Sampling and Analysis Quality Plan (SAQP)

Woolstores Place, Mount Elphinstone, WA

Rowe Group

66001 | 155,373 (Rev A)

24 November 2023

We acknowledge the Traditional Custodians of Country throughout Australia and their connections to land, sea and community.

We pay respect to Elders past and present and in the spirit of reconciliation, we commit to working together for our shared future.

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1. Introduction and Background

1.1 Introduction

JBS&G Australia Pty Ltd (JBS&G) was commissioned by Rowe Group (the 'client') to prepare a Sampling and Analysis Quality Plan (SAQP) for the ten (10) lot parcel of land at Woolstores Place, Mount Elphistone (the site). The site includes the cadastral lots as detailed in Table 1-1 below. The site location and layout are presented in **Figure 1** and **Figure 2,** respectively.

Table 1-1: Site Lot Details

Lot address	Certificate of title	Lot area (ha)
34 Woolstores Place	Lot 1104 on Deposited Plan 165964	2.00
34 Woolstores Place	Lot 1209 on Deposited Plan 173935	3.36
34 Woolstores Place	Lot 895 on Deposited Plan 161301	4.05
34 Woolstores Place	Lot 1350 on Deposited Plan 184224	0.43
N/A	Lot 1156 on Deposited Plan 171141	0.20
N/A	Lot 1157 on Deposited Plan 171141	2.25
23 Woolstores Place	Lot 141 on Deposited Plan 27076	0.20
23 Woolstores Place	Lot 142 on Deposited Plan 416233 (formerly known as part Lot 140 on Deposited Plan 27076)	1.56
15 Woolstores Place	Lot 111 on Deposited Plan 416232 (formerly known as part Lot 11 on Diagram 53535)	0.43
N/A	Lot 44 on Deposited Plan 171141	0.30

1.2 Background

JBS&G completed a Preliminary Site Investigation (PSI) for the site in 2022/2023 (JBS&G 2023)[1] with the objective of assessing the nature of current or historical potentially contaminating activities that may have occurred within the site or on adjacent properties. The key findings of the PSI relating to potential contamination are summarised below.

Former Site Structures and Stockpiled Soil

The site investigation included an assessment for Potentially Asbestos Containing Material (PACM) associated with demolition and dilapidation of former site structures and stockpiled soils. Fragments of PACM were observed at multiple locations during the site inspection. The presence of PACM fragments presents a potentially unacceptable health risk to future residents and construction workers, as well as an aesthetic risk. The potential for fibre generation during civil works also poses a risk to on-site receptors.

Stockpiled soil was also present within the site. Stockpiled soil on the Woolstores lots was observed to contain a combination of building rubble, sheet metal, steel and PACM.

Illegal Dumping/ Fly Tipping

Along the eastern portion of the Woolstores lots, illegal dumping/ fly tipping was observed. Fragments of PACM were observed at multiple locations during the site inspection. The presence of PACM fragments and other COPCs associated with fly tipping (metal pipes, steel framework, sheet metal, concrete, paint tins, bricks,

[1] *Preliminary Site Investigation, Woolstores Place, Western Australia,* JBS&G Australia Pty Ltd, 27 February 2023.

tyres etc.) presents a potentially unacceptable health risk to future residents and construction workers, as well as an aesthetic risk.

Potential Uncontrolled Fill

The Woolstores site has been built on reclaimed land. There is a potential risk associated with the unknown nature and extent of the imported material. During the preliminary site investigation, PACM fragments were observed within the fill material that was used to create site levels as they are today. The uncontrolled fill presents a potentially unacceptable health risk to future residents and construction workers, as well as an aesthetic risk.

At the time of inspection, a limestone road base had been imported to assist with site levels off-site. The limestone road base originated from virgin quarry material[2]. As the material has been directly sourced from a quarry, the potential for contamination from this material to migrate on-site is considered negligible. It should be noted that the imported limestone clean fill is off-site as the site boundary has changed since the investigation was initiated.

Historical Land Uses

The Woolstores site has been subject to commercial/ industrial land uses for roughly 70 years. There is potential for site wide contamination associated with these historical potentially contaminating activities to exist. The Woolstores site while operational was used as a wool storage facility with truck and machinery access. During the PSI, soak wells were observed but the linings were unable to be visually assessed. Further assessment to determine whether the soak wells are lined or unlined is required. Most of the site is also unsealed creating a potential pathway for contaminants from onsite activities to leach through the soil profile to impact groundwater.

Migration of Potentially Contaminated Groundwater from Up-gradient Properties

The PSI identified various up-gradient properties that are impacted by contaminated groundwater. Based on the information reviewed, it is possible that these impacts have migrated on-site. General regional groundwater quality is known to be acidic. As future land uses on-site are proposed to be a combination of residential and mixed commercial uses, there is a risk that site receptors may come into contact with this contaminated groundwater if abstracted for use. Groundwater in the local area is also relatively shallow (<2m bgl).

Acid Sulfate Soils

The DWER (2015) guidance states that in areas of 'High to Moderate risk' of ASS occurring, an ASS investigation is required prior to the following ground disturbance activities:

- Earthworks that will disturb more than 100 m^3 of soil.
- During dewatering or soil draining activity.

Given the site's aim is for re-zoning to a residential land use it is likely that both the ground disturbance events above will occur. This will, therefore, trigger the requirements for ASS investigation.

Recommendations

Based on the PSI conclusions, the following recommendations were made.

[2] Mainroads Western Australia – Great Sothern Region – ARR Material Summary, Armstrong's Gravel Pit, Main Roads Limestone Pit.

- Further assessment or management/remediation of the potentially impacted soils and groundwater identified in the PSI should be considered to assess the potential risks to future site receptors. It was noted that an intrusive sampling program should be considered to characterise impacts associated with the Areas of Potential Environmental Concern (APEC) identified.
- It was recommended that JBS&G provide a scope for a Sampling Analysis and Quality Plan (SAQP) to inform a Detailed Site Investigation (DSI) in order to characterise the nature, extent and risk of potential contamination onsite (site derived and offsite migration).
- It was recommended that waste material identified on site, derived from the illegal dumping/fly tipping activity is removed and disposed of off-site appropriately at the time of demolition, prior to the completion of further investigative activities.

1.3 Objectives

The objective of the SAQP is to document the intrusive works required for the site to adequately assess the nature and extent of potential contamination issues identified in the PSI (JBS&G 2023).

The aims of this SAQP are to detail the following:

- Methodology that will be adopted for investigation works.
- Procedures and protocols that will be adopted for the laboratory analysis program.
- Other field procedures in accordance with the requirements of relevant guidelines.
- Data interpretation and reporting.

2. Site Condition and Surrounding Land Use

2.1 Site Details

The site details are summarised in Table 2-1.

Table 2-1: Site Details

Site Address & Lot ID	34 Woolstores Place (Lot 1104 on Deposited Plan 165964) 34 Woolstores Place (Lot 1209 on Deposited Plan 173935) 34 Woolstores Place (Lot 895 on Deposited Plan 161301) 34 Woolstores Place (Lot 1350 on Deposited Plan 184224) 23 Woolstores Place (Lot 141 on Deposited Plan 27076) Lot 142 on Deposited Plan 416233 (formerly known as part of 23 Woolstores Place, Lot 140 on Deposited Plan 27076) Lot 111 on Deposited Plan 416232 (formerly known as part of 15 Woolstores Place, Lot 11 on Diagram 53535) N/A (Lot 1156 on Deposited Plan 171141) N/A (Lot 1157 on Deposited Plan 171141) N/A (Lot 44 on Deposited Plan 171141)
Approximate Coordinates of Estate Boundary (UTM)	N Corner = -35.023117, 117.859034
	E Corner = -35.026987, 117.867681
	W Corner = -35.026381, 117.856086
	S Corner = -35.027743, 117.856934
Site Area (ha)	14.78
Site Owner(s)	Mainbeam PTY LTD – Lot 1156, Lot 1157, Lot 895, Lot 1104, Lot 1209, Lot 141, Lot 142, Lot 111. State of Western Australia – Lot 44 (unallocated), Lot 1350 (vested with City of Albany)
Site Operator	The site is currently non-operational and undergoing demolition.
Current Land Use	The site is currently non-operational and undergoing demolition.
Former Land Use	Rural residential properties, and commercial/ industrial warehouse housing the Albany Woolstores and associated activities.
Proposed Land Use	Mixed use, including commercial uses and residential R50, R80, R100 and R160; neighbourhood centre; public open space (POS).
Local Government Authority	City of Albany
Zoning	Rural (Small Lot Holdings), General Industry and Park and Recreation (Albany Local Planning Scheme No. 1)
Proposed Zoning	Mixed Use – Residential and Commercial Spaces
Site Classification	Currently not classified

2.2 Site Inspection

On 4-5th July 2022, an experienced JBS&G environmental scientist undertook a site inspection as part of the PSI (2022). The observations made have been separated into two tables. Table 2-2 summarises the site inspection findings for the undeveloped northern rural properties and summaries for the large

commercial warehouses present are summarised in Table 2-3 below. **It is noted that the site conditions will have changed significantly since the July 2022 site inspection as decommissioning and demolition activities have progressed across the site. Based on information provided by the client, it is anticipated that at the time of DSI implementation, all site infrastructure will have been demolished, and waste materials (including stockpiles), will have been removed from site.**

Table 2-2: Site Inspection Findings Summary – Northern Rural Properties[3]

Aspect	Observations
Accessibility	Access to these lots is via Woolstores Place, there is a main driveway that allows access to each of the residential properties. At the time of inspection, the northern Rural Residential Properties remained undeveloped, although clean limestone road base has been imported to the north of the site (outside the site boundary) for construction activities and assisting in site levels.
Topography	The lots are generally flat, with a progressive slope to the south toward Lockyer Bay. Ground levels as depicted on Landgate range from 1 – 2 m AHD. There are surface water expressions present.
Surface drainage	All soils on site comprise of permeable sand, therefore most of the drainage onsite will be through infiltration at site surface.
Site nature and condition	Most of the site is undeveloped. There is remnant vegetation present.
Visible signs of contamination	There were no notable visible signs of contamination.
On-site buildings and other infrastructure	The site did not contain infrastructure. The only buildings and other infrastructure that were present onsite at the time of inspection were the demountable dongas for the civil works being undertaken to the north (off-site).
Aesthetic issues	No odours or visual signs of contamination were detected, and general housekeeping was appropriate.
Stockpiled material	There was a large stockpile of material located to the north (off-site), most likely associated with the topsoil scrape of the site before the fill was imported. The extent of the material is estimated to be circa 765m^3. As this material was located off-site, no further assessment was undertaken.
Presence of PACM	No PACM was observed
Groundwater bores	No groundwater bores were observed
Surrounding land use	The surrounding land is used for rural residential, general industry and parks and recreation purposes.

Table 2-3: Site Inspection Findings Summary – Commercial/ Industrial Warehouses[4]

Aspect	Observations
Accessibility	Access to these lots is via Woolstores Place, there is a main driveway that allows access the lots. The boundary of the lots is demarcated by temporary fencing.
Topography	The lots are generally flat, with a progressive slope to the south toward Lockyer Bay. Ground levels range from 1 – 2 m AHD.
Surface drainage	All soils on site comprise of permeable sand, therefore most of the drainage onsite will be through infiltration at site surface. There were various drains and sumps present on site.
Site nature and condition	At the time of inspection, the warehouse located on Lot 895 had been partially demolished with all roofing and wall structures removed. The warehouse to the south was still in good condition with only roughly 10% of roofing panels removed.

[3] Northern Rural Properties – Lot 141 on DP 27076, Lot 140 on DP 27076, Lot 11 on D 53535, Lot 1157 on DP 171141, Lot 44 on DP 171141.

[4] Lot 1104 on DP 165964, Lot 1209 on DP 173935, Lot 895 on DP 161301, Lot 1350 on DP 184224.

Aspect	Observations
Visible signs of contamination	No gross contamination was observed. Fugitive PACM fragments were found around the warehouses and within the imported fill material along the southern and eastern boundary of the site.
On-site buildings and other infrastructure	Two historical warehouses associated with the historical Woolstores operations were present at the time of inspection. Both were in the process of being demolished. Roofing panels on both buildings comprised predominantly of PACM.
Aesthetic issues	No odours were detected, however, at the time of inspection the site was covered in demolition material from the warehouses.
Stockpiled material	Stockpiled material was present throughout site with construction and demolition waste, including PACM, scattered throughout the site
Presence of PACM	PACM (in the form of fibre-cement sheeting) was observed around the warehouses and within the imported fill material along the southern and eastern boundary of the site.
Groundwater bores	Three groundwater bores were observed around the boundary of the site.
Surrounding land use	The surrounding land is used for residential, public open space and mixed purposes

2.3 Surrounding Land Use

Under the Albany Local Panning Scheme 1, the site is bordered by Urban Residential and General Industry. The surrounding land uses are depicted in Figure 1.

Further details on the surrounding land use are presented in Table 2-4.

Table 2-4: Surrounding Land Use

Location	Detail
North	The site is bounded by a priority road (Frenchman Bay Road) and a railway. Further to the northeast is remnant bushland zoned as parks and recreation. Northwest of the site is zoned as rural with small lot holdings.
East	Directly east of the site is the rail line and Princess Royal Drive (major road). There are residential dwellings further east
South	The site is bound by Frenchman Bay to the south.
West	Land to the west is zoned as Tourist/ Residential with various tourist accommodation and residential dwellings.

3. Desktop Study

A desktop study of the site's environmental setting and history was undertaken as part of the PSI (JBS&G 2023) with key aspects summarised herein.

3.1 Environmental Setting

3.1.1 Topography

A detailed site features survey provided by the client indicates an elevation of ~6.7 m AHD in the northern portion of the rural residential lots, with an elevation of ~2.7 m AHD in the southern portion of the commercial/ industrial lots near the coast. Based on the elevation difference between the current Lots 1209 and 1104 and adjacent unfilled (based on historical aerial imagery) Lot 52, it is considered likely that approximately 1.5 m to 2 m of fill was placed across the commercial/ industrial lots to achieve the current site levels.

3.1.2 Hydrology

There is one permanent surface water body on site, this is located on Lot 11 on Diagram 53535. Lockyer Bay is located immediately south of Lot 1209 on Deposited Plan 173935.

3.1.3 Geology

The site is located within the Albany-Fraser Orogen Nornalup Complex range formation, comprising of gneiss, metamorphic rock and granitoid.

GeoVIEW.WA indicates that the site is largely located within an area of depositional sediments derived from residual or erosional landforms; including colluvial, sheetwash, alluvial, lacustrine, sandplain, eolian and marine deposits of variable thickness.

Acid Sulphate Soils

Acid sulfate soils (ASS) are naturally occurring, iron-sulfide rich soils, sediments, or organic substrates, formed under waterlogged conditions. If exposed to air, these sulfides can oxidise and release sulfuric acid and heavy metals. This process can occur due to drainage, dewatering or excavation.

The ASS risk mapping available from the Australian Soil Resource Information System (ASRIS) (2013) and DWER (2017). The site is classed as having a 'High Probability of Occurrence' (ASRIS 2013) and/or 'High to Moderate risk' (DWER 2017) of ASS occurring within 3 m of the natural soil surface that could be disturbed by most land development activities. The DWER (2015) guidance states that in areas of 'High to Moderate risk' of ASS occurring, an ASS investigation is required prior to the following ground disturbance events:

- Earthworks that will disturb more than 100 m^3 of soil.
- During dewatering or soil draining activity.

3.1.4 Hydrogeology

According to data published by the DWER in the Perth Groundwater Atlas (PGA), the site is underlain by the Bremer West Superficial Sediment Aquifer.

Given the site's proximity to the coast, groundwater levels range from approximately 7.5 metres below ground level (m bgl) to less than 1 m bgl. Groundwater flow direction within the site broadly flows southward, toward the coast.

Groundwater quality in the area is noted to be from fresh to saline, with approximate total dissolved solid (TDS) measurements between 100 – 100,000 mg/L. The site does not fall within a Public Drinking Water Source Areas (PDWSA), with the closest PDWSA being approximately 1km west of the site.

Groundwater Bore Search

A review of the Department of Water and Environmental Regulation (DWER) Water Register indicates that there are 0 licensed[5] groundwater abstraction bores located within a 1.0 km radius of the site. The closest abstraction bore is located approximately 1.2km west of the site.

There are 10 registered bores within 500 m of the site, all of which are located within the boundary of the site. The details of the bores registered within the boundary of the site is summarised in Table 3-1 below. It is recognised that in WA in most instances there is no requirement to obtain a license for a domestic groundwater bore.

Table 3-1: Registered Groundwater Bore Details

Licence #	Drill Depth (m bgl)	Bore Use	Direction and distance from centre of site	Additional information
60210190	4 m bgl	Groundwater bore	310 m southwest	Department of Water
60210191	4 m bgl	Groundwater bore	320 m southwest	Department of Water
60210112	5.5 m bgl	Groundwater bore	300 m northeast	Department of Water
60210113	9.8 m bgl	Groundwater bore	300 m northeast	Department of Water
60210114	15.2 m bgl	Groundwater bore	300 m northeast	Department of Water
60210115	4 m bgl	Groundwater bore	In centre of Site	Department of Water
60210116	8.3m bgl	Groundwater bore	In centre of Site	Department of Water
60210117	11.2 bgl	Groundwater bore	In centre of Site	Department of Water
60210118	14.3 m bgl	Groundwater bore	In centre of Site	Department of Water
60210411	15.2 m bgl	Groundwater bore	350 m northwest	CSBP

3.2 Site History Summary

3.2.1 Historical Aerial Review

Historical aerial photographs have been reviewed in order to gain an understanding of the historical use of the site, and to identify areas and activities of potential environmental concern with respect to contamination. A summary of the available aerial images from Landgate 'Map Viewer Plus' were reviewed as part of the investigation and are summarised in Table 3-2.

[5] There is a requirement to obtain a groundwater abstraction licence where groundwater is used for commercial/industrial purposes (e.g. process water), especially if abstraction is occurring from deeper confined aquifers. There may be additional unregistered groundwater wells in the area.

Table 3-2: Summary of Historical Aerial Photograph Observations

Date	General Observation	Lot Specific Observations
1954	• First available photograph, Woolstores place seems to be a sealed road. • The surrounding land remains mainly uncleared.	• All lots remain uncleared with the exception of Lot 895 which contains a commercial/industrial building.
1961	• Remains largely unchanged from previous photo. • The surrounding land remains mainly uncleared.	• Lot 895 had expanded its commercial/industrial building into Lot 1104.
1977	• Land within the lots has been cleared for agricultural purposes. • Surrounding land continues with residential development to the west, and industrial/commercial development to the north.	• The expansion of the commercial/industrial building on Lot 895 has continued and now occupies Lot 895, Lot 1104 and Lot 1209. • Lot 1209 has been filled to reclaim land for the warehouses to be built on. • Lot 140 further development of residential property at northern part of the lot.
1988	• Remains largely unchanged from previous photograph. • Commercial/industrial development continues to the north and east of the lots.	• Remains largely unchanged from previous photograph. • A surface water body has appeared on Lot 140
1996	• Remains largely unchanged from previous photograph. • Commercial/industrial development continues to the north and east of the lots.	• Residential building developed on Lot 11.
2007	• Remains largely unchanged from previous photograph. • Commercial/industrial development continues to the north of the lots.	• The commercial/industrial building that crosses over Lot 895 and Lot 1104 has been demolished.
2012	• Remains largely unchanged from previous photograph.	• Remains largely unchanged from previous photograph.
2018	• Remains largely unchanged from previous photograph. • Commercial/industrial development continues to the north of the lots.	• Lot 140 has developed a dam like structure along the eastern border of the lot. • Surface water bodies are present in Lot 141.
2020	• Remains largely unchanged from previous photograph.	• Remains largely unchanged from previous photograph.

3.2.2 Dangerous Goods Search

A dangerous goods license search request was completed on 20 May 2022 with the WA Government Department of Mines, Industry Regulation and Safety (DMIRS) for each of the site Lots. The Notice of Decision provided by DMIRS found various documents pertaining to the storage of Dangerous Goods onsite dating from 1993 – 2002. The dangerous goods documents for the site related to the storage of a 3.8 kL Liquid Petroleum Gas Tank from 1993 to 2002. The latest correspondence with DMIRS in relation to the storage of the tank was in 2002. The letter stated, *"The Albany Woolstores are no longer in operation and the gas tank has been removed."*

3.2.3 DWER Records

Site Records

A BSR Request was submitted to DWER for each of the Lots on 20 May 2022. A search of the department's records indicate that the site has not been reported to the department as a known or suspected contaminated site.

Surrounding Properties

Seven (7) properties within a 1 km radius have been classified as *'Remediated for restricted use"*, located north of the site. Table 3-3 provides a summary of the property details.

Table 3-3: DWER Online Contaminated Sites Database Search

Property Description	Address	Classification	Distance from Site	Reason for Classification
Lot 201 on Plan 76615	198 Hanrahan Rd Mount Elphinstone, WA, 6330	Remediated for Restricted Use (26/02/2021) ID no: 72939	820 m	A preliminary site investigation in 2004 identified that the north-eastern portion of this site was historically used as a sand quarry up until the 1960s. The quarry void was subsequently used for the disposal of industrial wastes associated with the nearby fertiliser works. Wastes disposed included neutralised lead sulphate chamber washings, and contaminated sediments dredged from drainage systems during the 1980s. At the time of classification, the site was used for passive agricultural uses, including a tree plantation. Remedial works were historically undertaken at this site which involved the excavation and off-site disposal of lime solids waste. It is understood that remedial works were guided by in-field x-ray fluorescence measurements and included the collection of soil validation samples. However, limited documentation was prepared at the time to demonstrate the effectiveness of these remedial works. A targeted soil investigation was undertaken in 2018 as part of a broader detailed site investigation. Elevated concentrations of metals, such as lead, cadmium and copper, were identified at depths up to 1.5 metres below ground level. Groundwater at the site has been found to be acidic and have elevated concentrations of some metals (such as aluminium and iron) and fluoride. The elevated concentrations of aluminium and iron are associated with the acidic groundwater conditions which are likely caused, in part, by the presence of naturally occurring acid sulfate soils in the area.
Lot 201 on Plan 76615	198 Hanrahan Rd. Mount Elphinstone, WA, 6330	Remediated for Restricted Use (26/02/2021) ID no: 72938	615 m	A superphosphate fertiliser plant historically operated on the site for approximately 47 years, from 1954 to 2001. The site has also been used for fuel and chemical storage and fertiliser dispatch for approximately 67 years, since 1954. Historically, solid, and liquid wastes were disposed on-site. Fertiliser production, fuel and chemical storage and landfilling are land uses which have the potential to cause contamination. Lead-impacted soils in the sulphur pad area were further investigated (2018) and confirmed to be localised in nature. Several soil samples reported lead at concentrations exceeding Ecological Investigation Levels and Health Investigation Levels for commercial and industrial land. An estimated 220 cubic metres of lead-impacted material remains at the site which poses a

Property Description	Address	Classification	Distance from Site	Reason for Classification
				potential risk to human health and requires ongoing management. Anecdotal information indicates empty railway carts were historically parked in this area and residual superphosphate fertiliser in the carts was swept out onto the soil surface. This area was subject to targeted remediation in June 2019, with approximately 200 cubic metres of phosphorus-impacted surface soils being excavated and reused off-site as fertiliser. Groundwater in the vicinity of the sulfur pad is highly acidic, with pH values less than 3 in some monitoring locations. Concentrations of lead in groundwater near the sulfur pad (where lead-impacted soils remain) are generally low and appear to be decreasing over time. Concentrations of lead in recent years have been well below assessment levels relevant to the non-potable use of groundwater.
Lot 76 on Plan 26132	76 Grey St Mount Melville, WA, 6330	Remediated for Restricted Use (29/10/2018)	420 m	This site formed a portion of a larger land-holding occupied by the Albany fertiliser works. A preliminary site investigation was undertaken in 2004 which found that the site had not historically been used for any purpose related to the fertiliser works. However, the south-western portion of the site was used as a bulk fuel depot for approximately 18 years between 1956 and 1974. Soil investigations were undertaken in 2017 specifically targeting soils in the vicinity of the abandoned ASTs and other buildings associated with the former use of the site. Petroleum hydrocarbon impacts were not identified, however, an area of lead-impacted soils was identified adjacent to the opening of an unknown concrete building. The source of the lead was not known but was suspected to be associated with runoff from surfaces of the building potentially coated with lead-based paint. Remedial works were undertaken during 2018 comprising the excavation and off-site disposal of approximately half a cubic metre of lead-contaminated soils. Final validation sampling and analysis demonstrated that lead-impacted soils exceeding relevant health-based and ecological based screening criteria had been successfully remediated. Periodic groundwater monitoring has been undertaken at the site and across the broader catchment area which includes a former fertiliser manufacturing facility to the west and an operating municipal landfill to the north. These investigations have found that groundwater to the north and west of this site has been impacted by landfill leachate associated with the municipal landfill located at 37 Maxwell Street, Mount Melville. Nutrients, acidity and metals (such as iron, copper and zinc) were also identified in groundwater at levels exceeding assessment levels for marine waters (DER, 2014). These criteria are relevant given the site

Property Description	Address	Classification	Distance from Site	Reason for Classification
				is within 500 metres of Princess Royal Harbour. However, a review of groundwater data from across the catchment area indicates that the levels of nutrients, acidity, and metals in groundwater beneath this site are indicative of background up-hydraulic gradient groundwater quality.

3.2.4 Heritage Records

Federal Heritage

A search of the Australian Heritage Trust Database[6] was undertaken on 15 June 2022 for wider site area. The search did not identify the presence of any items of national significance at, or in the immediate vicinity of the site.

Heritage Council of Western Australia

A database search of the WA State Heritage Office[7] was undertaken on 15 June 2022 for the wider site area. The search did not identify the presence of any items of state registered places at the site.

Department of Indigenous Affairs

A search of the Aboriginal Heritage Inquiry System (AHIS)[8] was undertaken on 15 June 2022. The search did not identify the presence of any heritage item on the AHIS. The closest heritage item is located immediately north of the sites and is called the Frenchman Bay Road Camp and is registered for Mythological, Camp and Natural Feature.

6 http://www.environment.gov.au/cgi-bin/ahdb/search.pl

7 http://inherit.stateheritage.wa.gov.au/Public/?advanced=True.

8 https://espatial.dplh.wa.gov.au/AHIS/index.html?viewer=AHIS.

4. Historical Environmental Document Review

No environmental investigations are known to have been complete at the site other than the JBS&G 2023 PSI.

4.1 JBS&G (2023) Preliminary Site Investigation

JBS&G was commissioned by Rowe Group to undertake a PSI for the ten (10) Lot parcel of land at Woolstores Place (the site).

The objective of the project was to undertake a PSI, to assess the nature of current and or historical potentially contaminating activities that may have previously occurred within the site or on adjacent properties.

The following scope of works was completed in order to meet the project objectives.

- Completion of a site inspection to identify potentially contaminating activities.
- Completion of a desktop review of available client provided and publicly available information.
- Preparation of an interpretative PSI report including a Conceptual Site Model (CSM), in general conformance with the WA DWER Contaminated Sites Guidelines (2021).

The key findings of the PSI are summarised below.

Former Site Structures and Stockpiled Soil

The site investigation included an assessment for Potentially Asbestos Containing Material (PACM) associated with demolition and dilapidation of former site structures and stockpiled soils. Fragments of PACM were observed at multiple locations during the site inspection. The presence of PACM fragments presents a potentially unacceptable health risk to future residents and construction workers, as well as an aesthetic risk. The potential for fibre generation during civil works also poses a risk to on-site receptors.

Stockpiled soil was also present throughout the site. Stockpiled soil on the Woolstores lots was observed to contain a combination of building rubble, sheet metal, steel and PACM.

Illegal Dumping/ Fly Tipping

Along the eastern portion of the Woolstores lots, illegal dumping/ fly tipping was observed. Fragments of PACM were observed at multiple locations during the site inspection. The presence of PACM fragments and other COPCs associated with fly tipping (metal pipes, steel framework, sheet metal, concrete, paint tins, bricks, tyres etc.) presents a potentially unacceptable health risk to future residents and construction workers, as well as an aesthetic risk.

Potential Uncontrolled Fill

The Woolstores site has been built on reclaimed land. There is a potential risk associated with the unknown nature and extent of the imported material. During the preliminary site investigation, PACM fragments were observed within the fill material that was used to create site levels as they are today. The uncontrolled fill presents a potentially unacceptable health risk to future residents and construction workers, as well as an aesthetic risk.

At the time of inspection, a limestone road base had been imported to assist with site levels off-site. The limestone road base originated from virgin quarry material[9]. As the material has been directly sourced from a

[9] Mainroads Western Australia – Great Sothern Region – ARR Material Summary, Armstrong's Gravel Pit, Main Roads Limestone Pit.

quarry, the potential for contamination from this material to migrate on-site is considered negligible. It should be noted that the imported limestone clean fill is off-site as the site boundary has changed.

Historical Land Uses

The Woolstores site has been subject to commercial/ industrial land uses for roughly 70 years. There is potential for site wide contamination associated with these historical potentially contaminating activities to exist. The Woolstores site while operational was used as a wool storage facility with truck and machinery access. During the PSI, soak wells were observed but the linings were unable to be visually assessed. Further assessment to determine whether the soak wells are lined or unlined is required. Most of the site is also unsealed creating a potential pathway for contaminants from onsite activities to leach through the soil profile to impact groundwater.

Migration of Potentially Contaminated Groundwater from Up-gradient Properties

Table 3.3 identified various up-gradient properties that are impacted by contaminated groundwater. Based on the information reviewed, it is possible that these impacts have migrated on-site. General regional groundwater quality is known to be acidic. As future land uses on-site are proposed to be a combination of residential and mixed commercial uses, there is a risk that site receptors may come into contact with this contaminated groundwater if abstracted for use. Groundwater in the local area is also relatively shallow (<2m bgl).

Acid Sulfate Soils

The DWER (2015) guidance states that in areas of 'High to Moderate risk' of ASS occurring, an ASS investigation is required prior to the following ground disturbance activities:

- Earthworks that will disturb more than 100 m^3 of soil.
- During dewatering or soil draining activity.

Given the site's aim is for re-zoning to a residential land use it is likely that both the ground disturbance events above will occur. This will, therefore, trigger the requirements for ASS investigation.

Recommendations

Based on the PSI conclusions, the following recommendations were made.

Further assessment or management/remediation of the potentially impacted soils and groundwater should be considered to assess the potential risks to future site receptors. It is noted that an intrusive sampling program should be considered to characterise impacts associated with the APECs identified.

It was recommended that JBS&G provide a scope for a Sampling Analysis and Quality Plan (SAQP) and subsequent Detailed Site Investigation (DSI) in order to characterise the nature, extent and risk of potential contamination onsite (site derived and offsite migration).

It was recommended that waste material identified on site, derived from the illegal dumping/fly tipping activity is removed and disposed of off-site appropriately at the time of demolition, prior to the completion of further investigative activities.

5. Preliminary Conceptual Site Model

A preliminary conceptual site model (CSM) was developed as part of JBS&G (2023) presented herein. The CSM will be further refined following the additional investigations proposed as part of this SAQP during development of the DSI.

For a potential contamination risk to be present at a site, a complete exposure pathway must exist which consists of:

- Areas of potential environmental concern (e.g., primary sources such as leaking chemical tanks; secondary sources such as impacted soils/groundwater/surface water).
- A transport mechanism (pathway) between the source and the receptor (e.g., direct dermal contact with soil/dust/water, inhalation of vapours, migration of groundwater through aquifer matrix).
- An exposure point where a receptor comes into contact with the contamination.
- An exposure route (i.e., inhalation, ingestion or dermal).

5.1 Areas of Potential Environmental Concern

Based on the information obtained in the desktop assessment and site inspection the following APEC were identified:

1. Former site structures and stockpiled soils
2. Illegal dumping/fly tipping activities.
3. Potential uncontrolled fill.
4. Historical land uses of the site.
5. Migration of potentially contaminated groundwater beneath the site from up-gradient properties.

5.2 Potential Receptors

On Site

- Current and future excavation/maintenance workers potentially exposed to impacted soils and groundwater during trenching works, dewatering works or remedial works.
- Future on-site residents
- Terrestrial ecology.
- Surface water at the site
- Groundwater beneath the site.

Off Site

The following potential off-site receptors have been identified in the event that site derived contamination is migrating off site.

- Current and future excavation/maintenance workers potentially exposed to impacted soils and/or groundwater during trenching works or remedial works completed adjacent to the site.
- Future off-site residents and site visitors.
- Terrestrial ecology

- Surface water bodies

5.3 Potential Pathways

Potential contaminant exposure or migration pathways for the COPCs are summarised below.

- Infiltration of contaminants into the underlying soil and groundwater.
- Vapour migration from impacted soil or groundwater.
- Direct contact with impacted soils or groundwater.
- Windblown dusts and/or fibres.
- Groundwater migration and abstraction.

Potential exposure routes for human health include:

- Dermal contact.
- Ingestion.
- Inhalation.

Potential exposure routes for ecological receptors include:

- Direct contact.
- Uptake through roots.

5.4 Potential Pollutant Linkages

Table 5-1 provides a summary of updated potential pollutant linkages of the conceptual site model.

Table 5-1: Conceptual Site Model

APEC	Receptor	Exposure Pathway	Linkage Status	Justification
1.Contamination associated with the former site structures and stockpiled soils. <u>COPC</u> • ACM • TRH • BTEX • PAH • VOC/SVOC •Metals	**Onsite -** future site visitors and residents.	Dermal contact and incidental ingestion of soil and/or groundwater.	Possible	Stockpiled soils were observed on Lot 1104 and off-site (north of Lot 11 and Lot 140 – not included in this investigation). The nature and extent of potential contamination within the stockpiled soil on Lot 1104 is currently unknown. Risks to onsite workers, visitors and residents via dermal contact of soil is possible. The leaching of potential contaminants associated with the stockpiled soils can possibly migrate to groundwater. Dermal contact of groundwater for site visitors and residents on-site will only be possible through groundwater abstraction. Dermal contact of groundwater for on-site site visitors and residents is considered highly unlikely as there are no current abstraction bores on-site. It is highly unlikely that a bore will be installed in the future due to the saline nature of the groundwater.
		Inhalation of dust and fibres	Possible	There is a possibility that wind can generate dust off the stockpiles and therefore mobilise the identified stockpiles COPC, creating unacceptable risks to future on-site workers, visitors and residents via dust inhalation. The preliminary site investigation identified PACM within Lot 1104, 1209, 895 and 1350. The presence of PACM fragments in these areas present a potentially unacceptable health risk to future residents, workers and site visitors, including an aesthetic risk. **Qualitative Risk Rating: Moderate**
	Onsite - intrusive maintenance and civil contractors	Dermal contact and incidental ingestion of soil and/or groundwater.	Possible	Stockpiled soils were observed on Lot 1104 and off-site (north of Lot 11 and Lot 140 – not included in this investigation). The nature and extent of potential contamination within the stockpiled soils is currently unknown. Risks to intrusive maintenance workers and civil contractors via dermal contact of stockpiled soil is possible. The leaching of potential contaminants associated with the stockpiled soils can possibly migrate to groundwater. As groundwater at the site is shallow, intrusive maintenance workers and civil contractors may encounter potentially contaminated groundwater.
		Inhalation of dust and fibres	Possible	There is a possibility that future civil works generate dust and therefore mobilise the identified stockpiles COPC, creating unacceptable risks to intrusive maintenance and civil contractors via dust inhalation. The preliminary site investigation identified PACM within Lot 1104, 1209, 895 and 1350. Excavation activities (particularly during development) could result in significant disturbance of PACM and potential for generation of fibres if not appropriately managed. **Qualitative Risk Rating: Moderate**

APEC	Receptor	Exposure Pathway	Linkage Status	Justification
	Onsite – Ecological Receptors	Uptake by roots	Possible	Vegetated areas for the current (general industry and rural residential) and future (mixed use) land uses are considered to be low ecological significance. No signs of vegetation stress were observed during the preliminary site investigation. **Qualitative Risk Rating: Low**
	Offsite - human receptors including recreational users of the Royal Princess Harbour	Dermal contact and incidental ingestion of groundwater.	Unlikely	Stockpiled soils were observed on Lot 1104 and off-site (north of Lot 11 and Lot 140 – not included in this investigation). The nature and extent of potential contamination within the stockpiled soils is currently unknown. There is a possibility (unlikely) that potentially impacted soils may leach into groundwater and then migrate off-site where recreational users of the marine environment may be exposed via dermal contact and incidental ingestion. The closest groundwater abstraction bore is 1.2 km cross-gradient (west) of the site, it is therefore considered that potential contaminants from the site present in groundwater (if present) will not impact the human receptors abstracting water from the bore.
		Inhalation of dust and fibres	Possible	There is a possibility that future civil works and wind generate dust and therefore mobilise the identified stockpiles COPC, creating unacceptable risks to off-site human receptors via dust inhalation. The preliminary site investigation identified PACM within Lot 1104, 1209, 895 and 1350. Development activities would result in significant disturbance of soils and possible generation of fibres which may impact offsite receptors if not appropriately managed. **Qualitative Risk Rating: Low**
	Offsite - Ecological Receptors	Direct Contact	Unlikely	The Royal Princess Harbour is the closest down-gradient ecological receptor to the site. The Royal Princess Harbour is located along the southern boundary of the site. Leaching of contaminants within the stockpiled material to groundwater and subsequent off-site migration is possible, although unlikely, and could pose risks to the sensitive ecological receptors (if reported above ecological criteria) within the Harbour. **Qualitative Risk Rating: Low**
2. Illegal dumping/ Fly tipping activities <u>COPC</u> • ACM • TRH • BTEX	**Onsite -** future site visitors and residents.	Dermal contact and incidental ingestion of soil and/or groundwater.	Possible	During the site inspection, fly tipping was observed in areas of cleared land, primarily located in the eastern portion of the site. The nature and extent of this fly tipping is currently unknown but is comprised mainly of steel structures, metal sheeting and wire, concrete, rubble, concrete pipes etc. It is possible that fly tipping may have resulted in contamination to the underlying soils. If disturbance works are completed on the material, there is possibility for residents, on-site workers and visitors to be exposed to contaminants. Fly tipping also represents an aesthetic risk. Potential groundwater impacts through leaching are unknown but are considered unlikely.

APEC	Receptor	Exposure Pathway	Linkage Status	Justification
• PAH • VOC/sVOC •Metals		Inhalation of impacted dusts/fibres	Possible	PACM along with other COPCs were observed in association with the fly tipping observed on-site. It is possible that fly tipping may have resulted in contamination to the underlying soils. Therefore, future civil works that generate dust and therefore mobilise the identified COPC, can creating unacceptable risks on-site future workers, site visitors and residents via dust and fibre inhalation. **Qualitative Risk Rating: Low**
	Onsite - intrusive maintenance and civil contractors	Inhalation of impacted dusts/fibres. Dermal contact and incidental ingestion of soil and/or groundwater.	Possible Possible	During the site inspection, fly tipping was observed in areas of cleared land, primarily located in the eastern portion of the site. The nature and extent of this fly tipping is currently unknown but is comprised mainly of steel structures, metal sheeting and wire, concrete, rubble, concrete pipes etc. If disturbance works are completed on the material, there is possibility for contaminants and PACM to be exposed to onsite intrusive maintenance workers. The current nature and extent of contaminants associated with fly tipping is currently unknown, although, potential groundwater impacts through leaching that pose risks to future onsite intrusive maintenance and civil contractors are considered low (groundwater assumed to be less than 2 m bgl). **Qualitative Risk Rating: Low**
	Onsite – Ecological Receptors	Uptake by roots	Unlikely	Vegetated areas for the current (general industry and rural residential) and future (mixed use) land uses are considered to be low ecological significance. No signs of vegetation stress were observed during the preliminary site investigation. **Qualitative Risk Rating: Low**
	Offsite - Current and future off-site workers and residents	Inhalation of impacted dusts/fibres Dermal contact and incidental ingestion groundwater.	Possible Unlikely	During the site inspection, fly tipping was observed in areas of cleared land, primarily located in the eastern portion of the site. The nature and extent of this fly tipping is currently unknown but is comprised mainly of steel structures, metal sheeting and wire, concrete, rubble, concrete pipes etc. On-site civil works and wind can mobilise contaminants and PACM associated with fly tipping, it is possible for contaminants to pose a risk to off-site site workers and residents. The current nature and extent of contaminants associated with fly tipping is unknown, therefore, potential groundwater impacts through leaching are unknown. Dermal contact and incidental ingestion of potentially contaminated groundwater for future off-site workers and residents is considered unlikely as there are no down gradient off-site residents or site workers. The closest groundwater abstraction bore is 1.2 km cross-gradient (west) of the site, it is therefore considered that potential contaminants from the site present in groundwater will not impact the human receptors abstracting water from the bore.

APEC	Receptor	Exposure Pathway	Linkage Status	Justification
				Qualitative Risk Rating: Low
	Offsite – recreational users of the Royal Princess Harbour	Inhalation of impacted dusts/fibres	Possible	During the site inspection, fly tipping was observed in areas of cleared land, primarily located in the eastern portion of the site. The nature and extent of this fly tipping is currently unknown but is comprised mainly of steel structures, metal sheeting and wire, concrete, rubble, concrete pipes etc. On-site civil works and wind can mobilise contaminants and PACM associated with fly tipping, it is possible for contaminants to pose a risk to off-site recreational users of the Royal Princess Harbour.
		Dermal contact and incidental ingestion of groundwater.	Unlikely	Potential contaminants associated with onsite fly tipping are unknown. Contaminated groundwater on-site associated with the leaching of COPC from fly tipping could migrate off-site and be expressed as surface water in Princess Harbour. Ingestion of this contaminated groundwater by recreational users (now expressed as surface water) is unlikely. **Qualitative Risk Rating: Low**
	Offsite – Ecological Receptors	Direct Contact	Unlikely	The Royal Princess Harbour is the closest down-gradient ecological receptor to the site. The Royal Princess Harbour is located along the southern boundary of the site. Leaching of contaminants within the fly tipping material to groundwater and subsequent off-site migration is possible, although unlikely, and could pose risks to the sensitive ecological receptors (if reported above ecological criteria) within the Harbour. **Qualitative Risk Rating: Low**
3.Potential uncontrolled fill <u>COPC</u> • Asbestos • TRH • BTEX • PAH • VOC/sVOC •Metals	**Onsite -** future site visitors and residents.	Dermal contact and incidental ingestion of soil and/or groundwater.	Possible	Review of historical aerial imagery at the site identified the potential for uncontrolled fill placement prior to, and during, development of the Woolstores site. During the site inspection it was noted that the site was generally flat, and slopes to the south towards Princess Royal Harbour. The Woolstores warehouses have been built on top of the reclaimed land. The imported material was observed to contain PACM along with other rubble. At the time of inspection, the off-site northern rural residential properties had been cleared of most vegetation and site structures (residential houses). A limestone road base was imported to assist with site levels. The origin of this limestone road base is from the Great Southern Region Quarry Pits. The quarry certificates are presented in Appendix G and does not pose any risks to receptors. The areas that have been subject to imported fill (the material under the Woolstores warehouses) could potentially pose risks via direct contact, dust and fibre inhalation, although the nature and extent of contamination is currently unknown. As the nature and extent of contaminants associated with the potential uncontrolled fill is currently unknown, potential groundwater impacts through leaching are possible. Dermal contact
		Inhalation of impacted dusts/fibres	Possible	

APEC	Receptor	Exposure Pathway	Linkage Status	Justification
				of groundwater for site visitors and residents on-site will only be possible through groundwater abstraction. Dermal contact of groundwater for on-site site visitors and residents is considered highly unlikely as there are no current abstraction bores on-site. It is also highly unlikely that a bore will be installed in the future due to the saline nature of the groundwater. **Qualitative Risk Rating: Low/Moderate**
	Onsite - intrusive maintenance and civil contractors	Inhalation of impacted dusts/fibres. Dermal contact and incidental ingestion of soil and/or groundwater.	Possible Possible	Review of historical aerial imagery at the site identified the potential for uncontrolled fill placement prior to, and during, development of the site. During the site inspection it was noted that the site was generally flat, and slopes to the south towards Princess Royal Harbour. The Woolstores warehouses have been built on top of the reclaimed land. The imported material was observed to contain PACM along with other rubble. At the time of inspection, the off-site northern rural residential properties had been cleared of most vegetation and site structures (residential houses). A limestone road base was imported to assist with site levels. The origin of this limestone road base is from the Great Southern Region Quarry Pits. The quarry certificates are presented in Appendix G and does not pose any risks to receptors. The areas that have been subject to imported fill (the material under the warehouses) could potentially pose risks via direct contact and fibre inhalation, when civil works begin or general intrusive maintenance works. The current nature and extent of contaminants associated with the imported fill is currently unknown, therefore, potential groundwater impacts through leaching of the potentially contaminated soil are unknown but could pose risks to future onsite intrusive maintenance and civil contractors (groundwater assumed to be less than 2 m bgl). **Qualitative Risk Rating: Low/Moderate**
	Onsite – Ecological Receptors	Uptake by roots	Possible	Vegetated areas for the current (general industry and rural residential) and future (mixed use) land uses are considered to be low ecological significance. No signs of vegetation stress were observed during the preliminary site investigation. **Qualitative Risk Rating: Low**
	Offsite - Current and future off-site workers and residents	Inhalation of impacted dusts/fibres Dermal contact and incidental ingestion of groundwater.	Possible Unlikely	It is possible for dust to be generated during future excavation and earthworks of material on-site. PACM was observed within the fill material present on the Woolstores lots. There are surrounding residential and industrial properties that may be at risk from impacted dusts/ fibres once airborne. a potential pathway link via leaching of contaminants within the fill to offsite receptors. As groundwater flow direction is to the south (Princess Harbour), the likelihood of exposure to off-site site workers and residents is unlikely Potential contaminants present

APEC	Receptor	Exposure Pathway	Linkage Status	Justification
				in the fill material on site are unknown. Groundwater is present between roughly 0 – 2 m bgl and is therefore. **Qualitative Risk Rating: Low**
	Offsite – recreational users of the Royal Princess Harbour	Inhalation of impacted dusts/fibres Dermal contact and incidental ingestion of groundwater.	Possible Unlikely	On-site civil works and wind can mobilise contaminants and PACM associated with fly tipping, it is possible for contaminants to pose a risk to off-site recreational users of the Royal Princess Harbour. Contaminated groundwater on-site associated with the leaching of COPC from the imported fill could migrate off-site and be discharged to surface water in Princess Harbour. Contact with contaminated groundwater by recreational users is unlikely. **Qualitative Risk Rating: Moderate**
	Offsite – Ecological Receptors	Direct Contact	Possible	The Royal Princess Harbour is the closest down-gradient ecological receptor to the site. The Royal Princess Harbour is located along the southern boundary of the site. Leaching of contaminants within the fly tipping material to groundwater and subsequent off-site migration is possible, although unlikely, and could pose risks to the sensitive ecological receptors (if reported above ecological criteria) within the Harbour. **Qualitative Risk Rating: Moderate**
4. Historical land uses of the site. <u>COPC</u> • TRH • BTEX • PAH • VOC/sVOC • OCP/OPP •Metals •Asbestos	**Onsite** - Current and site visitors and residents.	Dermal contact and incidental ingestion of soil and/or groundwater.	Possible	The historical operation of the Woolstores lots as industrial since the 1950s and rural residential land uses in the remaining lots has the potential to cause contamination. Historical aerials suggest that the site has been predominantly unsealed including at the time of this investigation. Potential hydrocarbons, pesticides and heavy metals could be present through the unsealed soil profile and groundwater onsite. The on-site drain network present on the Woolstores lots could act as a potential pathway for contaminated soils to leach into groundwater on-site. The northern rural residential lots, although currently undeveloped, have the potential to be a source of contamination. No visual or olfactory contamination was observed at the rural residential lots at the time of inspection, although, this does not discount the possibility of contamination being present. As the nature and extent of contaminants associated with the historical land uses is currently unknown, potential groundwater impacts through leaching are possible. Dermal contact of groundwater for site visitors and residents on-site will only be possible through groundwater abstraction. Dermal contact of groundwater for on-site site visitors and residents is considered highly unlikely as there are no current abstraction bores on-site. It is also highly unlikely that a bore will be installed in the future due to the saline nature of the groundwater.

APEC	Receptor	Exposure Pathway	Linkage Status	Justification
		Inhalation of vapours	Unlikely	Potential hydrocarbon contamination in the soil profile can also migrate via leaching into groundwater and may represent a risk to human receptors via vapour inhalation. Although, no hydrocarbon staining or contamination was observed, therefore, the risk of this is considered low.
		Inhalation of fibres	Possible	Historical building structures (PACM roofing panels) were observed during the site inspection, although were in the process of being removed. There is still a possibility that fugitive PACM fragments will exist in the surrounding soil once the roofing panels have been removed. **Qualitative Risk Rating: Low**
	Onsite - intrusive maintenance and civil contractors	Dermal contact and incidental ingestion of soil and/or groundwater.	Possible	The historical operation of the Woolstores lots as industrial since the 1950s and rural residential land uses in the remaining lots has the potential to cause contamination. Historical aerials suggest that the site has been predominantly unsealed including at the time of this investigation. Potential hydrocarbons, pesticides and heavy metals could be present through the unsealed soil profile and groundwater onsite. The on-site drain network present on the Woolstores lots could act as a potential pathway for contaminated soils to leach into groundwater on-site. No visual or olfactory contamination was observed at the rural residential lots at the time of inspection, although, this does not discount the possibility of contamination being present. As the nature and extent of contaminants associated with the historical land uses is currently unknown, potential groundwater impacts through leaching are possible and pose risks to intrusive maintenance workers and civil contractors (groundwater assumed to be less than 2 m bgl).
		Inhalation of vapours	Possible	Based on the depth to groundwater, intrusive workers could potentially come into contact with groundwater at the site. The current nature and extent of contaminants associated with the historical industrial land use is currently unknown, therefore, potential groundwater impacts through leaching are unknown but could pose risks to future onsite intrusive maintenance and civil contractors (groundwater assumed to be less than 2 m bgl). If present, vapours have the potential to accumulate in trenches and excavations posing unacceptable risks to intrusive maintenance workers and civil contractors.
		Inhalation of fibres	Possible	Historical building structures (PACM roofing panels) were observed during the site inspection, although were in the process of being removed. There is still a possibility that fugitive PACM fragments will exist in the surrounding soil once the roofing panels have

APEC	Receptor	Exposure Pathway	Linkage Status	Justification
				been removed. This PACM material (if present) will pose risks to onsite intrusive maintenance and civil contractors via fibre inhalation. **Qualitative Risk Rating: Low**
	Onsite – Ecological Receptors	Uptake by roots	Possible	Vegetated areas for the current (general industry and rural residential) and future (mixed use) land uses are considered to be low ecological significance. No signs of vegetation stress were observed during the preliminary site investigation. **Qualitative Risk Rating: Low**
	Offsite - human receptors including residents and recreational users of the Royal Princess Harbour	Dermal contact and incidental ingestion of groundwater. Inhalation of dust and fibres	Unlikely Possible	Potential contaminants associated with the historical industrial land use of the Woolstores lots are unknown. Potentially contaminated soils on-site could possibly leach into the shallow groundwater and migrate down gradient to the Princess Harbour and become expressed as surface water. Dermal contact and incidental ingestion of potentially contaminated groundwater (expressed as surface water) for recreational receptors in the Royal Princess Harbour is considered possible but unlikely. It is possible for contaminated dust and PACM fibres to be generated during future excavation, earthworks and wind. Surficial PACM was observed throughout the Woolstores lots. There are surrounding residential and industrial properties that may be at risk from impacted dusts/ fibres if airborne. Recreational users of the Royal Princess Harbour could potentially be at risk from fibres and dust generated from wind and during future excavation and earthworks of material onsite. **Qualitative Risk Rating: Low**
	Offsite - Ecological Receptors	Direct Contact	Possible	The Royal Princess Harbour is the closest down-gradient ecological receptor to the site. The Royal Princess Harbour is located along the southern boundary of the site. Leaching of contaminants within the soil to groundwater and subsequent off-site migration is possible, although unlikely, and could pose risks to the sensitive ecological receptors (if reported above ecological criteria) within the Harbour. **Qualitative Risk Rating: Low**
5. Migration of contaminated groundwater from up-gradient properties COPC	**Onsite** - Current and future on-site workers, site visitors and residents.	Dermal contact and incidental ingestion of groundwater.	Possible	There are various properties to the north of the site that have been classified as Remediated for Restricted Use (commercial/ industrial). Groundwater from these up-gradient properties have reported acidic conditions and contain elevated concentrations of metals (aluminium, iron, copper and zinc). The acidic groundwater conditions are thought to be representative of regional conditions, although, elevated concentrations of metals are associated with the contaminating activities from the up-gradient classified sites. There is no evidence to confirm that these impacts have migrated off-site (creating

APEC	Receptor	Exposure Pathway	Linkage Status	Justification
• pH •Metals				a 'source site'). If these impacts were to migrate off-site and come on-site, dermal contact and ingestion of water would only be possible through groundwater abstraction. Dermal contact of groundwater for on-site site visitors and residents is considered highly unlikely as there are no current abstraction bores on-site. It is also highly unlikely that a bore will be installed in the future due to the saline nature of the groundwater. **Qualitative Risk Rating: Low**
	Onsite intrusive maintenance and civil contractors	Dermal contact and incidental ingestion of groundwater.	Possible	There are various properties to the north of the site that have been classified as Remediated for Restricted Use (commercial/ industrial). Groundwater from these up-gradient properties have reported acidic conditions and contain elevated concentrations of metals (aluminium, iron, copper and zinc). However, a review of groundwater data from across the catchment area indicates that the levels of nutrients, acidity, and metals in groundwater beneath this site are indicative of background up-hydraulic gradient groundwater quality. There is no evidence to confirm that these impacts have migrated off-site (creating a 'source site'). Groundwater on-site could potentially be intersected by regular maintenance activities and therefore may present unacceptable risks for intrusive maintenance workers. **Qualitative Risk Rating: Moderate**
	Onsite – Ecological Receptors	Uptake by roots	Possible	Vegetated areas for the current (general industry and rural residential) and future (mixed use) land uses are considered to be low ecological significance. No signs of vegetation stress were observed during the preliminary site investigation. **Qualitative Risk Rating: Low**

6. Community Consultation

NEPM Schedule B8 provides guidelines for community engagement and risk communication strategies on contaminated site projects. Table 6-1 below, provides a community involvement framework that has been considered to help guide the selection of the appropriate level of consultation.

Table 6-1: Selecting the Level of Community Involvement

Assessment Questions	V. Low	Low	Med	High	V. High
Perceptions of persons external to the proposal (the community)					
What is the level of existing controversy surrounding this type of facility?		✓			
How significant are the potential impacts to the community?		✓			
What is the level of significance of this issue to the major stakeholders?	✓				
What level of involvement does the community appear to desire?	✓				
What level of involvement do key stakeholders appear to desire?	✓				
What is the probable level of difficulty in solving the issue?		✓			
What is the required level of public input?	✓				
What is the potential for the number of actively involved stakeholders to balloon?	✓				
To what degree does the public appear to want to be involved?	✓				
What is the potential for the public to influence the potential outcome?	✓				
How significant are the possible benefits of involving the public?	✓				
How serious are the ramifications of not involving the public?	✓				
What is the possibility that the media will become interested?	✓				
What is the likelihood that decision-makers will give full consideration to public input?	✓				
What is the likelihood that adequate resources will be made available to support community involvement?	✓				
What is the likely level of political controversy on this issue?	✓				

As no offsite activities are anticipated at this point in time, it is assessed that the level of community consultation required is currently low and community consultation activities are not required at this stage of the investigation. The requirement for community consultation will need reassessment depending on the outcome of this investigation.

7. Data Quality Objectives

7.1 Data Quality Objectives

Data quality objectives (DQOs) consistent with the NEPM DQO process, as outlined in Schedule B2: Guideline on Site Characterisation (NEPM, 2013) were developed for the contamination assessment, as discussed in the following sections.

7.1.1 State the Problem

The PSI completed for the site has identified a number of APEC which require further investigation. Intrusive sampling is required in order to characterise the contamination status of the site to enable an assessment of potential risk to human health and/or the environment to be made and to confirm suitability for future proposed land uses, which include commercial activities, residential land use (varying densities) and public open space.

Additionally, the PSI identified that the site is classed as having a 'High Probability of Occurrence' (ASRIS 2013) and/or 'High to Moderate risk' (DWER 2017) of ASS occurring within 3 m of the natural soil surface that could be disturbed by most land development activities. The DWER (2015) guidance states that in areas of 'High to Moderate risk' of ASS occurring, an ASS investigation is required prior to the following ground disturbance events:

- Earthworks that will disturb more than 100 m^3 of soil.
- During dewatering or soil draining activity.

7.1.2 Identify the Decision

The specific decisions required to be made as part of investigation of the identified APECs are summarised below.

- Are there any unacceptable risks from soil and groundwater contamination that are likely to impact current or future on-site and off-site receptors?
- Are there any aesthetic issues at the site such as odorous soils or groundwater?
- Is remediation and/or management of APECs required to facilitate future development of the site?
- Is ASS present which will require management during future development activities?

7.1.3 Identify Inputs to the Decision

Inputs to the decisions will be:

- Environmental data to be collected by sampling and analysis, and additional site observations made during the investigation.
- The advancement of soil bores and collection of soil samples.
- The installation of groundwater monitoring wells.
- The collection of groundwater samples from newly installed groundwater monitoring wells.
- Analytical methods for COPCs are selected so that assessment can be made relative to applicable site criteria.
- Confirmation that data generated by sampling and analysis are of an acceptable quality as undertaken by assessment of quality assurance / quality control as per the data quality indicators (DQIs).

- Identification of potential receptors and exposure pathways with consideration of potential exposure periods in relation to identified COPCs.

7.1.4 Define the Study Boundaries

The lateral extent of the study will comprise the full extent of the site boundary, presented on **Figure 1** attached, with no intrusive investigation proposed outside of the site boundary. The vertical extent of the investigation will be approximately 6m bgl for soil for the ASS investigation, 2 m bgl for the asbestos and other COPC investigation and 9.5 m bgl for groundwater investigation, which is approximately 2 m below the maximum anticipated depth of groundwater at the site.

7.1.5 Develop a Decision Rule

Analytical data will be assessed against criteria appropriate for the proposed land uses, including commercial, public open space and residential.

The decision rules adopted to address the identified problem are summarised in Table 7-1**.**

Table 7-1: Summary of Decision Rules

Decision Required to be Made	Decision Rule
Are there any unacceptable risks to on-site and potential off-site future receptors from sampled media?	Soil and groundwater analytical data will be compared against relevant adopted site assessment criteria. The Tier 1 qualitative risk assessment will identify whether concentrations of COPCs reported from environmental media potentially pose an unacceptable risk to the identified receptors where potentially complete source-pathway-receptor (SPR) linkages have been identified. If the analytical data exceeds the adopted assessment criteria the decision will be Yes. Statistical analysis may be considered to assess the data set if the answer to the decisions is Yes. If the analytical data is below the adopted assessment criteria, the answer to the decision will be No.
Are there any aesthetic issues at the site?	If there are any unacceptable odours, soil discoloration or visual considerations (such as the presence of rubbish or rubble), the answer to the decision is Yes. Otherwise, the answer to the decision is No.
Is remediation and/or management of APECs required to facilitate future development of the site?	Should any unacceptable risks to on-site or potential off-site receptors remain, the answer to the decision will be Yes. Otherwise, the answer to the decision is No.
Are the results of acid sulfate soil field indicators indicative of ASS, as per Table 5 of DWER 2015?	ASS field data will be compared against DWER 2015 indicators for ASS. If the reported field results do not meet the criteria presented in Table 5 as indicative of ASS, then the answer will be No. If the criteria are not satisfied, the decision will be Yes. Where the answer is Yes, laboratory analysis is required as per below.
Are the results of laboratory testing for ASS on selected samples above the relevant net acidity action criteria?	Soil analytical data will be compared against DWER 2015 net acidity action criteria. The reported concentrations are all below the site criteria; If the criteria stated above is satisfied, the decision will be No. If the criteria are not satisfied, the decision will be Yes.

7.1.6 Specify Limits of Decision Error

This step is to establish the decision maker's tolerable limits on decision errors, which are used to establish performance goals for limiting uncertainty in the data. Data generated during this project must be appropriate to allow decisions to be made with confidence.

Specific limits for this project have been adopted in accordance with the appropriate guidance from the NEPM (NEPC 2013), appropriate data quality indicators (DQIs used to assess QA/QC) and standard JBS&G procedures for field sampling and handling.

To assess the usability of the data prior to making decisions, the data will be assessed against pre-determined Data Quality Indicators (DQIs) established for the project are discussed below in relation to precision, accuracy, representativeness, comparability, completeness and sensitivity (PARCCS parameters), and are detailed in Table 7-2**.**

- **Precision** - measures the reproducibility of measurements under a given set of conditions. The precision of the laboratory data and sampling techniques is assessed by calculating the Relative Percent Difference (RPD) of duplicate samples.
- **Accuracy** - measures the bias in a measurement system. The accuracy of the laboratory data that are generated during this study is a measure of the closeness of the analytical results obtained by a method to the 'true' value. Accuracy is assessed by reference to the analytical results of laboratory control samples, laboratory spikes and analyses against reference standards.
- **Representativeness** –expresses the degree which sample data accurately and precisely represent a characteristic of a population or an environmental condition. Representativeness is achieved by collecting samples on a representative basis across the site, and by using an adequate number of sample locations to characterise the site to the required accuracy.
- **Comparability** - expresses the confidence with which one data set can be compared with another. This is achieved through maintaining a level of consistency in techniques used to collect samples; ensuring analysing laboratories use consistent analysis techniques and reporting methods.
- **Completeness** – is defined as the percentage of measurements made which are judged to be valid measurements. The completeness goal is set at there being sufficient valid data generated during the study.
- **Sensitivity** – expresses the appropriateness of the chosen laboratory methods, including the limits of reporting, in producing reliable data in relation to the adopted criteria.

If any of the DQIs are not met, further assessment will be necessary to determine whether the non-conformance will significantly affect the usefulness of the data. Corrective actions may include requesting further information from samplers and/or analytical laboratories, downgrading of the quality of the data or alternatively, re-collection of the data.

Table 7-2: Summary of Quality Assurance/Quality Control Program

Data Quality Objectives	Frequency	Data Quality Indicator
Precision		
Blind duplicates (intra laboratory)	1 / 20 samples	<30% RPD for concentrations greater than 10 times the LOR. <100% RPD where concentrations are less than 10 times the LOR.
Blind triplicates (inter laboratory)	1 / 20 samples	<30% RPD for concentrations greater than 10 times the LOR. <100% RPD where concentrations are less than 10 times the LOR.

Data Quality Objectives	Frequency	Data Quality Indicator
Laboratory Duplicates	1 / 20 samples	<50% RPD
Accuracy		
Surrogate spikes	All organic samples	70-130%
Laboratory control samples	1 per lab batch	70-130%
Matrix spikes	1 per lab batch	70-130%
Representativeness		
Sampling appropriate for media and analytes	-	-
Samples extracted and analysed within holding times.	-	As per laboratory's NATA accreditation
Rinsate	1 per day where reusable equipment is used	<LOR
Laboratory (method) Blanks	1 per analytical method	<LOR
Comparability		
Standard operating procedures for sample collection & handling	All samples	All samples
Standard analytical methods used for all analyses	All samples	All samples
Consistent field conditions, sampling staff and laboratory analysis	All samples	All samples
Limits of reporting appropriate and consistent	All samples	All samples
Completeness		
Sample description and COCs completed and appropriate	All samples	All samples
Appropriate documentation	All samples	All samples
Satisfactory frequency and result for QC samples	All QA/QC samples	-
Data from critical samples is considered valid	-	Critical samples valid
Sensitivity		
Field and analytical methods and limits of recovery appropriate for media and adopted site assessment criteria	All samples	LOR < adopted site criteria (where possible)

If any of the DQIs are not met, further assessment will be necessary to determine whether the non-conformance will significantly affect the usefulness of the data. Corrective actions may include requesting further information from samplers and/or analytical laboratories, downgrading of the quality of the data or alternatively, re-collection of the data.

A qualitative assessment of compliance with standard procures and appropriate sample collection methods will be completed during the DQI compliance assessment.

7.1.7 Optimise the Design for Obtaining Data

The sampling design for the investigation of the areas of concern is based on the current understanding of the site's CSM, including review of historical information.

Optimisation for the investigation of each APEC has been discussed in the relevant methodology sections (**Section 8**). Generally, a targeted sampling approach has been adopted to facilitate lateral and vertical delineation of identified APECs.

8. Methodology

8.1 Proposed Investigation Locations and Rationale

A sampling plan has been developed, reflecting the findings of the PSI, and is presented herein.

The works will be completed in general conformance with WA DWER Contaminated Sites Guidelines (2021), the National Environment Protection (Assessment of Site Contamination) Measure 1999, (NEPC 2013), and with respect to relevant Australian Standards (AS4482.1, AS4482.2, 5667.1, 5667.11, etc.).

Based on JBS&G's experience with similar projects it is envisaged that this site will follow a staged process whereby the following stages will be required in order to achieve DWER reclassification:

Sampling and Analysis Quality Plan (SAQP) → Detailed Site Investigation (DSI) → Remediation Action Plan (RAP) → Site Remediation and Validation (SRV) → Site Management Plan (SMP) (if required).

8.1.1 Asbestos Investigation

Commercial/ Industrial Lots

Although not identified as a specific APEC, asbestos was identified as a relevant COPC for all APEC defined in the PSI. However, the potential for asbestos to be present is different in different areas of the site, resulting in different investigative requirements. Contamination is likely to be in the form of bonded ACM rather than fibrous asbestos (FA) or asbestos fines (AF).

Commercial/ industrial site structures which have recently been demolished are known to have included asbestos containing materials (ACM) However, there is considered a low potential for demolition to have resulted in the contamination of soils at the site with asbestos based on the controlled manner in which asbestos removal and subsequent demolition occurred. It is also possible that asbestos may be present in underground structures at the site, including pipes, infrastructure conduits, footings, and slabs which have not yet been identified. In the absence of any evidence of the existence of such structures, it is suggested that if they are identified in the future (during development activities), they are managed as unexpected finds.

Imported Fill Material, Fly Tipping/ Illegal Dumping, Observed PACM Fragments

There is an area in the eastern portion of the site where fill material is observed to have been placed. Multiple PACM fragments were also observed across this area, and it is considered likely that these are (at least in part) associated with the inappropriate demolition of a historical building in the area. Numerous instances of fly tipping/ illegal dumping, including building wastes, were also observed in this area of the site. The relevant area is depicted in **Figure 2**. Based on the above, in accordance with Table 4 of DoH 2021, the likelihood of asbestos is considered 'likely', and double density sampling in this area is warranted. Based on an area of ~1.5 ha, this would equate to 50 test pit locations. Investigation will be required to extend to below the depth of imported fill materials where virgin/natural soils are present, which is anticipated to be 1.5 m bgl to 2 m bgl. Proposed test pit locations are presented in **Figure 3.**

Reclaimed Land

A review of historical aerial photographs has identified that the southern portion of the site is reclaimed land. The fill utilised to create the current site levels is of unknown origin. The relevant area is depicted in **Figure 2**. Based on the presence of uncontrolled fill, in conjunction with the description in the PSI of stockpiled soil being present throughout the site observed to contain building wastes, in accordance with Table 4 of DoH 2021, the likelihood of asbestos is considered 'suspect', and single density sampling is considered to be appropriate. Based on an area of ~3.7 ha, this would equate to 45 test pit locations. Investigation will be required to extend to below the depth of imported fill materials where virgin/natural soils are present, which is anticipated to be 1.5 m bgl to 2 m bgl. Proposed test pit locations are presented in **Figure 3.**

Balance of Commercial/ Industrial Lots

The site has a long commercial/ industrial history and the presence of structures containing ACM is known. Additionally, the PSI described stockpiled soil being present throughout the commercial/ industrial lots observed to contain building wastes. It is also possible that areas of fill placement encroach on this portion of the lots. The relevant area is depicted in **Figure 2**. Based on the above, in accordance with Table 4 of DoH 2021, the likelihood of asbestos is considered 'suspect', and single density sampling is considered to be appropriate. Based on an area of ~4.5 ha, this would equate to 52 test pit locations. Investigation will be required to extend to below the depth of imported fill materials where virgin/natural soils are present, which is anticipated to be a maximum 1.5 m bgl to 2 m bgl (likely less in this area of the site). Proposed test pit locations are presented in **Figure 3.**

Northern Rural Residential Lots

The potential for asbestos to be present within the northern rural lots is more limited based on their less disturbed nature. Areas of historical infrastructure associated with the rural residential land use visible in the historical aerial photographs appear to be limited to areas associated with Main Roads earthworks, outside the current site boundary, with the areas within the site boundary appearing to have been used for possible grazing purposes only. As there was no evidence of PACM identified during the site inspection, and no known significant infrastructure within these lots, it is not considered that sampling for asbestos is warranted in this area.

8.1.2 Former Site Structures and Stockpiled Soil

Commercial/ Industrial Lots

It is understood that at the time of DSI implementation, all stockpiled materials and site structures will have been removed from site as part of decommissioning and demolition activities. Potential contamination associated with former site structures and stockpiled soil will be addressed by the site-wide asbestos investigation described at Section 8.1.1, and the investigations relating to uncontrolled fill at Section 8.1.4 and historical land use described at Section 8.1.5 will address other COPC associated with former site structures and former stockpiled materials.

Northern Rural Residential Lots

Areas of historical infrastructure associated with the rural residential land use visible in the historical aerial photographs appear to be limited to areas associated with Main Roads earthworks, outside the current site boundary, with the areas within the site boundary appearing to have been used for possible grazing purposes only. No stockpiling was identified as having occurred in this area. As such, no specific sampling is proposed in the northern rural residential lots associated with former site structures.

8.1.3 Illegal Dumping/ Fly Tipping

Commercial/ Industrial Lots

Along the eastern portion of the Woolstores lots, illegal dumping/ fly tipping was observed. Fragments of PACM were observed at multiple locations during the site inspection.

It is understood that at the time of DSI implementation, these areas of fly tipping/ illegal dumping will have been removed from the site, as per the recommendations of the PSI. Regardless, contamination of soil may have occurred associated with the placement of these materials, which requires assessment.

50 test pits will be required in this area of the site to support the asbestos investigation detailed at Section 8.1.1. It is proposed that samples to assess potential contamination from illegal dumping/ fly tipping be collected from 25 of these test pits (selected based on field observations), which will be extended to the depth of virgin/ natural material (likely to be 1.5 m bgl to 2 m bgl), from a different wall of the excavation to the asbestos sampling. Given the occurrence of various instances of illegal dumping/ fly tipping, the requirement

for 25 test pits is based on AS4482.1-2005 recommendation for 25 sampling points for an area of 1.5 ha for hot spot identification.

Due to the diverse range of COPC which could be associated with illegal dumping/ fly tipping, a broad suite of COPC is proposed, including:

- Total Recoverable Hydrocarbons (TRH).
- Benzene, Toluene, Ethylbenzene, Xylenes and Naphthalene (BTEXN).
- Polycyclic Aromatic Hydrocarbons (PAH).
- Volatile Organic Compounds (VOC)/ Semi Volatile Organic Compounds (SVOC).
- Metals
- Organochlorine Pesticides (OCP)/Organophosphorous Pesticides (OPP).

Northern Rural Residential Lots

No evidence of illegal dumping or fly tipping was observed in the northern rural residential lots, and therefore no investigations associated with this activity are proposed in the area.

8.1.4 Potential Uncontrolled Fill/ Reclaimed Land

Commercial/ Industrial Lots

The Woolstores site has been built on reclaimed land. Suspected imported fill material was also observed along the eastern boundary of the commercial/ industrial lots; however, the eastern area is addressed in Section 8.1.3 in conjunction with the fly tipping/ illegal dumping investigation.

45 test pits will be required in this area of the site to support the asbestos investigation detailed at Section 8.1.1. It is proposed that samples be collected to assess contamination from potential uncontrolled fill/ reclaimed land from 25 of these test pits, which will be extended to the depth of virgin/ natural material (likely to be 1.5 m bgl to 2 m bgl), from a different wall of the excavation to the asbestos sampling. 25 test pits are considered appropriate (representing approximately half the density recommended in AS4482.1-2005 for hot spot identification) given that a large proportion of the relevant area of land has been sealed with hardstand for the duration of the land use, limiting the potential for contamination.

Due to the diverse range of COPC which could be associated with uncontrolled fill, a broad suite of COPC is proposed, including:

- TRH.
- BTEXN.
- PAH.
- VOC/ SVOC.
- Metals
- OCP/ OPP.

Northern Rural Residential Lots

The potential for uncontrolled fill was not identified within the northern rural residential lots, and therefore investigations relating to that APEC are not proposed in this area.

8.1.5 Historical Land Uses

Commercial/ Industrial Lots

The Woolstores site has been subject to commercial/ industrial land (including historical rail lines) uses for approximately 70 years. There is potential for contamination across the commercial/ industrial lots associated with these historical potentially contaminating activities to exist. The Woolstores site while operational was used as a wool storage facility with truck and machinery access. During the PSI, soak wells/ drains were observed but the linings were unable to be visually assessed.

52 test pits will be required in this area of the site to support the asbestos investigation detailed at Section 8.1.1. It is proposed that samples be collected to assess contamination from historical land uses from 26 of these test pits, which will be extended to the depth of virgin/ natural material (likely to be a maximum of 1.5 m bgl to 2 m bgl), from a different wall of the excavation to the asbestos sampling. 26 test pits are considered appropriate (representing approximately half the density recommended in AS4482.1-2005 for hot spot identification) given that a large proportion of the relevant area of land has been sealed with hardstand for the duration of the land use, limiting the potential for contamination.

In relation to the soak wells/ drains, it is recommended that this infrastructure is removed prior to environmental field works so that underlying and surrounding soils may be more easily assessed for contamination. Any sediment within these soak wells/ drains at the time of removal should be characterised by a qualified environmental consultant and disposed to an off-site appropriately licensed landfill. The test pits proposed for the asbestos investigation in the vicinity will be advanced to target the location of each soak well/ drain.

Due to the diverse range of COPC which could be associated with the various historical land uses, a broad suite of COPC is proposed, including:

- TRH.
- BTEXN.
- PAH.
- VOC/ SVOC.
- Metals
- OCP/ OPP.

Northern Rural Residential Lots

Areas of historical infrastructure associated with the rural residential land use visible in the historical aerial photographs appear to be limited to areas associated with Main Roads earthworks, outside the current site boundary, with the areas within the site boundary appearing to have been used for possible grazing purposes only. As such, no specific sampling is proposed in the northern rural residential lots associated with the historical grazing land use.

8.1.6 Groundwater Investigation

The PSI identified the potential for contaminated groundwater from up-gradient properties to migrate beneath the site. The potentially contaminating activities conducted at the site historically also have the potential to have resulted in groundwater contamination. A such, it is proposed to complete a groundwater investigation to assess the quality of groundwater beneath the site.

Given the site's proximity to the coast, groundwater levels range from approximately 7.5 metres below ground level (m bgl) to less than 1 m bgl. Groundwater flow direction beneath the site broadly flows southward, toward the coast.

The installation of six groundwater monitoring wells is proposed in the following locations (**Figure 5**):

- Within the central northern portion of the northern rural residential lots to assess groundwater conditions migrating onto the site from upgradient locations.

- Within the central northern portion of the commercial/ industrial lots to assess groundwater conditions migrating onto the site from upgradient locations.
- In the approximate centre of the commercial/ industrial lots, in the vicinity of the former drains/ soak wells to assess potential impacts from this infrastructure, the former rail line, and the general commercial/ industrial land use.
- In the eastern portion of the site in the area of imported fill and the historical building.
- Two locations in the southern area of the site to assess quality of groundwater migrating off-site.

It is noted that groundwater well locations may need to be adjusted dependent on field observations during the field investigation (e.g. if areas of gross soil contamination are identified), and dependent on the findings of the proposed groundwater monitoring event, additional groundwater monitoring wells may require installation.

Groundwater samples will be analysed for a broad suite of COPC, to account for both on-site sources of contamination and off-site, up-gradient sources of contamination:

- TRH.
- BTEXN.
- PAH.
- VOC/ SVOC.
- Metals
- OCP/ OPP.
- Nutrients.
- pH.

8.1.7 Acid Sulfate Soils

The PSI identified that the site is within an area of 'High to Moderate risk' of ASS occurring. The DWER (2015) guidance states that in areas of 'High to Moderate risk' of ASS occurring, an ASS investigation is required prior to the following ground disturbance activities:

- Earthworks that will disturb more than 100 m^3 of soil.
- During dewatering or soil draining activity.

Given the proposed re-zoning and redevelopment of the site, it is likely that both the ground disturbance events above will occur. This will trigger the requirements for ASS investigation.

DER 2015 indicates that for non-linear disturbances at a site >4 ha, 2 sampling locations per hectare are required. ASS investigation will be required at both the northern rural residential lots, and the commercial/ industrial lots. Based on the size of each of these areas, the following number of sample locations are proposed:

- Northern rural residential lots (~6 ha) – 12 sampling locations.
- Commercial/ industrial lots (~10 ha) – 20 sampling locations.

Based on proposed conceptual level service plans provided by the client, the following was able to be ascertained regarding proposed ground disturbance at the site:

- An invert level of 0.92 m AHD will be required for a stormwater inlet headwall located along Woolstores Place where the current site levels are approximately 3 m AHD, indicating ground disturbance of approximately 2.1 m bgl will be required in this area.

- An outlet headwall level of 4 m AHD was depicted on the eastern end of Woolstores Place, where an existing ground level of 5.75 m AHD is depicted, indicating disturbance of approximately 1.75 m bgl.
- The schematic sewer concept indicates an invert level of -1 m AHD in an area where current ground levels are approximately 3.3 m AHD, indicating a ground disturbance depth of approximately 4.3 m bgl.
- The schematic sewer concept indicates an invert level of 0.5 m AHD in an area where current ground levels are approximately 2.8 m AHD, indicating a ground disturbance depth of approximately 2.3 m bgl.

The maximum depth of disturbance identified based on the provided plans is 4.3 m bgl. The guidelines require that investigation is undertaken to at least 1 m in excess of the maximum depth of disturbance. Therefore, it is proposed that soil bores for the purposes of characterising ASS are advanced to 6 m bgl, as a conservative measure.

8.1.8 Summary of Sample Locations

A summary of proposed sample locations has been presented in Table 8-1 below.

Table 8-1: Summary of Sample Locations

Media	Area of Potential Concern	Number of Investigation Locations	Number of Samples to be Collected	Analytical Suite (no. of primary samples analysed)
Soil	Asbestos in soil (~10 ha)	147 test pits, 1 m x 1 m to a max. depth of 2 m bgl.	294[10]	NA
	Former site structures and stockpiled soil	No additional sampling for this APEC as it is captured under other APEC.	-	-
	Illegal dumping/ fly tipping (~1.5 ha)	25 of the above test pits will include sampling for other COPC.	100[11]	TRH (25), BTEXN (25), PAH (12), SVOC (6), VOC (6), metals (25), OCP (12), OPP (12)
	Potential uncontrolled fill (~3.7 ha)	25 of the above test pits will include sampling for other COPC.	100	TRH (25), BTEXN (25), PAH (12), SVOC (6), VOC (6), metals (24), OCP (12), OPP (12)
	Historical land uses (~4.5 ha)	26 of the above test pits will include sampling for other COPC.	104	TRH (26), BTEXN (26), PAH (13), SVOC (6), VOC (6), metals (26), OCP (13), OPP (13)

[10] Assuming two samples per test pit – noting that these samples are sieved with ACM fragments weighed, not submitted for laboratory analysis.
[11] It is expected that four soil samples per test pit will be collected, with one sample per test pit submitted for laboratory analysis in the first instance with the remainder of samples remaining on hold pending the results of preliminary analysis.

Media	Area of Potential Concern	Number of Investigation Locations	Number of Samples to be Collected	Analytical Suite (no. of primary samples analysed)
	ASS	32 x soil bores to a depth of 6 m bgl	768[12]	Suspension Peroxide Oxidation Combined Acidity and Sulfur (SPOCAS) (192)[13] Chromium Reducible Sulfur (CRS) (10)[14]
	Background (to allow calculation of site specific EILs)	5 x surface soil samples from areas unlikely to have been impacted by site activities	5	Metals Cation Exchange Capacity (CEC) pH Clay content (% clay)
Groundwater	-	6 x new monitoring wells	MW01 – MW06	TRH (6), BTEXN (6), PAH (6), SVOC (6), VOC (6), metals (6), OCP (6), OPP (6), nutrients (6), pH

8.2 Subsurface Clearance

Due to the inherent risks associated with excavation works and the potential to intercept below ground services, JBS&G follows strict procedures to reduce the risk of striking any below ground services during ground disturbance works. The JBS&G procedures involve obtaining Before You Dig Australia plans and engaging a qualified service locator to mark out underground services (using a Cable Avoidance Tool and Ground Penetrating Radar). Site service plans, where available, will also be reviewed as part of the clearance works. Non-destructive drilling techniques (e.g. hand tools) are implemented for the top 1 m of all bores where possible, and may extend deeper where uncertainties remain regarding the presence of services.

8.3 Soil Sampling Methodology

8.3.1 Sampling for Asbestos

The following methodology will be followed for the asbestos in soil investigation.

- 147 1 m x 1 m test pits will be excavated in an approximately grid based pattern through fill material, extending to virgin/natural material beneath (anticipated to be 1.5 m bgl to 2 m bgl). The excavation will be such that the sidewall can be examined to assist in sample targeting.
- All sample locations will be recorded via GPS.
- One (1) 10L sample will be collected from each relevant stratum (or per 1 m depth) of one wall, with discretionary samples collected as necessary from other suspect spots.
- The samples will be screened manually through a <7mm sieve.

[12] Assumes a maximum bore depth of 6 m bgl, with samples collected every 0.25 m for field testing.
[13] It is assumed that 25% of the ASS field samples will be submitted for laboratory analysis.
[14] An allowance has been made for a small proportion of laboratory samples to be analysed for both SPOCAS and CRS in the event that conditions are observed in the field indicating high organic content in soil samples (e.g. peaty soil conditions).

- Identified bonded ACM will be weighed to calculate asbestos soil concentration for individual samples, as per the methodology presented in Appendix 2 of DoH 2021.

8.3.2 Sampling for Other COPC

The following methodology will be followed for the investigation of COPC other than asbestos.

- A proportion of the 1 m x 1m test pits excavated for the asbestos investigation will be utilised for collection of samples to be analysed for other COPC (as per Table 8-1). The depth of test pits will be dependent on the thickness of fill materials observed in the field but is considered likely to be a maximum of 1.5 m bgl to 2 m bgl.
- Soil samples will be collected from a different wall of the excavation to the asbestos sampling, with samples collected at surface (0.0 – 0.1 m bgl), shallow depth (0.4 – 0.5 m bgl; 0.9 – 1.0 m bgl), and then at 1 m intervals based on lines of evidence including visual and/or olfactory evidence of impacts.
- The observed soils are to be logged in accordance with the Unified Soil Classification System, as well as observations of visual / olfactory indicators of potential soil contamination (i.e. discolouration, odour, etc.). Soil samples are to be screened for volatiles using a Photo Ionisation Detector (PID). PID readings are to be recorded on the bore logs.
- All soil sampling locations will be recorded with a handheld GPS unit.

8.3.3 Sampling for ASS

The following number of sample locations are proposed:

- Northern rural residential lots (~6 ha) – 12 sampling locations.
- Commercial/ industrial lots (~10 ha) – 20 sampling locations.

Sample locations are proposed to be soil bores advanced via direct push to a depth of 1 m below the maximum depth of disturbance. As a conservative measure, it is proposed that the depth of investigation is 6 m bgl.

ASS Field Testing

pH Test (pH_F)

The pHF test measures the existing acidity of a soil:water paste, and is therefore used to help identify if ASS are present. If the measured pH of the soil paste is pHF <4, oxidation of sulfides has probably occurred in the past, indicating the presence of actual ASS (AASS). Highly organic soils or heavily fertilised soils may also return a pHF close to 4. A pHF >4 but <5 indicates an acid soil, but the cause of the acidity will need to be further investigated by laboratory analysis. The pHF test does not detect any unoxidised sulfides (i.e. PASS). For this reason, this test must be used in conjunction with the pHFOX test.

Testing followed the procedure summarised below.

- The battery powered field pH meter will be calibrated.
- Separate test tube racks will be prepared for the pHF and pHFOX tests as contamination may occur when the pHFOX reactions are violent.
- Tests will be conducted at intervals on the soil profile of 0.25 m or at least one test per horizon, whichever is lesser.
- Approximately one teaspoon of soil sample (per test tube) will be removed from the profile and placed into the appropriate pHF and pHFOX test tubes.
- Deionised water (pH 5.5) will be added to the pHF test tube to make a paste stirring with a skewer or similar to ensure all soil 'lumps' are removed.

- The pHF will be measured using a pH meter with spear point electrode, waiting for the reading to stabilise before recording the final pH measurement.
- All measurements will be recorded on a data sheet.

pH Peroxide Test (pH_{FOX})

The pHFOX test is used to indicate the presence of iron sulfides or PASS. This test involves adding 30 per cent hydrogen peroxide (pH adjusted to 4.5-5.5) to a sample of soil. If sulfides are present a reaction will occur. The reaction can be influenced by the amount of sulfides present in the sample, the presence of organic matter, or the presence of manganese. Once the reaction has occurred, the pH is measured.

A combination of three factors is considered in arriving at a 'positive field sulfide identification':

- A reaction with hydrogen peroxide—the strength of the reaction with peroxide is a useful indicator but cannot be used alone. Organic matter, 'coffee rock' and other soil constituents such as manganese oxides can also cause a reaction. Care should be exercised in interpreting a reaction on surface soils and high organic matter soils such as peats and 'coffee rock' and some mangrove/estuarine muds and marine clays. This reaction should be rated, e.g. L = low reaction, M = medium reaction, H = high reaction, X = extreme reaction, V = volcanic reaction.
- The actual value of pHFOX—if pHFOX <3, and a significant reaction occurred, then it strongly indicates PASS. The more the pHFOX drops below 3, the more positive the presence of inorganic sulfides.
- A much lower pHFOX than field pHF—the lower the final pHFOX value and the greater the difference between the pHFOX compared to the pHF, the more indicative of the presence of PASS.

Testing followed the procedure summarised below.

- The pH of the hydrogen sulphide will be adjusted to 5.0-5.5 prior to mobilisation.
- Separate test tube racks will be prepared as per the methodology for pHF.
- Tests will be conducted at intervals on the soil profile of 0.25 m or at least one test per horizon, whichever is lesser.
- Approximately one teaspoon of soil sample (per test tube) will be removed from the profile and placed into the appropriate pHF and pHFOX test tubes.
- A few drops of 30 per cent H2O2 adjusted to pH 4.5–5.5 will be added to the to the pHFOX test tube, and the mixture stirred.
- Approximately 20 minutes will be allowed for any reactions to occur. The rate of any reaction will be recorded using a slight (X), moderate (XX), vigorous (XXX) or very vigorous (XXXX) scale.
- The soil/peroxide mixture will be allowed to cool as placing an electrode into high temperature materials can result in physical damage and inaccurate readings.
- The pHFOX will be measured using a pH meter with spear point electrode, waiting for the reading to stabilise before recording the final pH measurement.
- All measurements will be recorded on a data sheet.

8.3.4 Soil Sample Handling

Collected soil samples will be placed directly into laboratory supplied sample jars/bags.

Collected soil samples required for laboratory ASS assessment will be immediately transferred to laboratory supplied snap-lock bags, excluding air to minimise oxidation of the samples as much as possible.

All samples will be placed directly into a pre-chilled ice chest, for transport to the testing laboratories.

Chain of custody documentation will be completed for each batch of samples relinquished to the laboratory and included: sample ID; number of jars; media type; project ID; name; date; and time of relinquishment.

All samples will be retained in storage (frozen or specially dried) at the laboratory until the ASS and contamination investigations are finalised.

8.4 Groundwater Well Installation

It is proposed to install six (6) groundwater monitoring wells using push tube technology to 2m below encountered groundwater. Based on available information, groundwater may be approximately 7.5 m bgl in the north of the site, and as shallow as 1 m bgl in the south of the site.

Groundwater monitoring wells will be constructed with 50 mm Class 18 slotted and blank PVC pipe and finished with a steel gatic cover flush with ground level. It is intended that the groundwater wells will be screened with 3 m screens straddling the water table, which will assist in the assessment of the presence of surface infiltration to groundwater and Light Non-Aqueous Phase Liquid (LNAPL) (e.g. fuel/oils).

The installed monitoring wells will be developed using a submersible pump to remove turbidity and potential water introduced by the drilling and construction process. It shall be ensured that development is continued until such time that no visible sediment or turbidity is present in purge water, where practicable.

8.5 Groundwater Sampling

A groundwater monitoring event will be completed at the four (4) new monitoring wells to assess the groundwater quality beneath the site. Proposed monitoring well locations have been presented on **Figure 5**. Sampling will be undertaken a minimum of 5 to 7 days after monitoring well installation.

Groundwater sampling will be undertaken via low flow sampling technology. The proposed methodology for groundwater sampling is as follows.

- Depth to groundwater and total well depth, will be gauged using an oil/water interface probe. The interface probe will be decontaminated appropriately between locations.
- Groundwater purging and sampling will be undertaken for all wells using low-flow techniques at each location. Using a flow through cell and calibrated water quality meter, field parameters including pH, EC, dissolved oxygen, oxidation/reduction potential and temperature will be measured during purging and recorded on the sampling field sheet. The wells will only be sampled when all parameters have stabilised.
- Groundwater samples will be collected in dedicated sampling containers provided by the laboratory and immediately placed on ice in an insulated esky. The samples will be forwarded, under appropriate chain-of-custody (COC) documentation, to NATA accredited laboratory, Eurofins and MPL (secondary Laboratory), under strict chain of custody protocols. All samples will be returned to the laboratory within appropriate holding times for each of the analytes being tested.

8.6 Decontamination Procedures

All non-disposable sampling equipment will be decontaminated between sample locations by washing with Decon 90 and rinsing with potable water.

Rinsate samples will be collected daily from all non-disposable sampling equipment and submitted for laboratory analysis of COPC relevant to the day's sampling activities.

8.7 Quality Assurance and Quality Control

Duplicate and triplicate samples will be collected at a rate of 1:20.

One trip spike and one trip blank sample will be analysed per media per day of field works.

8.8 Sample Labelling, Storage and Transport

Samples will be collected directly into appropriate laboratory supplied sampling containers (zip-lock bags or sample jars, as appropriate) and placed on ice in a chilled esky.

Sample labels will record the job number, sample identification, date of sampling and initials of the sampler.

All samples will be tracked by chain-of-custody documentation from leaving the site to arrival at the laboratory.

8.9 Waste Management

All soil investigation locations will be reinstated in the order which they were excavated. It is not anticipated that any spoil will be generated requiring management.

Purged groundwater (from both well development and sampling) will be discharged to ground unless visual or olfactory indication of contamination are observed, in which case it will be containerised and disposed of off-site to an appropriately licensed facility.

8.10 DSI Reporting

An interpretative report including an updated contaminant CSM will be prepared for the site in accordance with the NEPM 2013 and DWER reporting guidance for a DSI. Soil and groundwater analytical data obtained as part of the investigation works will be screened against applicable criteria to assess risks posed to on-site and off-site human and ecological receptors based on the proposed mixed residential, commercial, public open space land use. The report will contain the following elements:

- A concise executive summary, which clearly addresses the project objectives and outcomes.
- Copies of relevant field documentation including calibration certificates, soil bore logs, gauging sheets.
- Photos of the site recording aspects of the work undertaken.
- Copies of sample summary tables showing all analytical results.
- Copies of laboratory documentation.
- Site plans showing all sample locations and locations of any assessment criteria exceedances.
- An assessment of quality assurance / quality control including calculation of all required DQIs. Where field or laboratory based DQIs fail SAQP objectives, comprehensive discussions will be provided as to the source of the failure and potential implications for data quality.
- An assessment of compliance with the acceptable limits for decision error as determined in the DQOs for each analyte recorded at a concentration above the laboratory detection limit. Where acceptable limits for decision error are not met for any analyte, requirements for additional sampling and analysis to meet acceptable limits of decision error will be determined as per the procedure provided to AS4482.1-2005.
- Updating of the CSM based on environmental data and observations made during the site investigation.
- A clear statement identifying the requirement for further assessment and the rationale for any proposed further actions.
- Conclusions and recommendations regarding the contamination status of the site to clearly address the project objectives.

The report will be provided in draft electronic format for client review prior to being finalised. A final electronic (PDF) report will be issued.

9. Assessment Criteria

9.1 Regulatory Guidelines

The investigation will be undertaken with consideration to aspects of the following guidelines, as relevant:

- National Environment Protection Council (NEPC), 2013, *National Environment Protection (Assessment of Site Contamination) Amendment Measure (ASC NEPM))* (No.1) 1999 as amended May 2013
- Cooperative Research Centre for Contamination Assessment and Remediation of the Environment (CRC Care, 2011).
- Australian and New Zealand Guidelines for Fresh and Marine Water Quality, August 2018 (ANZG 2018).
- *Assessment and Management of Contaminated Sites*. Contaminated Sites Guidelines November 2021, WA DWER (2021).

Assessment criteria applicable to residential, commercial/ industrial and public open space land use have been selected given the expected future mixed use of the site.

Where Australian published guidelines are unavailable consideration will be given to the USEPA regional screening levels (RSLs).

9.2 Soil Assessment Criteria

9.2.1 Health Investigation Levels (NEPM 2013)

Health Investigation Levels (HILs) have been developed for a broad range of metals and organic substances. HILs are applicable for assessing human health risk via all relevant pathways of exposure and are generic to all soil types. HILs for low-density residential land use (HIL-A), high-density residential land use (HIL-B), public open space (HIL-C), and commercial/ industrial land use (HIL-D) will be adopted.

9.2.2 Health Screening Levels (NEPM 2013)

Health Screening Levels (HSLs) were developed for selected petroleum compounds and fractions and are applicable to assessing human health risk via the inhalation exposure pathways from site sources for a range of situations. The HSLs for low – high density residential land use (HSL-A & B), recreational/ open space land use (HSL-C) and commercial/ industrial land use (HSL-D) will be adopted. Based on the current understanding of the site, the coarse grain soil values will be used. HSL values applicable to the depth of sample collection will be applied.

9.2.3 CRC Care (2011)

CRC Care (2011) HSLs for direct contact to soil will be adopted from the CRC Care *Technical Report 10: Health Screening Levels for Petroleum Hydrocarbons in Soil and Groundwater.*

9.2.4 Petroleum Hydrocarbon Management Limits (NEPM 2013)

Management Limits are applicable to petroleum hydrocarbon compounds only. They are applicable as screening levels following evaluation of human health and ecological risks and risks to groundwater resources. Management Limits relate to policy considerations which reflect the nature and properties of petroleum hydrocarbons including:

- Formation of observable light non-aqueous phase liquid (LNAPL).
- Fire and explosion hazards.

- Effects on buried infrastructure.

Management Limits for residential, parkland and public open space land use and commercial/ industrial land use, coarse soil texture, will be adopted for this assessment.

9.2.5 Ecological Screening Levels (NEPM 2013)

The ecological screening levels (ESLs) were developed for selected petroleum hydrocarbon compounds and total petroleum hydrocarbon fractions and are applicable for assessing risk in terrestrial ecosystems. For the purposes of this assessment, urban residential and public open space and commercial/ industrial land use values for coarse soil texture will be adopted. The ESLs for areas of ecological significance have also been applied in consideration of the proximity of a Priority Ecological Community/ Threatened Ecological Community (PEC/TEC) as described in Section 9.3.

9.2.6 Ecological Investigation Levels (NEPM 2013)

Ecological Investigation Levels (EILs) for the protection of terrestrial ecosystems have been derived for common contaminant in soil based on a species sensitivity distribution model developed for Australian conditions.

Five background soil samples are proposed to be collected and analysed for metals, CEC, pH and clay content, to enable the calculation of site-specific EILs. EILs for both urban residential/ public open space land use and commercial/ industrial land use will be adopted. The EILs for areas of ecological significance have also been applied in consideration of the proximity of a PEC/TEC as described in Section 9.3.

9.3 Groundwater Assessment Criteria

Based on the presence of existing groundwater bores within the site, it is considered plausible that groundwater could be abstracted for domestic non-potable use (including garden irrigation), despite its varying quality (fresh to saline). Drinking water guidelines have not been considered as part of this assessment as the use of water for drinking water is implausible given the likely provision of scheme water to a new development.

The marine environment directly to the south of the site is the likely discharge location for groundwater, and therefore marine water guidelines have been applied. It is identified that the mapped extent of the Subtropical and Temperate Coastal Saltmarsh TEC/PEC and its associated buffers overly the site. This community is listed as a Priority 3 PEC within Western Australia, and a 'Vulnerable' TEC nationally under the *Environment Protection and Biodiversity Conservation Act* (EPBC Act). In consideration of the proximity of the PEC/TEC, it is considered appropriate to apply the 99% level of species protection.

9.3.1 Marine Water Quality Guidelines (ANZG 2018)

Default guideline values for toxicants have, where possible, been derived using the species sensitivity distribution model. The toxicant default guideline values for the protection of marine aquatic ecosystems have been adopted in consideration of the situation of the site immediately adjacent to the coast. Given the proximity of the PEC/TEC, the 99% species protection level is considered appropriate.

9.3.2 Non-Potable Groundwater Use (DoH 2014)

The non-potable groundwater use (NPUG) criteria (generally, 10-fold the drinking water criteria) are adopted to assess any risks to non-potable users of groundwater at the site or down hydraulic gradient of the site. This includes people who may be exposed to contaminated groundwater from domestic non-potable beneficial use of the aquifer (e.g., irrigation of gardens [including edible produce] or parks and reserves, washing vehicles and clothes, flushing toilets and recreational use of water).

9.3.3 Groundwater Health Screening Levels (NEPM 2013)

Health Screening Levels (HSLs) were developed to be protective of human health by determining the reasonable maximum exposure from site sources for a range of situations (ASC NEPM 2013). The soil vapour HSLs for low – high density residential land use (HSL-A & B), recreational/ open space land use (HSL-C) and commercial/ industrial land use (HSL-D) will be adopted. Based on the current understanding of the site, the coarse grain soil values will be used. HSL values applicable to the depth of groundwater at the specific sampling location will be adopted, noting groundwater is expected to be anywhere between 1 m bgl and 7.5 m bgl across the site.

10. Limitations

Scope of services

This report ("the report") has been prepared by JBS&G in accordance with the scope of services set out in the contract, or as otherwise agreed, between the Client and JBS&G. This report is strictly limited to the matters stated in it and is not to be read as extending, by implication, to any other matter in connection with the matters addressed in it.

Reliance on data

In preparing the report, JBS&G has relied upon data and other information provided by the Client and other individuals and organisations, most of which are referred to in the report ("the data"). Except as otherwise expressly stated in the report, JBS&G has not verified the accuracy or completeness of the data. To the extent that the statements, opinions, facts, information, conclusions and/or recommendations in the report ("conclusions") are based in whole or part on the data, those conclusions are contingent upon the accuracy and completeness of the data. JBS&G has also not attempted to determine whether any material matter has been omitted from the data. JBS&G will not be liable in relation to incorrect conclusions should any data, information or condition be incorrect or have been concealed, withheld, misrepresented or otherwise not fully disclosed to JBS&G. The making of any assumption does not imply that JBS&G has made any enquiry to verify the correctness of that assumption.

The report is based on conditions encountered and information received at the time of preparation of this report or the time that site investigations were carried out. JBS&G disclaims responsibility for any changes that may have occurred after this time. This report and any legal issues arising from it are governed by and construed in accordance with the law of Western Australia as at the date of this report.

Environmental conclusions

Within the limitations imposed by the scope of services, the preparation of this report has been undertaken and performed in a professional manner, in accordance with generally accepted environmental consulting practices. No other warranty, whether express or implied, is made.

The advice herein relates only to this project and all results conclusions and recommendations made should be reviewed by a competent person with experience in environmental investigations, before being used for any other purpose.

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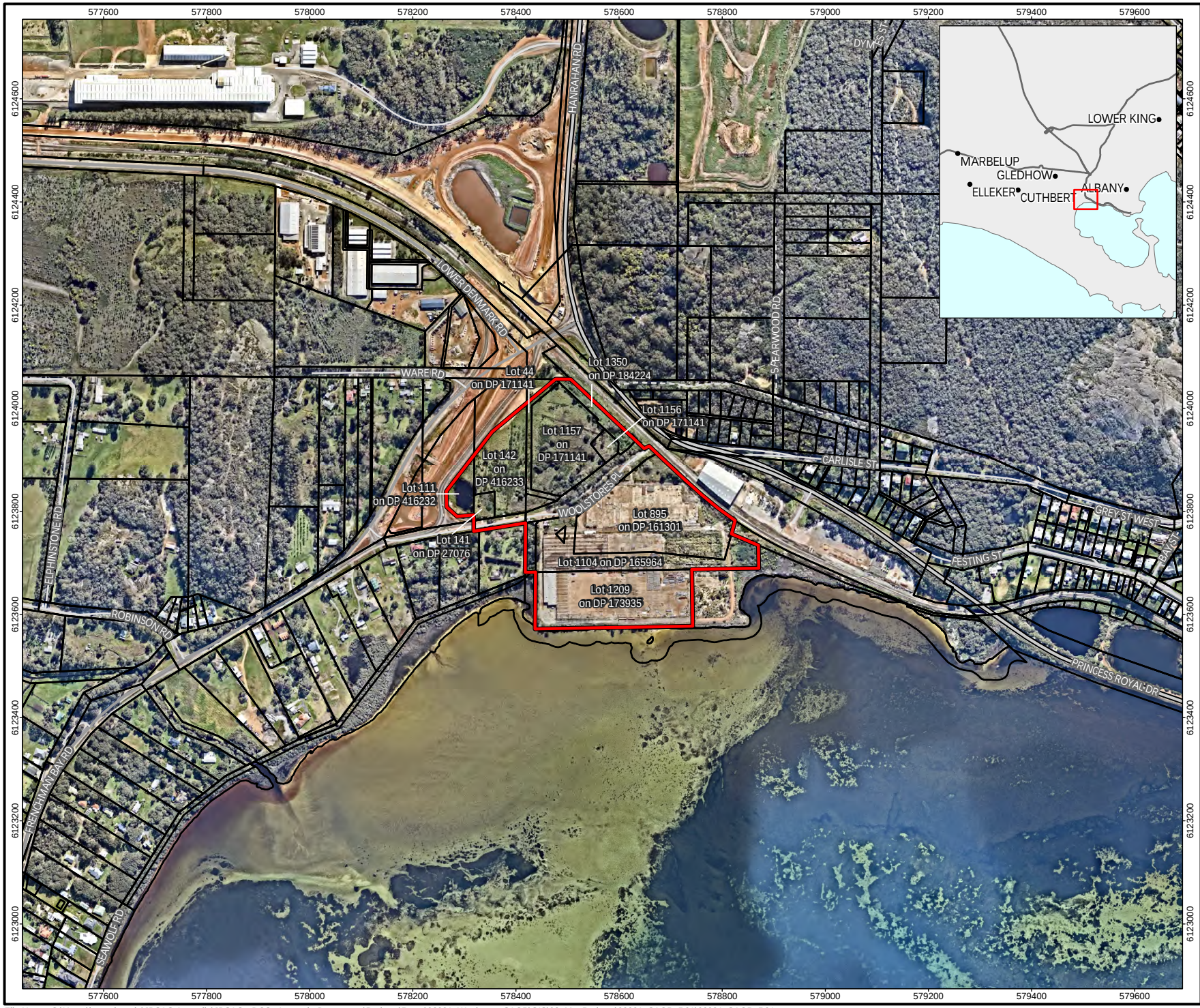
Figures



Legend

- Site boundary
- Cadastral boundary
- Highway
- Major road
- Minor road
- Track

JBS&G

Job No: 66001

Client: Rowe Group

Version: A	Date: 16/11/2023
Drawn By: ianandagoda	Checked By: PK

Scale 1:10,000 at A4

0 150 300
metres

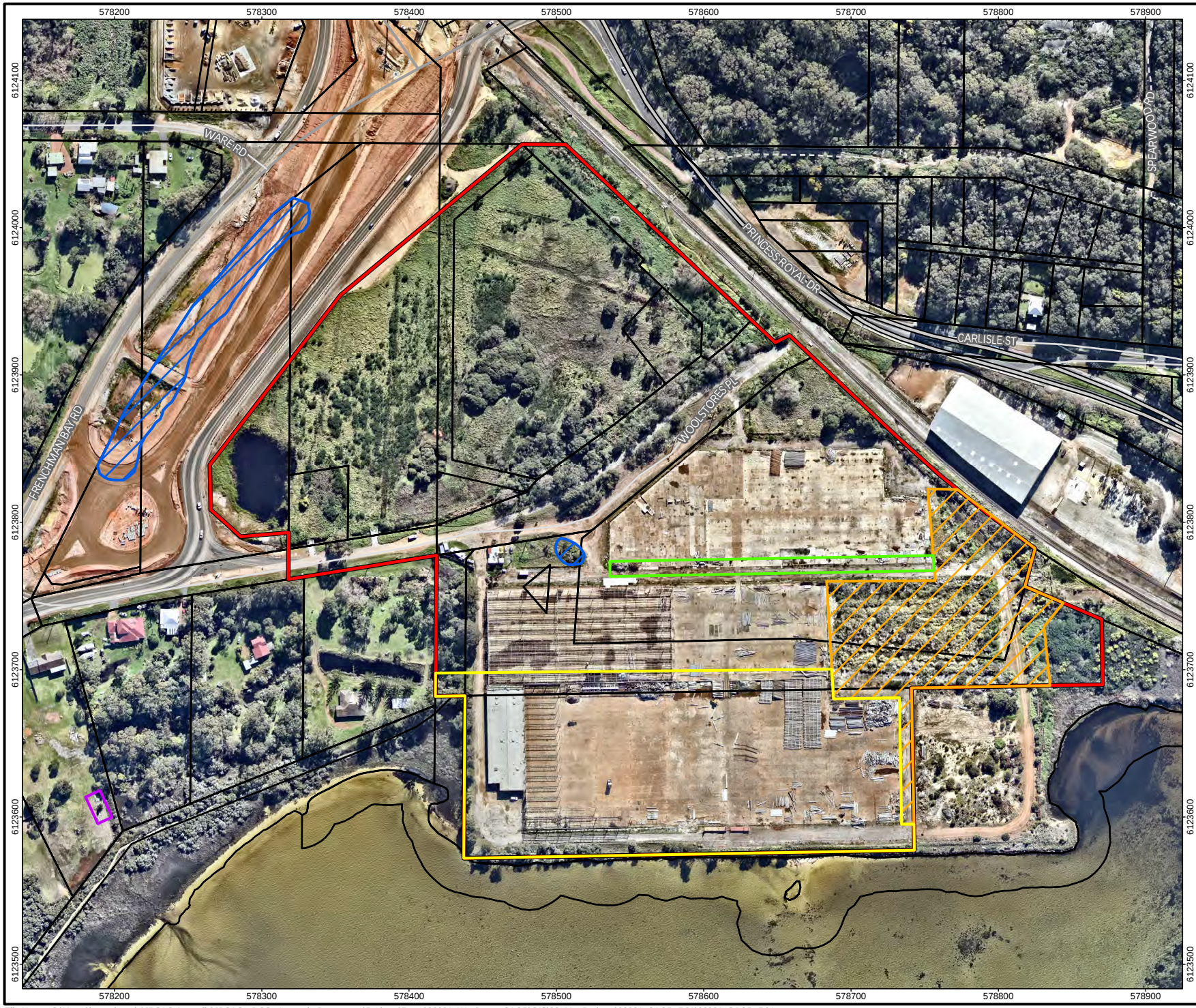
Coord. Sys. GDA2020 MGA Zone 50

Woolstores Place
Mt. Elphinstone, WA

SITE LOCATION

FIGURE 1

File Name: C:\Users\ianandagoda\JBS&G Australia\JBS&G - DCS - Internal - Documents\Projects\Rowe\66001_Woolstore_SAQP\GIS\02_MapProjects\66001_SAQP_R01\66001_SAQP_R01.aprx
Image Reference: www.nearmap.com© - Imagery 01 August 2023.



Legend

- Site boundary
- Reclaimed land
- Historical rail line/ drains/ sumps
- PACM sheets
- Stockpile
- Imported fill/fly tipping (PACM present)
- Cadastral boundary
- Highway
- Major road
- Minor road
- Track

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Job No: 66001	
Client: Rowe Group	
Version: A	Date: 16/11/2023
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Scale 1:3,500 at A4

0 25 50
metres

Coord. Sys. GDA2020 MGA Zone 50

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FORMER SITE LAYOUT

FIGURE 2

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Legend

- Site boundary
- Commercial / Industrial lots
- Reclaimed land
- Imported fill/fly tipping (PACM present)
- Balance of lots / Historical land uses
- Cadastral boundary

Test pits

- Asbestos only
- Asbestos and other COPC
- Highway
- Minor road

JBS&G

Job No: 66001

Client: Rowe Group

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Scale 1:2,750 at A4

0 25 50
metres

Coord. Sys. GDA2020 MGA Zone 50

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PROPOSED TEST PIT LOCATIONS - COMMERCIAL / INDUSTRIAL LOTS

FIGURE 3

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Legend

- Site boundary
- Commercial / Industrial lots
- Reclaimed land
- Imported fill/fly tipping (PACM present)
- Balance of lots / Historical land uses
- Cadastral boundary
- Soil bore
- Highway
- Minor road

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Scale 1:2,750 at A4	

0 25 50
metres

Coord. Sys. GDA2020 MGA Zone 50

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ASS INVESTIGATION - COMMERCIAL / INDUSTRIAL LOTS

FIGURE 4a

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Legend

- Site boundary
- Northern rural lots
- Commercial / Industrial lots
- Balance of lots / Historical land uses
- Cadastral boundary
- Soil bore
- Highway
- Major road
- Minor road
- Track

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Job No: 66001

Client: Rowe Group

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Scale 1:2,000 at A4

0 25 50
metres

Coord. Sys. GDA2020 MGA Zone 50

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ASS INVESTIGATION - NORTHERN RURAL LOTS

FIGURE 4b

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Legend

- Site boundary
- Reclaimed land
- Imported fill/fly tipping (PACM present)
- Balance of lots / Historical land uses
- Commercial / Industrial lots
- Northern rural lots
- Cadastral boundary
- Highway
- Major road
- Minor road
- Track

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Job No: 66001

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Version: A | Date: 16/11/2023

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Scale 1:3,500 at A4

0 25 50
metres

Coord. Sys. GDA2020 MGA Zone 50

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PROPOSED GROUNDWATER MONITORING WELL LOCATIONS

FIGURE 5

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A	P. King	S. O'Brien	DRAFT FOR CLIENT COMMENT		24/11/23

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