPP TRH PCBs BTEX Asbestos. PAHs	A mound of soil, anecdotally identified as containing asbestos building material debris, is present in the northern portion of Precinct 1 and was subject to remedial works by Robson (2015) which removed majority of the asbestos materials. Further assessment of the mound and any residual asbestos impacts is required.
AEC#09 Fill Whole Site	Metals OCP/ OPP TRH PCBs BTEX Asbestos. PAHs	Extensive fill material has been identified across the site. There is uncertainty in the exact nature, extent and composition of filling activities. Further assessment was recommended to reduce this uncertainty.
AEC#10 Residential Precincts	Metals OCP/ OPP TRH PCBs BTEX Asbestos. PAHs	The location of the development areas was not known at the time of SMEC (2016). Accordingly additional targeted locations were proposed.
AEC#11 Benzene in Groundwater	BTEX	SMEC (2016) detected benzene (albeit at low concentrations) in groundwater at monitoring wells M2 and M7. Temporal and spatial variation of benzene concentrations within groundwater at the site have not been fully assessed.

4.0 ASSESSMENT CRITERIA

The Arcadis (2017) SAQP presents rational for the appropriate groundwater and soil assessment criteria for assessing the site, these have been reviewed by Agon and refined as follows:

Soil

- ASC (2013) NEPM Ecological Investigation Levels (EILs):
  - Urban residential and public open space – Values adopted from Arcadis (2017) SAQP.
  - Commercial/ Industrial – Generated from data sourced from Robson (2015).
- ASC (2013) NEPM Ecological Screening Levels (ESLs):
  - Urban residential and public open space (fine soil texture).
  - Commercial/ industrial (fine soil texture).
- ASC (2013) NEPM Human Health Investigation Levels (HILs):
  - HIL A – Low Density Residential (soil access).
  - HIL B – Medium Density Residential (limited soil access).
  - HIL C – Recreational Land Use.
  - HIL D – Commercial/ Industrial Land Use.
- ASC (2013) NEPM Human Health Screening Levels (HSLs) with a Clay geology:
  - HSL A – Low Density Residential (soil access).
  - HSL B – Medium Density Residential (limited soil access).
  - HSL C – Recreational Land Use.
  - HSL D – Commercial/ Industrial Land Use.

Groundwater

- ASC (2013) NEPM: Groundwater Investigation Levels (EILs):
  - Groundwater Investigation Levels (EILs) - Freshwater.
  - HSLs (Clay) for petroleum hydrocarbon vapour intrusion depth to water >8mbgl.
- ACT EPA (2017) 'Environmental Guidelines for service station sites and hydrocarbon storage'. These provide assessment criteria for TPH, BTEX and lead.

The applicability of the assessment criteria to each development Precinct is shown below in Table 4.

Table 4: Adopted Assessment Criteria

Precinct	Description	Criteria
Heritage Core	Comprised of the brickwork's kilns, workshops and general areas. Area to be used for mixed commercial.	EIL (Commercial/ Industrial) ESL (Commercial/ Industrial) HIL D HSL D (Clay)
Open Space and Road Network	Proposed open public spaces (Quarry Park, the Remnants) and road network.	EIL (Urban Residential) ESL (Urban Residential & Open Space) HIL C HSL C (Recreational, Clay, 0-1m)
Precincts 1-9	Predominately comprised of medium density residential land uses with underground carparking. As the area will comprise underground carparking EILs/ ESLs have not been considered.	HIL B HSL B (Clay, 0-1m)
Precincts 10-11	Proposed low density residential allotments.	HIL A HSL A (Clay, 0-1m) EIL Urban Residential

5.0 FIELD PROGRAM

The sections that follow provide a summary of the assessment completed as part of the SESA.

5.1 Sampling Plan and Rationale

The sampling plan is detailed below in Table 5 with the SESA sample locations depicted in Figure 3. Previous investigation sample locations are also provided as Figures 4, 5 and 6.

Table 5: Sampling and Analysis Plan

Sample Location	Target Area	Rationale
AEC#01 – Kilns (Surface Soils)		
KS1-KS6 CB1-CB11	Surface sands and clay base of the Kilns (Heritage Core)	Both kiln dust samples and the clay base beneath the kilns were sampled to provide further insight into concentrations of CoPCs.
AEC#02 – Kiln 1 Fan House (Surface Soils)		
TP257	Kiln 1 Fan House	Test pit 257 was advanced adjacent to the Kiln 1 fan house which reported elevated concentrations of Zinc and Lead.
AEC#03 – Quarry Fill		
TP201-TP208	Quarry Fill	Sample locations were distributed across the quarry area to provide site wide coverage and intercept any potential soil contamination arising from uncontrolled fill across the site.
AEC#04 – Groundwater (Quarry Area)		
M4, M5 M6	Groundwater (Quarry)	All monitoring wells within the quarry were sampled as part of this SESA. M1 was observed to be dry.
AEC#05 - Brickworks Soils		
BH101, BH102 BH104-BH109	Brickworks (Heritage Core)	Boreholes were advanced across the brickworks area.
AEC#06 - Groundwater (Brickworks Area)		
MW100-MW104	Brickworks (Heritage Core)	Five wells were installed within the historical brickworks area. These wells (sampled in conjunction with existing groundwater wells) were considered sufficient to assess the nature and extent of CoPCs in groundwater beneath the site.
AEC#07 - UST		
BH103	UST	BH103 was advanced in the area to assess for any hydrocarbon impacts to soil as a result of the underground storage of fuels.
AEC#08 - Asbestos Dump		
TP246-TP252	Asbestos Dump (Precinct 1)	Test pits advanced within the area identified as the ‘asbestos dump’ to determine quality of soils and degree of asbestos impacts.
AEC#09 – Fill (Whole Site)		
TP200-TP259 BH100-BH115	General site area	Fill material was sampled where encountered in all sample locations.
AEC#10 – Residential Precincts		
TP211-TP225 TP231-TP245	General site area	Further test pitting was conducting in footprints of the precincts to provide insight into the suitability of site soils for the proposed land uses.
AEC#11 -Benzene in Groundwater		
M2, M3 MW100-MW104	Groundwater (Brickworks)	Groundwater wells were assessed for benzene to determine the nature and extent of these impacts to groundwater (if any).

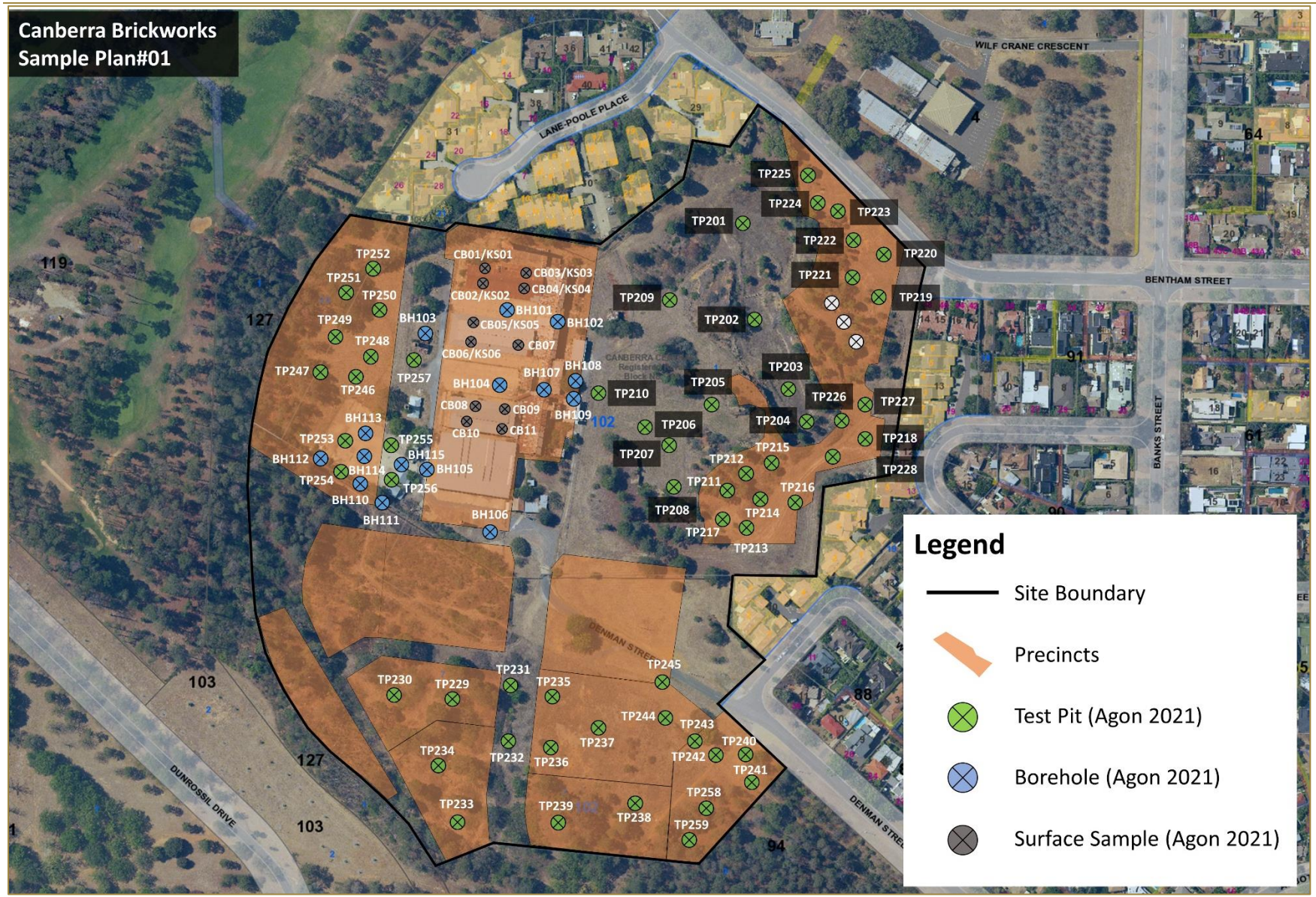


Figure 3: Agon (2021) SESA Sample Locations

Source: ACTmapi (2021)

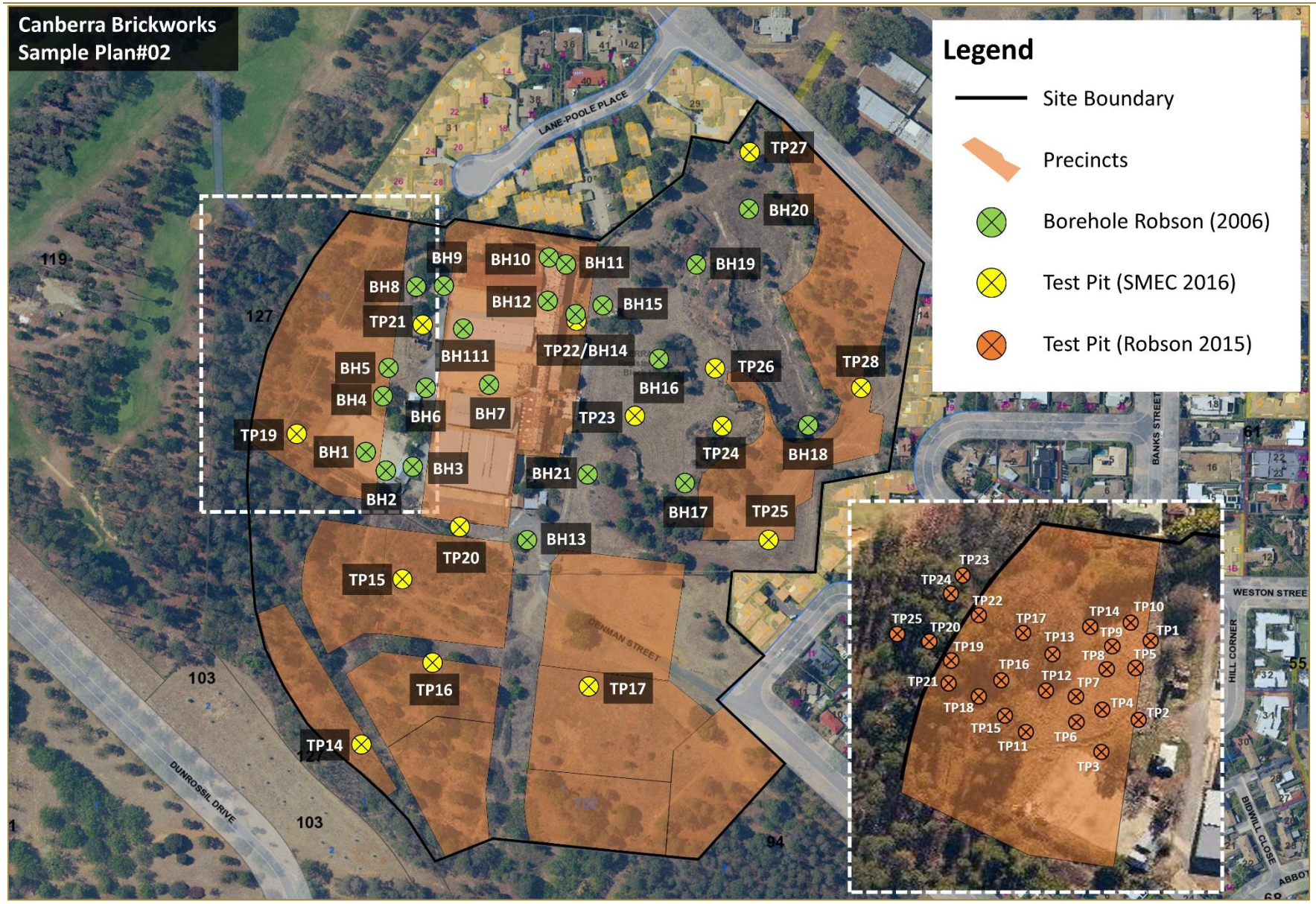


Figure 4: **SMEC (2013) and Robson (2006 and 2015) Sample Locations**
Source: ACTmapi (2021)

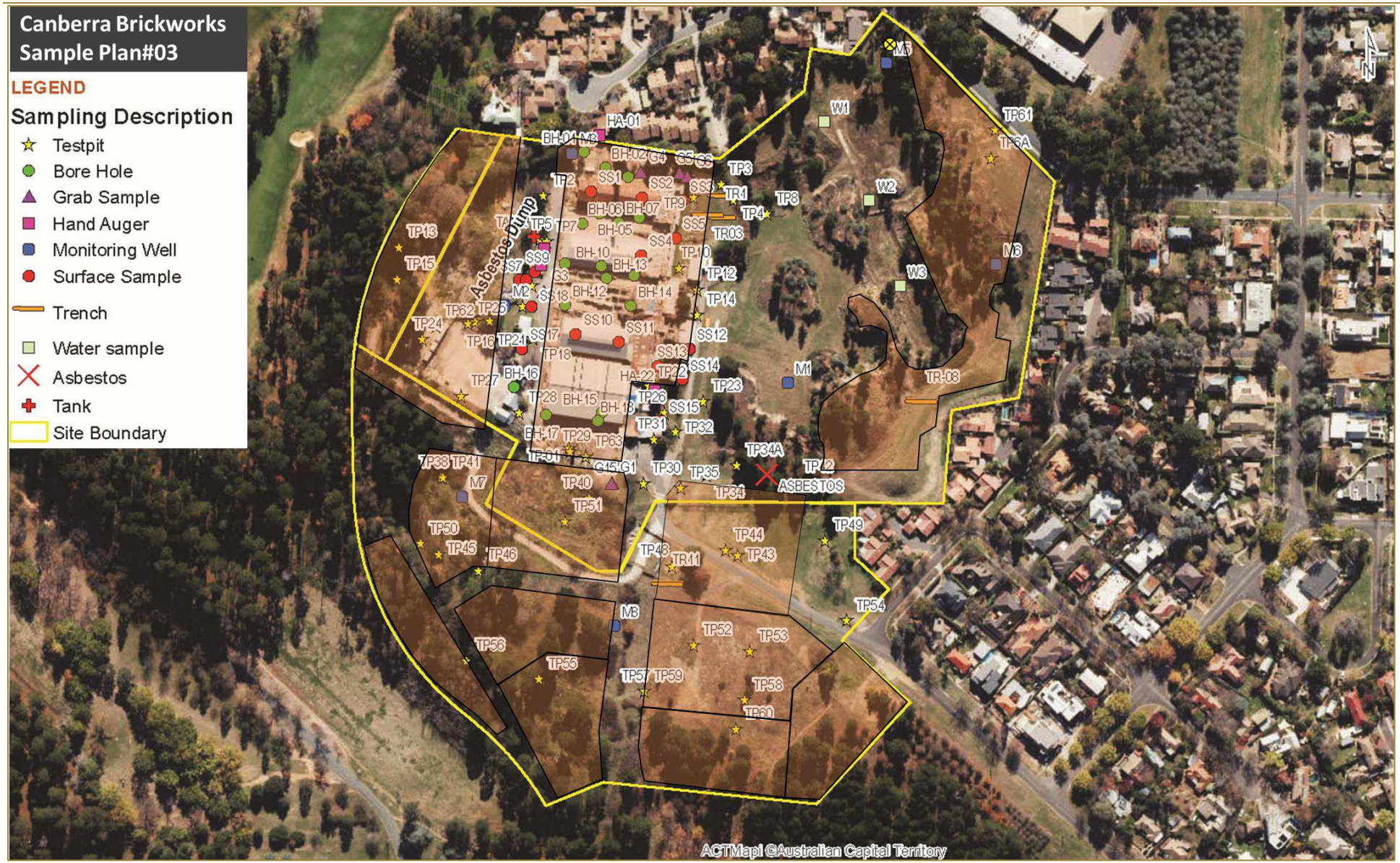


Figure 5: SMEC (2016) Sample Locations

Source: ACTmapi (2021)

Figure 6: Groundwater Well Locations
Source: ACTmapi (2021)

5.2 Field Methodologies

The soil and groundwater investigation were undertaken between March 2021 and May 2021. Field methodologies employed are described below in Table 6.

Table 6: Soil Investigation Methodology

Task	Description
Service Location	Prior to the commencement of soil investigations, the site was cleared for underground utilities by licensed underground service locators. Copies of Dial Before You Dig plans were obtained and reviewed onsite during underground service locating.
Test Pits	Test pits were excavated by contractor D-Group using a 7 and 30 tonne excavator. Surface samples were collected by hand using nitrile gloves, while deeper samples were collected from fresh soil material from the excavator bucket, ensuring samples were collected from fresh soil that had not contacted the bucket surface. Upon completion, test pits were backfilled with the excavated soil and compacted (tyre rolled). Photographs showing site conditions are provided in **Appendix B**.
Boreholes **Groundwater Wells**	Boreholes were drilled by Numac using a track mounted Geoprobe utilising solid stem augers and air hammer drilling methodologies. Samples were collected by Agon from the drilling cuttings. Selected boreholes were converted to groundwater monitoring wells (MW100-MW104), these wells were constructed from Class 18 uPVC 50 mm outside diameter machine threaded casing and screen (0.5 mm slots). Graded filter sand was added to approximately 0.5 m above the top of the screened interval. A minimum 0.5 m hydrated bentonite seal was added above the filter sand. Soil cores were logged in general accordance with the Australian Standard AS1726-1993 and the Unified Soil Classification System (USCS). Samples were screened in field for the presence of volatile contaminants using a calibrated PID. Borehole logs and groundwater well construction details are included in **Appendix C**.
Soil Sample Collection	Samples were typically collected from the boreholes and test pits at 0.5m, 1.0m and every 0.5-1.0m thereafter targeting changes in lithology and/ or at the presence of visual or olfactory indicators contamination. Samples were collected using disposable nitrile gloves and placed in clean laboratory provided jars. Samples were immediately placed on ice in a cooler prior to transport to the laboratory. Duplicate samples were forwarded by Eurofins to the secondary laboratory (ALS Environmental).
Groundwater Development	Development of the monitoring wells used surge methodology (bailer) to remove accumulated installation debris and improve water flow into the screened interval. Each well was purged 3 well volumes.
Groundwater Gauging	Onsite monitoring well caps were opened, the Standing Water Level (SWL) and Total Depth (TD) and presence of LNAPL (Light Non Aqueous Phase Liquids) were measured using an electronic oil separator interface probe (IP). The SWL and TD measurements were taken from each well prior to purging.
Groundwater Purging	Wells were purged using Micropurge low flow sample kits. During purging a calibrated Water Quality Meter (WQM) was used to measure water parameters, including temperature, electrical conductivity, redox, dissolved oxygen and pH. Wells which yielded sufficient groundwater were purged until the water parameters had stabilised to within 10% and at least one well volume purged. Once stabilised, purged water was considered representative of the groundwater at the Site.
Groundwater Sampling	Groundwater samples were collected directly from the tubing connected to the Micro purge pump into laboratory prepared sample bottles and kept chilled. Samples collected for metals analysis were field filtered (0.45 micron filter), prior to filling acid preserved laboratory provided sample bottles. Groundwater wells M4, M5 and M6 all had less than a metre of water present so were sampled using a Hyrdasleeve. no-purge grab sampler. The Hydrasleeve was lowered into the monitoring well at a sufficiently slow speed (<0.3m/ s, in accordance with manufacturer's specifications) to minimise disturbance before being left to stabilise for a minimum of 5 minutes. After stabilising (approximately 5 minutes), the Hydrasleeve was removed at a minimum speed of 0.3m/ s to allow the check valve to open. Samples were transferred from Hydrasleeves into the sample containers using a discharge tube.
QA/ AC	An evaluation of QA/ QC is presented in **Appendix D**.
Laboratory Method	All primary and QA/ QC samples were submitted to Eurofins Laboratories (NATA accreditation No. 1261). Inter-laboratory duplicates were submitted to ALS Laboratories (NATA accreditation no. 2562). Laboratory analysis was conducted in accordance with the requirements of the ASC NEPM (2013) and are referenced to USEPA and APHA methods.

5.3 Variations to SAQP

Overall Agon consider that the field investigation was undertaken in compliance with the Arcadis (2017) SAQP. The following additional sample locations were advanced:

- Shallow hydrocarbon odours and stained soils were observed to be present directly below the concrete slab located in the southern portion of Precinct 1. Sample locations TP253-TP27 and BH110-BH115 were advanced to determine the nature and extent of these impacts.
- BH108 and BH109 were advanced at the location of the former oil store.

6.0 RESULTS

6.1 Soil Conditions

Soil observations have been separated into the following sub areas and are supported by photographs provided in **Appendix B**:

Quarry Area

- Fill was predominantly found in the central and south-east portion of the Quarry Area.
- No fill was observed in the north-east portion (TP219-TP225) of the Quarry Area.
- Fill material typically comprised of clayey sands and gravelly sandy clays with gravels and cobbles of siltstone. The most widespread anthropological inclusions were brick materials, and these were encountered in almost all sample locations. Less frequently observed anthropogenic inclusions comprised ash, bitumen, metal waste and machinery pieces.

Brickworks (Heritage Core)

- Fill was observed in the majority of sampling points within the heritage core area and was recorded to a maximum depth of 1.5 mbgl in BH101. Fill was predominantly comprised of reworked natural clays with no anthropogenic inclusions. No evidence of anthropogenic inclusions were encountered in any sample locations.
- BH102 intercepted black stained sands directly below the surface concrete slab. The staining appeared to have an oily texture possibly related to the use of machinery lubricants associated with brick production.
- BH108 and BH109 intercepted black stained fill overlying weathered siltstone at depths between 0.5 and 1.0 m. This location was adjacent to a former above ground oil storage area, Agon noted remnant pipework originating from this area suggesting lubrication oils were plumbed from this area and distributed to machinery associated with brick production.
- Two underground fuel supply lines were found to run between the former boiler house and Kilns 4-6. These fuel lines were exposed with viscous black hydrocarbons observed around the lines suggestive of a heating oil type hydrocarbon, the fuel lines were found to terminate at the boiler house. The fuel lines are associated with the transition from coal fired kilns to hydrocarbon fuel fired kilns.

Asbestos Dump (Precinct 1)

The area known as the asbestos dump comprises a large mound of soil which was subject to remedial works in 2015. Robson (2015) detailed the removal of 323.6 tonnes of asbestos impacted soil from the surficial layer of the mound. Robson (2015) undertook further test pitting at the mound and determined the mound to contain bonded asbestos impacted soil comingled with other wastes (metal, glass, plastic, brick, tile, slag, ash and wood fragments). The asbestos impacted materials were observed to be present in a shallow (1 m) layer as well as being present in deeper pockets.

Observations made by Agon during this SESA are as follows:

- The southern portion of mound predominately comprised layers of fill free of anthropogenic inclusions.
- More frequent pockets of anthropogenic inclusions were noted in the central and northern portions of the mound. Fragments of potential bonded asbestos were observed at:
    - TP248 -2.0: A single fragment (22 g / 70 x 35 x 5 mm) of cement sheeting.
    - TP250-3.0: A single fragment (104 g / 110 x 50 x 7 mm) of cement sheeting.
- The fill mound was variable in soil types and density of anthropogenic inclusions. No other indicators of contamination (i.e., staining or odours) were observed.

Southern Portion of Precinct 1

- Hydrocarbon odours and stained soils were observed to be present directly below the former extrusion plant slab, notably in sample locations TP254, TP255, TP256 and BH111. The impacts appeared to be confined to shallow subgrade gravels directly below the concrete slab and are confined by the underlying stiff clays.
- Sample locations TP253-TP27 and BH110-BH115 were advanced to determine the nature and extent of these impacts.
- The area is east of the former boiler house (known as the extrusion plant) where two underground fuel supply lines which extend to Kilns 4-6. No evidence of a UST could be identified in the area via exploratory test pits and GPR survey. It is possible heating oil was stored in ASTs at the former extrusion plant with leaks/ spills contributing to the shallow hydrocarbon impacts encountered below the extrusion plant east of the boiler bouse.
- Agon note the exploratory test pits exposed a layer of surficial bonded asbestos (depths between 0-100mm) at a number of locations depicted in the Clearance Certificate provided in **Appendix G**. Jesco Asbestos Removalists were engaged to undertake an emu pick to remove any residual bonded asbestos on the site surface. At the completion of these works the areas were inspected by Class A Licensed Asbestos Assessor Peter Hengst (License No. AA00010) which confirmed there to be no visible surface asbestos fragments.

Southern Areas (Precincts 2-11)

- Soils encountered in the southern areas of the site consisted primarily of natural materials consisting of silts, clays and bedrock (both weathered and fresh siltstone). Clays were more prevalent in the southern areas than other sections of the site and were red-brown, pale-brown and graded to olive-brown with depth. In some locations black mottling was observed within the clay and were attributed to weathered iron specs. Bedrock consisted of siltstone that varied from grey to yellow-brown.
- Fill was observed in two distinct areas consisting of Precinct 2 and 7.
    - A shallow (200 mm) shallow mixed waste deposit was uncovered underneath a worn bituminous surface at sample location TP243 in Precinct 2. The waste deposit was observed to include a range of anthropogenic inclusions including bitumen, metals pieces, brick and a potential fragment of bonded asbestos material.
    - The western portion of Precinct 7 (TP235-TP237) had a historical bitumen hardstand which was in a very poor state of repair.

6.2 Soil Analysis Results (All Data)

All historical and contemporary (collected as part of this SESA) data has been compiled for each of the development Precincts and compared to the adopted assessment criteria identified in **Section 5**. All exceedances of the adopted criteria are detailed in Table 77.

6.2.1 Precinct 1

Tabulated soil analysis results are included in Table 1, **Attachment A** with copies of the laboratory certificates included in **Appendix E**. In summary, a total of 99 samples have been analysed from this area of the site. All soil analysis results were less than the adopted assessment criteria with the exception of concentrations of Lead and Benzo(a)pyrene (BaP) in two samples (see Table 77).

Bonded asbestos fragments were identified at the following sample locations:

- TP248 -2.0: A single fragment (22g / 70 x 35 x 5mm) of cement sheeting was confirmed to contain chrysotile, amosite and crocidolite asbestos.

- TP250-2.0: Chrysotile, amosite and crocidolite asbestos detected in weathered fibre cement fragments. Total estimated asbestos concentration in FA = 0.000071% w/ w*
- TP250-3.0: A single fragment (104g / 110 x 50 x 7mm) of cement sheeting was confirmed to contain chrysotile, amosite and crocidolite asbestos.
- TP03 (0.0-0.1): Fragments (20 x 10 x 3mm) of cement sheeting was confirmed to contain chrysotile asbestos.
- TP09 (0.0-0.1): Fragments (100 x 60 x 5mm) of cement sheeting was confirmed to contain chrysotile, amosite and crocidolite asbestos.
- Robson (2015) presumed cement sheeting to contain asbestos at sample locations TP5 (1.9-2.0), TP6 (0.9-1.0), TP13 (0.0-0.1), TP13 (0.4-0.5), TP13 (1.9-2.0) and TP13 (2.9-3.0).

Fibrous Asbestos (FA) and Asbestos Fibre (AF) (<2 mm) was also detected in one location as follows:

- TP 13: FA and AF were detected at 0.0-0.1m (0.37 % w/ w) and 1.9-2.0m (0.053 % w/ w).

The extent of remediation works undertaken by Robson in 2014 is unknown. It is probable that some of the asbestos impacts reported in Robson (2015) summarised above have been remediated and removed from site.

6.2.2 Precincts 2-9

Tabulated soil analysis results are included in Table 2, **Attachment A** with copies of the laboratory certificates included in **Appendix E**. In summary, a total of 45 samples have been analysed from these areas of the site.

All soil analysis results were below adopted assessment criteria with the exception of BaP in a sample collected at 0.2 m depth in TP 243 (see Table 77). TP243 was the location of a thin (200mm) shallow mixed waste deposit (refer **Section 6.1**) uncovered underneath a worn bituminous surface. It is probable the elevated B(a)P concentrations were a result of bitumen fragments being incorporated into the sample.

A single fragment (256g / 160 x 110 x 4mm) of cement sheeting was also detected at sample location TP243. This fragment was confirmed to contain chrysotile and amosite asbestos.

6.2.3 Precincts 10-11

Tabulated soil analysis results are included in Table 3, **Attachment A** with copies of the laboratory certificates included in **Appendix E**. In summary, a total of 46 samples have been analysed from this area of the site.

All soil analysis results were below adopted assessment criteria with the exception of a single sample for lead in TP 223 at 1 m depth (see Table 77). This sample was retrieved from 1 mbgl in a test pit that was advanced directly into natural soils. No indicators of contamination (i.e. staining, odour, anthropogenic inclusions) were observed. On this basis Agon are of the opinion the result to be anomalous and not representative of in-situ conditions in this area of the site. Further assessment is recommended to support this opinion.

6.2.4 Heritage Core

Tabulated soil analysis results are included in Table 4, **Attachment A** with copies of the laboratory certificates included in **Appendix E**. In summary, a total of 79 samples have been analysed from this area of the site. All soil analysis results were below adopted assessment criteria with the exception of those summarised in Table 77.

6.2.5 Road and Open Space Network

Tabulated soil analysis results are included in Table 5, **Attachment A** with copies of the laboratory certificates included in **Appendix E**. In summary, a total of 101 samples have been analysed from this area of the site. All

soil analysis results were below adopted assessment criteria with the exception of those summarised in Table 77.

Table 77: Soil Analysis – Exceedances of Adopted Criteria

Sample Location	Depth (m)	Contaminant	Concentration (mg/kg)	Criterion Exceeded	
				Criterion	Concentration (mg/kg)
PRECINCT 1					
BH110	1	Lead	2,600	**HIL B** **EIL Urban Residential**	1,100
TP13	0.0-0.1	BaP	9.5	**HIL B**	4
PRECINCT 2-9					
TP243	0.2	BaP	16	**HIL B**	4
PRECINCTS 10-11					
TP223	1	Lead	3,400	**HIL B** **EIL Urban Residential**	1,100
HERITAGE CORE					
SS4	Surface	Zinc	2,100	**EIL Urban Residential**	650
SS5	Surface		1,000		
BH18	0.2-0.3		660		
BH108	0.5	TRH C10-C16	1,600	**ESL** **Urban Residential and Open Space**	170
ROAD AND OPEN SPACE NETWORK					
SS6	Surface	Lead	4,300	**HILD** **EIL Urban Residential**	600 1,100
SS7	Surface		1,500		
SS6	Surface	Zinc	5,400	**EIL Urban Residential**	430
SS7	Surface		1,800		
HA7	0.2-0.3		460		
HA8	0.1-0.2		640		
TP34A	0.5		830		
BH111	0.5	TRH C10-C16	670	**ESL** **Urban Residential and Open Space**	120
	1		420		
TP210	0.1		260		
TP256	0.2		200		
TP210	0.1	TRH C16-C34	1,500		1300
TP255	0.3		3,200		
TP256	0.1		3,100		

TP256	0.2		4,400		

6.3 Groundwater Results

6.3.1 Groundwater Conditions

The Standing Water Levels (SWL), Total Depth (TD) and observations recorded during the GME undertaken as part of this DSI are summarised below in Table 88.

Table 88: Groundwater Conditions

Well ID	Date	SWL (m TOC)	TD (m TOC)	Observations
M1	5/ 3/ 21	-	8.5	Dry
M2	5/ 3/ 21	7.91	19.252	Clear, no odour/ sheen
M3	4/ 3/ 21	4.156	4.812	Turbid brown, no odour/ sheen
M4	4/ 3/ 21	2.813	3.56	Clear, no odour/ sheen
M5	4/ 3/ 21	4.65	4.8	Clear, no odour/ sheen
M6	4/ 3/ 21	14.12	14.46	Turbid brown, no odour/ sheen
MW100	4/ 3/ 21	2.905	5	Slightly turbid, brown, no odour/ sheen
MW101	4/ 3/ 21	5.234	6.9	Slightly turbid, brown, no odour/ sheen
MW103	4/ 3/ 21	9.755	12	Slightly turbid, brown, no odour/ sheen
MW104	4/ 3/ 21	13.612	17	Slightly turbid, brown, no odour/ sheen

Notes:
SWL: Standing Water Level; TD: Total Depth; TOC: Top of Casing

6.3.2 Groundwater Parameters

Groundwater parameters were measured during the first GME and is summarised in Table 99.

Table 99: Groundwater Parameters

Well ID	Dissolved Oxygen (ppm)	Electrical Conductivity (µS/ cm)	pH	Redox (mV)	Temperature (°C)
M1	Well Dry				
M2	2.44	0.422	6.38	103.1	21.9
M3	4.31	0.58	6.03	151.1	20.1
M4	Poor recharge, grab sample collected				
M5	Poor recharge, grab sample collected				
M6	Poor recharge, grab sample collected				
MW100	11.06	0.454	6.62	170	21.9
MW101	10.3	1.01	7.15	59.9	16.8
MW102	Poor recharge, grab sample collected				
MW103	5.46	0.59	7.46	140.1	19.2

MW104	7.11	0.55	7.61	72.9	22.15

Notes:
Redox = Reduction / Oxidisation Potential

6.3.3 Groundwater Analytical Results

A tabulated summary of groundwater analytical results is presented in Table 6 **Appendix A**. Laboratory report and chain of custody documentation are included in **Appendix D**. In summary, groundwater analysis results were less than the adopted groundwater assessment criteria with the exception of:

- **Cadmium**: Dissolved cadmium concentrations at sample location M2 were reported to be 0.004 mg/L exceeding the adopted GIL criterion of 0.0002 mg/L.
- **Copper**: Dissolved copper concentrations at sample locations M3, MW101 and MW102 were reported between 0.003 and 0.012 mg/L exceeding the adopted GIL criterion of 0.0014 mg/L.
- **Lead**: Dissolved lead concentrations at sample locations M3 and MW102 were reported between 0.041 and 0.004 mg/L exceeding the adopted GIL and ACT EPA (2017) criterion of 0.0034 mg/L.
- **Zinc**: Dissolved zinc concentrations at sample locations M2, M3, M6, MW101 and MW102 were reported between 0.014 mg/L and 0.2 mg/L exceeding the adopted GIL criterion of 0.008 mg/L.

In summary, only dissolved metals were detected in groundwater at the site at variable concentrations. SMEC (2016b) concluded that '*the presence of heavy metals may be a reflection of the underlying geology or may also include an anthropogenic component*'.

6.4 QA/ QC Assessment

The QA/ QC program implemented for the Investigation was generated as the outcome of the seven-step Data Quality Objective (DQO) process, as described in Arcadis (2017) SAQP. The achievement of the project DQOs was demonstrated by reference to the Data Quality Indicators (DQIs) which include precision, accuracy, representativeness, completeness and comparability.

The data evaluation procedure employed in the assessment of the field and laboratory QA/ QC data (refer **Appendix D**) indicated that the reported analytical results are representative of soil conditions at the sample locations and that the overall quality of the analytical data produced is acceptably reliable for the purpose of this investigation.

7.0 REVISED CONCEPTUAL SITE MODEL

7.1 Revised CSM

The initial Conceptual Site Model (CSM) presented in the Arcadis (2017) SAQP has been revised based on quantitative (and additional qualitative) data presented in this SESA. The revised CSM provides a description of potential pathways by which actual or potential site contamination sources may reach and impact on receptors. Where incomplete contaminated source-pathway-receptor linkages exist, the exposure to (or migration of) the chemical substance via that pathway cannot occur.

Table 1010: Revised Conceptual Site Model

AEC	Source	Receptors	Pathway Discussion
AEC#01 - Kilns (Surface Soils)	Kiln Sands	Workers Occupants	**No longer considered an AEC** The sands and clay base of the kilns were assessed and did not report elevated concentrations of CoPC.
AEC#02 – Kiln 1 Fan House (Surface Soils)	Surface Soils	Workers Occupants	Test pit TP257 was advanced in proximity to surface samples SS6 and SS7 which reported elevated Lead and Zinc. The elevated Lead and Zinc could not be replicated at a vertical depth of 0.5m in TP257. Agon note the ground surface in many areas of the brickworks contain surficial waste materials including deteriorated metals. It is possible the surface samples inadvertently incorporated deteriorated metallic particulates. The exceedance reported at SS6 and SS7 is not considered to pose a significant contamination risk noting the area falls within an area proposed for a roadway. Pathways are discussed as following: • Migration pathway incomplete – No evidence of gross contamination that would migrate to deeper soils and/ or groundwater. • Exposure pathway potentially complete – Risk of worker contact with soils containing deteriorated metals during construction and maintenance.
AEC#03 – Quarry Fill	Quarry Fill	Workers Occupants Visitors	**The Quarry Fill remains an AEC** Isolated exceedances of the EIL/ ESL reported in the quarry fill. Pathways are discussed as following: • Migration pathway incomplete – No evidence of gross contamination that would migrate to deeper soils and/ or groundwater. • Human exposure pathway incomplete – No exceedances of the adopted human health criteria under an open public space land use setting. • Ecological exposure pathway incomplete – Areas of isolated EIL/ ESL exceedances are unlikely to present overall risk to the proposed use of the area as parklands (i.e., Quarry Parkland). Whilst no complete exposure pathways have been identified under the proposed development of the Quarry. There remains a significant volume of unassessed fill that will require management for unexpected finds of contamination during intrusive excavation works.
AEC#04 – Groundwater (Quarry Area)	Quarry Fill	Groundwater Ecology	**No longer considered an AEC** No detections of CoPC present in groundwater below the quarry. Elevated concentrations of metals exceeding the adopted GIL criteria were reported but given the depth of groundwater and absence of current (or planned) local groundwater extraction there are no conceivable exposure pathways to receptors at the site.
AEC#05 - Brickworks Soils	Brickworks Soil	Workers Occupants	**The Brickworks remains an AEC** Isolated exceedances of the EIL/ ESL reported in soils at the brickworks. The exceedances are unlikely to present overall risk to the proposed use of the area for commercial purposes.
AEC#06 - Groundwater (Brickworks Area)	Brickworks Soil	Groundwater Ecology	**No longer considered an AEC** No detections of CoPC present in groundwater below the quarry. Elevated concentrations of metals exceeding the adopted GIL criteria were reported but given the depth of groundwater and absence of current (or planned) local groundwater extraction there are no conceivable exposure pathways to receptors at the site.
AEC#07 - UST	Storage of Fuels	Workers Soil Ecology Groundwater Ecology	**The UST remains an AEC until removed and validated** No gross impacts of hydrocarbons as a result of the underground storage of fuels identified in soils or groundwater in proximity to the AEC. However, the UST will continue to be a potential source of contamination until it is removed, there is also uncertainty as to the exact location of the UST. It is recommended the UST be located by mechanical means, excavated and validated.
AEC#08 - Asbestos Dump	Asbestos impacted soils	Workers Occupants	**The Asbestos Dump remains an AEC** The 'Asbestos Dump' contains pockets of anthropogenic inclusions which may contain fragments of bonded asbestos, these asbestos impacts and/ or other unexpected finds will require management and/ or remediation during construction works.
AEC#09 – Fill (Whole Site)	Uncontrolled fill	Workers Occupants Visitors	**Fill at the site remains an AEC** There remains a significant volume of unassessed fill that will require management for unexpected finds of contamination during intrusive excavation works.
AEC#10 – Residential Precincts	Soils	Occupants	**No longer considered an AEC** With the exception of the isolated areas identified in **Section 6.2**.
AEC#11 -Benzene in Groundwater	Unknown	Groundwater Ecology Occupants Workers	**No longer considered an AEC** SMEC (2016) reported detections of benzene in M2 and M7. This result could not be replicated during the GME undertaken as part of this SESA which included additional groundwater wells MW100, MW101, MW102, MW103 and MW104. In the absence of other indicators of hydrocarbon based contamination (i.e., sheen, odours, other detections in TRH fractions) Agon are of the opinion the detection of low levels of Benzene were result a result of either sample or laboratory error. No potential migration/ exposure/ migration pathway exists.

7.4 Revised CSM Summary and Uncertainties

Overall, the revised CSM has not identified any complete contaminant-source-pathway-receptor linkages associated with the AECs with exception of the following discrete areas present in the following development Precincts:

- **Precinct 1 (Medium Density Residential)**
    - Asbestos Dump (AEC#08) – The fill mound identified as the Asbestos Dump contains pockets of anthropogenic inclusions which may contain fragments of bonded asbestos. The fill mound is located in Precinct 1 which is proposed to be bulk excavated for the construction of basement carparking. It is recommended a trial be undertaken to determine if mechanical screening be undertaken to determine if asbestos impacts (and other anthropogenic inclusions) can be removed to enable the offsite reuse of the soils contained in the mound. Screened soil would be subject to further assessment in accordance with ACT EPA (2020) *Information Sheet 4 Requirements for the reuse and disposal of contaminated soils in the ACT*.
    - BH110-1.0 - Concentrations of Lead were greater than 2.5x the adopted human health assessment criteria. The source of this impact is unclear and could be anomalous, further assessment is recommended.
- **Precinct 2 (Medium Density Residential)**
    - TP243 – Contains bonded asbestos impacts and concentrations of B(a)P greater than 2.5x the adopted human health assessment criteria. Accordingly, this sample location is considered to be a hotspot that warrants further assessment, remediation and validation.
- **Precinct 11 (Low Density Residential)**
    - TP223 - Concentrations of Lead were greater than 2.5x the adopted human health assessment criteria. The source of this impact is unclear and could be anomalous, further assessment is recommended.
- **Road and Open Space Network**
    - SS6 - Concentrations of Lead were greater than 2.5x the adopted human health assessment criteria. Accordingly, this sample location (which should be extended to include SS7) is considered to be a hotspot that warrants remediation and validation.
    - UST (AEC#07) – The UST remains a potential source of hydrocarbon impacts to soil and groundwater. The UST must be decommissioned, removed and validation in accordance with ACT EPA (2016) *Information Sheet 1 Decommissioning, assessment and Audit of Sites Containing Above Ground or Underground Fuel Storage Tanks.*

The Heritage Core and Road and Open Space Network contain discrete areas of metals or hydrocarbon impacts exceeding the adopted ecological screening criteria. These impacts are not considered to pose a significant contamination risk for redevelopment to include commercial, road and open public space land uses. Management of these impacts during redevelopment is recommended to ensure these soils are not inadvertently moved to more sensitive areas of the site.

The site contains a significant volume of uncontrolled fill predominately located in Precinct 1, the brickworks area and the former Quarry. In addition, surficial bonded asbestos fragments were observed in the southern portion of Precinct 1 (refer Clearance Certificate **Appendix G**). There remains a risk from further surficial bonded asbestos impacts and/ or other unexpected finds of contamination to be encountered during intrusive excavation works.

It is recommended a Development Site Management Plan (DSMP) be prepared to manage the known impacts and unexpected finds that may be encountered during development works.

8.0 CONCLUSIONS AND RECOMMENDATIONS

This SESA has assessed the Areas of Environmental Concern (AECs) identified in the Arcadis (2017) SAQP.

in summary, the findings of this SESA indicate that the AECs do not pose a contamination risk that would preclude the suitability of the site for the proposed development Precincts, with the exception of discrete areas which warrant further assessment and/ or remediation.

To address the impacts within these discrete areas and provide an overall framework for the management of known and potential unexpected finds of contamination during development works, Agon recommend the preparation of the following documents:

- **Remediation Works Plan (RWP)**

  The RWP is to be prepared to provide a methodology to guide the further assessment and/ or remediation of the areas identified and discussed in **Section 7.4**.

- **Development Site Management Plan Construction (DSMP)**

  The DSMP is to be prepared to provide guidance regarding the management of potentially contaminated soils that may be encountered, reworked and moved at the site during development works. Areas of known/ suspected contamination are to be identified in the plan based on the findings of this SESA (refer **Section 7.4**). It is also recommended that an Unexpected Finds Protocol (UFP) be included to aid in the identification of contamination types or areas that were not explicitly anticipated based on this SESA.

On this basis Agon provide the following conclusions with regard to each of the development Precincts:

- **Precinct 1**: Could be made suitable for the proposed medium density residential development subject to implementation of the RWP and DSMP.
- **Precinct 2**: Could be made suitable for the proposed medium density residential development subject to implementation of the RWP and DSMP.
- **Precincts 3 to 9**: Are suitable for the proposed medium density residential development subject to implementation of the DSMP.
- **Precinct 10**: Is suitable for the proposed low density residential development subject to implementation of the DSMP.
- **Precinct 11**: Could be made suitable for the proposed low density residential development subject to implementation of the RWP and DSMP.
- **Heritage Core**: Is suitable for the proposed commercial development subject to implementation of the DSMP.
- **Road and Open Space Network**: Is suitable for the proposed development of roadways and public open spaces subject to implementation of the RWP and DSMP.

9.0 LIMITATIONS OF THIS REPORT

This report has been prepared in accordance with industry recognised standards and procedures current at the time of the work. The report presents the results of the assessment based on the quoted scope of works (unless otherwise agreed in writing) for the specific purposes of the engagement by the Client. No warranties expressed or implied are offered to any third parties and no liability will be accepted for use of this report by third parties.

The assessment of environmental and human health risk included in this report relate to the whole site as described in the report. If the site is subject to demolition works or redevelopment, the risk profile of the site will change and the conclusions of this report will no longer be valid. If the site is subject to subdivision different to the proposed development at time of writing, the risk profile of each division of the site will change and the conclusion of this report will no longer be valid.

Consideration of the aesthetic and geotechnical suitability of site soils has been excluded from this report. Aesthetic and geotechnical suitability may need to be addressed in subsequent assessments.

All information provided by third parties has been assumed to be correct and complete. Agon does not assume any liability for misrepresentation of information by third parties or for matters not visible, accessible or present on the subject site.

Opinions and judgements expressed herein are based on Agon's understanding of current regulatory standards and should not be construed as legal opinions.

No responsibility is accepted for use of any part of this report in any other context or for any other purpose or by third parties other than those listed above.

This report should be read in full.

10.0 REFERENCES

ACT Department of Environment and Sustainable Development Information Sheet 7 – Guidance for undertaking preliminary contamination investigations for development/ lease variation purposes. Australian Capital Territory.

ACT Government (2021) ACTmapi, located at http:/ / www.actmapi.act.gov.au/

ANZECC (1999) Guidelines for the Assessment of On-Site Containment of Contaminated Soil. Australian and New Zealand Environment Council, Canberra.

Arcadis (2017) *Yarralumla Brickworks, ACT data review and gap analysis and sampling, analysis and quality plan (SAQP)*. Ref 17152_SAQP_V03

Environment Protection Authority (2017) Contaminated Sites Environment Protection Policy**.**

National Environment Protection Council (1999) Amended 2013 National Environmental Protection Measures Schedule B series. Department of Sustainability, Environment, Water, Population and Communities, Canberra.

NHMRC/ NRMMC – National Health and Medical Research Council/ Natural Resource Management Ministerial Council (2011) *Australian Drinking Water Guidelines, Amended 2016*. Commonwealth of Australia.

Robson (2015) *Stage 1 Environmental Site Assessment*. Canberra brickworks remediation project, Block 1 Section 102 Yarralumla, Canberra Central ACT. Ref 9623_EAR_Stage 1 ESA Report_20150312

SMEC (2014) *Preliminary (Environmental) Site Investigation.* Canberra Brickworks. Ref 3002369.

SMEC (2016a) *Canberra Brickworks: Detailed Environmental and Geotechnical Site Investigation*. Canberra Brickworks Precinct, Yarralumla, ACT. Ref 3002523

SMEC (2016b) *Canberra Brickworks: Groundwater Investigation – Addendum Report*. Canberra Brickwork Precinct, Yarralumla, ACT. Ref 3002523

APPENDIX A: TABULATED ANALYTICAL RESULTS

APPENDIX B: LOGS

APPENDIX C: SITE PHOTOGRAPHS

APPENDIX D: QUALITY ASSURANCE AND QUALITY CONTROL

APPENDIX E: LABORATORY CERTIFICATES

APPENDIX F: SUPPORTING INFORMATION